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Institute of Social Sciences and International Relations**

**Recent Achievements and Prospects
of Innovations and Technologies**
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THANK YOU FOR YOUR PARTICIPATION!

INTRODUCTION



Image Courtesy : idacon.com/wp-content/uploads/2010/09/CogniFit-Brain-World-Change.jpg

The overall impact of innovation on national welfare has changed considerably. Innovation is a new idea applied to initiating or improving a process, product or service. All innovations imply changes. Innovation involves considerable amount of uncertainty, since progress and successful outcomes may be difficult to predict. Also, the process tends to be knowledge-intensive which means that those close to the development of innovation may possess most of the knowledge about the situation, during the development stages.

“Global competition is increasingly shifting to science, technology and education. In order to achieve high growth rates, it is also necessary to solve systemic problems to strengthen the potential of science, to form unique technological reserves. Now we have to implement new scientific and technological programs: genetic research, artificial intelligence. In the middle of the next decade, we must become one of the leaders in these scientific and technological areas, which, of course, will determine the future of the whole world and the future of Russia” said Vladimir Putin to Federal Assembly in 2019.

The VIII All-Russian Science-Practical Conference of Students, Postgraduates and Young Scientist “Recent Achievements and Prospects of Innovations and Technologies” will be a little part of the efforts at technological progress, at implementation of the innovative ideas into products and services, which create growth and working places for the society. The Conference is your platform to grow and network with likeminded researches all over the world.

The famous Australian scientist, Doctor, Associate Professor, medical scientist and health journalist Tim Crowe addressed to the participants of the conference:

“Greetings from Australia. Welcome to all of you attending this science practical conference with many fascinating topics that have so much to offer in helping improve the lives of people. The nature of your disciplines from ecology through to journalism is one that requires a questioning mind to ask the questions, seek the answers, and to communicate the relevance of this to the world. I wish you success not only today, but also in your future bright careers”.

Recent Achievements and Prospects of Innovations and Technologies
Kerch State Maritime Technological University
Kerch, April 22, 2019



SECTION 1: ENGINEERING INNOVATION PROCESSES



UDC 621.389

VECHICLES OBSTACLE POSITIONING SYSTEM

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Introduction

The problem associated with the positioning of objects in the process of movement of the vehicle is relevant because of the occurrence of numerous accidents, because of human factors, as well as inaccuracy, low range of operation and high cost of modern systems.

The main part

Existing systems for the positioning of vehicle obstacles are based on two methods: optical and ultrasonic. The disadvantages of optical methods are obvious and are associated with a strong dependence of accuracy on weather conditions, which can be critical when using only this method.

The ultrasonic method is more common today, but the distance at which the error is permissible is measured within the distance of less than 1.5 - 2 meters. These distances are comfortable when used in parallel rear parking, however, these distances may not be sufficient when implementing

safe braking systems. There is also a human factor in the use of the existing interface, which implies the use of an acoustic ultrasound frequency signal (about 40 kHz), with increasing frequency, when the vehicle approaches an obstacle or vice versa. Range detection systems based on electromagnetic sensors are also available.

However, these systems use only the amplitude component of the signal to determine the range, which are energy-intensive, and also not enough precise in the absence of expensive components. In modern unmanned vehicles, laser rangefinders are used for long-range monitoring. This system has the same number of disadvantages as optical systems, except for the human factor, which is excluded from the system, and there are various conditions affecting the integrity of optical equipment, which entails expensive maintenance.

In this paper we propose a system based on electromagnetic sensors, but its difference from the systems described above, it is proposed to determine the distance through the use of phase methods. Phase methods have high resolution regardless of the distance, thus allowing the driver to react to an obstacle in a timely and adequate manner.

The system will operate on the basis of 4 sensors located on all sides of the vehicle, and the sensitivity of the sensor pointing forward will be adjusted discretely to distances greater than the other three due to the fact that the maximum speed of the vehicle is achieved in this direction (Fig.1).

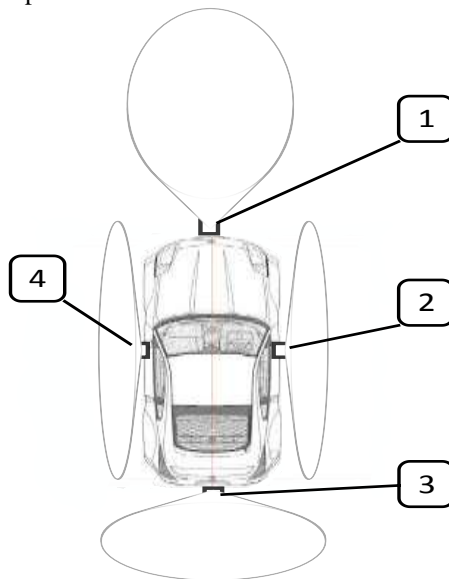


Figure 1 — Obstacle positioning system

Due to the design of sensors with certain directional diagrams, the maximum efficiency of the system will be achieved, namely sensor 1 will have an elongated diagram, due to the need to position objects at a long distance and with a high frequency, and sensors 2, 3, 4 will have a flattened diagram of directionality. This allows to use only 4 sensors and at the same time to position the damage along the entire area of the car side. Depending on the vehicle type, the sensitivity distance will be adjusted.

Thus, the truck will have a greater sensitivity and therefore the activation range of the system than the car, due to the greater braking distance. The system will also be integrated into the main processor of the car, thus it will be possible to automatically calibrate the activation range depending on the speed of the vehicle and, accordingly, the braking distance.

Conclusion.

Thus, a system of vehicle obstacle positioning is proposed in the paper. The system has better technical characteristics and is also cheaper. The development of antennas for this system is of applied importance in the implementation of this device.

Аннотация. В данной статье описаны существующие системы определения дальности транспортного средства до препятствия, а также недостатки существующих систем.

Предложена новая прецизионная система, функционирующая на основе фазовых методов.

Ключевые слова: позиционирование, система, частота, расстояние, транспортное средство, автомобиль.

Annotation. This article describes the existing systems for determining the vehicle's distance to the obstacle, as well as the shortcomings of existing systems. A new precision system based on phase methods is proposed.

Keywords: positioning, system, frequency, distance, vehicle, car.

UDC 004.413.2

ALGORITHM FOR AUTOMATIVE BELT OPERATING SYSTEM

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Introduction

To present day, the problems associated with ensuring the safety of people on the road are relevant, this problem has become relevant due to the high rate of growth of technologies related to the development of road transport. Algorithm for solving this problem is proposed in this paper. There are also a number of technologies available around the world to minimize road accidents, but this is compensated for by new technologies related to increasing the power characteristics of the vehicle. For the first time ever, Volvo has proposed a seat-belt technology that reduces the risk of death in a vehicle significantly. This technology has become widespread in the automotive industry worldwide. The system has also been further upgraded and in modern cars there is a belt lock that pulls it when approaching an obstacle. The system works in a complex with parking sensors of the car.

The main part.

The article [1] describes the system of emergency shift of seats, but this system has a number of drawbacks and should be improved. There is also an airbag activation system developed by an American scientist. The technology has significantly increased the survival rate of road traffic accidents. Belt tensioning system is proposed in the article. The algorithm of the seat-belt management program is shown in Fig. 1.

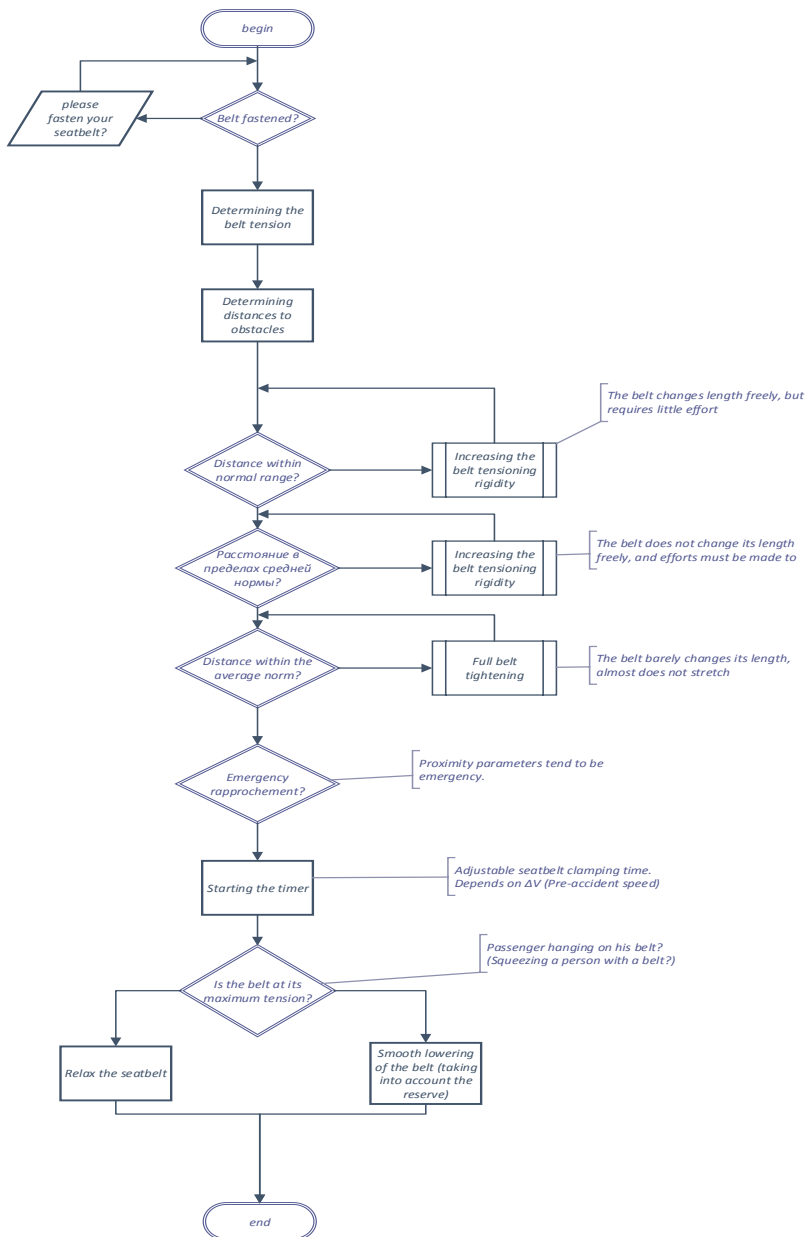


Figure 1 — Algorithm for automotive belt operating system

Modern belt tensioning systems have the main purpose of increasing the survivability of the passenger and driver, but this approach does not take into account the possibility of serious harm to the driver. This means that if the car is turned over, the belt does not release the safety catch, which can cause a lot of injuries. There are also injuries associated with clavicle fractures when the belt is suddenly stretched in case of frontal impact. The offered system has a software control of belt tensioning. The program operates on the basis of a smooth increase in tension, and the dependence of the distance to the obstacle on the tension of the belt is not straight, which will reduce the possibility of injury, and the control of the length of the belt used to fix the person in a stable ride, will determine the optimal tension, which eliminates injuries due to the seat belt.

The algorithm takes into account the distances between obstacles and the car, with the degree of tension and the distance at which the belts are tightened depending on the speed of the car. The higher the speed, the greater the distance the program will start. The algorithm can be applied to any type of car.

The system takes into account the specifics of the body belt wrap, which allows to minimize injuries associated with it, and the presence of a timer will allow to determine the position of the car (turned upside down or not), the level of tension of the belt, which will allow you to timely and smoothly lower the person to the ground, while adding the reserve length of the strap, you can achieve the most smooth descent.

Conclusion

Humans in accident safety increasing system is proposed in this article. System operates by means of microcontroller which rule operating of safety belts by means of developed algorithm. Algorithm includes the main variants of car accident which may damage passengers.

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Аннотация. В данной статье рассмотрены современные системы безопасности автомобиля, системы спасения человеческих жизней. Описаны недостатки данных систем. Предложена модификация системы натягивания ремней в зависимости от скорости аварии. Разработан алгоритм функционирования системы.

Ключевые слова: система, алгоритм, спасательные системы, ремень, дорога, автомобиль.

Annotation. This article considers modern car safety systems, life-saving systems. The disadvantages of these systems are described. The modification of the belt tensioning system depending on the accident speed is proposed. The algorithm of system functioning is developed.

Keywords: system, algorithm, life-saving systems, belt, road, car.

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POSITIONING SYSTEM FOR SHIP SHEATHING DAMAGE

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Introduction

The construction of a modern vessel is based on technologies developed in the distant past, as these structures have proved to be well-proven. However, the electronic component has undergone significant changes due to scientific progress in the field of automation. Modern ship damage positioning systems are based strictly on the visual observation of mariners as well as their perception of the shockwave and sound effects. There is a significant proportion of the human factor accordingly. The risk of this factor is very high and entails expensive losses, from the simple flooding of the compartment, to the sinking of the ship and the loss of human life. There are also water sensors in the ship's sections, but this technology does not provide information about the location of the breakdown, the size of the damage and their readings are post factum, which can often be fatal for the ship and its crew. Accordingly, the

relevance of research in this area is quite high and justifies the cost of producing the technologies that solve this problem.

The main part

In this paper it is proposed to use the technique based on vibration sensors. The mechanism of this type can allow to determine the damage and its size. The use of the system in combination with the software will make it possible to identify the problem remotely and quickly eliminate it. The system operates on the basis of sensors equally spaced across the housing (Fig. 1).

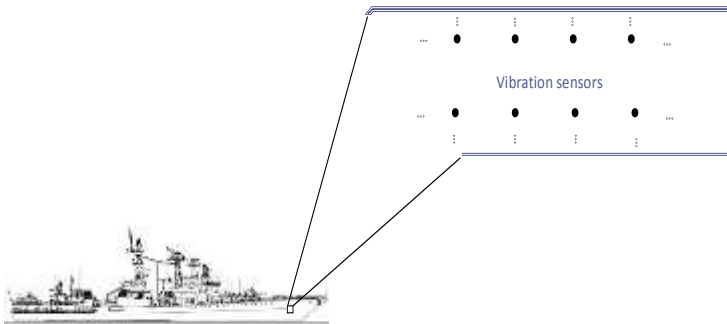


Figure 1 — Sensor location on the board

The distance of the sensors is not more than 0.5 meters, as the operation of this type of system has a number of limitations. Having been struck by any size or nature, the vibration spreads across the hull of the vessel to all sides and is uniformly attenuating. Sensors, recording the vibration of a certain amplitude, transmit a signal to the microcontroller, and it is possible to determine the amplitude of vibration from each sensor, and therefore the time of the beginning of fixation. These parameters allow us to determine the exact location of the damage, while estimating the time the signal starts and the nature of its attenuation will allow us to determine the area of the damage. Development of the algorithm of functioning of this device (Fig. 2) allows to use this system on a real sample, thus gaining statistical data.

Conclusion

The described system can be implemented in any type of vessel, and the cost of the system will depend solely on the size of the ship, and its advantages compensate for the high cost. The use of this system will reduce the risk of sinking the vessel and human casualties.

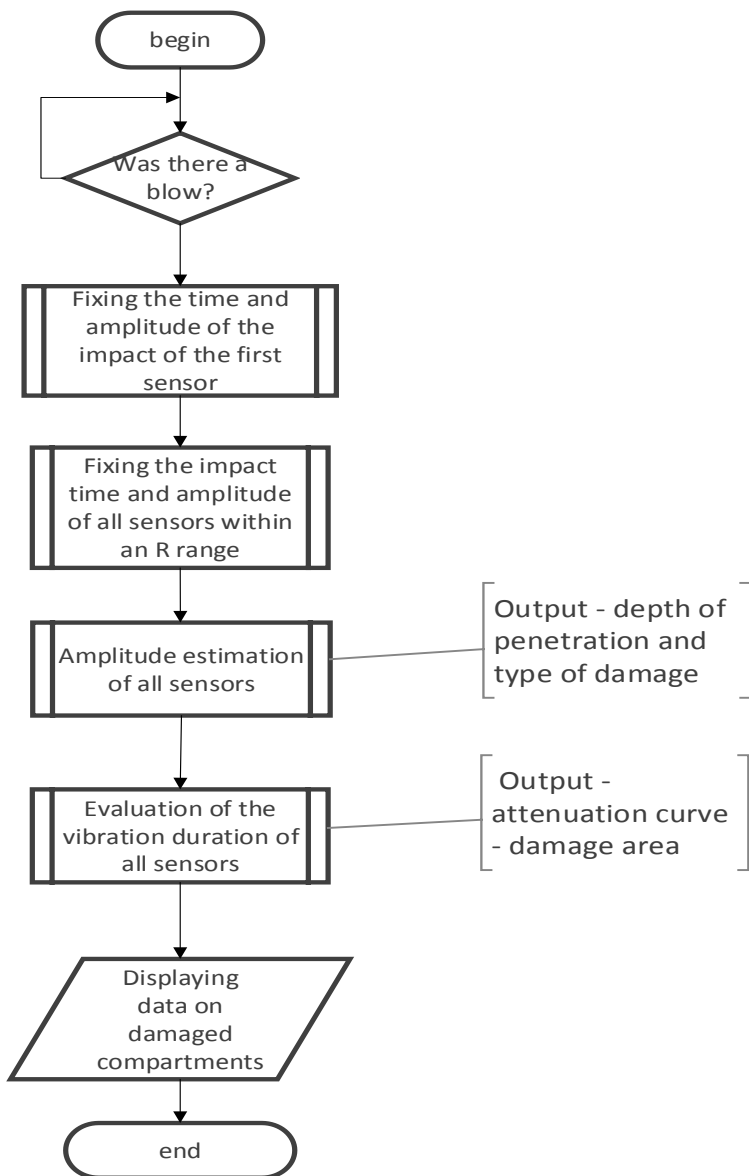


Figure 2 — Development of the algorithm of functioning of this device

Аннотация. В данной статье рассмотрены системы определения повреждений поверхности судна. Описаны недостатки данных систем. Описана новая система позиционирования повреждений обшивки судна, определяющая также помимо места, размер и характер повреждений.

Ключевые слова: ремень, система, алгоритм, судно, автоматика, датчики, датчики.

Annotation. This article describes the systems for determining ship surface damage. The disadvantages of these systems are described. The new system of positioning of the ship's shell damages is described, which also determines the size and nature of the damages in addition to the place.

Keywords: belt, system, algorithm, vessel, automation, sensors.

UDC 546.26-162

THE EXISTING TECHNOLOGIES AND THE PROSPECTS OF DEVELOPMENT OF GRAPHENE

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For the last decade the amount of the materials which are used in various spheres of the industry considerably grew. Technologies of the three-dimensional press are developed, two-dimensional materials, such as graphene, fullerene, a two-dimensional perovskite actively develop. The graphene became the first of such materials. Let's consider changes in use of materials on its example.

For the first time the uniqueness of graphene properties was confirmed in 2004 in K.S. Novosyolov and A.K. Geym's article [3] (the University of Manchester, Great Britain) for which they got a Nobel Prize. In the work they reported about successful separation of layers of atomic thickness from various layered crystals (see Fig. 1).

Graphene is a two-dimensional crystal which is rather simple for receiving by method of micromechanical cleavage of crystals of graphite. There are several types of receiving a graphene: mechanical, by graphite etching, and chemical, by an epitaxy or sedimentation of atoms of carbon on a basis or by growth with a high pressure and temperature. Its durability exceeds steel durability on 2 orders. Also material has high electrical and thermal conductivity and the record value of electron mobility does it by perspective material for use in the most various applications, in particular, as future basis of electronics.

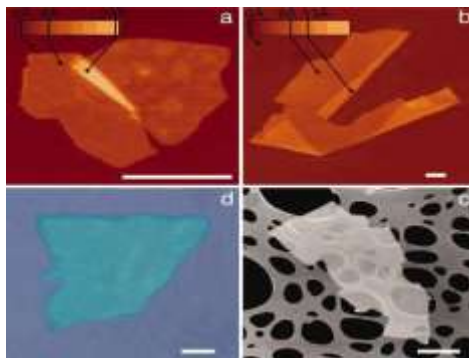


Fig. 1 — Two-dimensional structures: a) NbSe2 b) graphite c) Bi2Sr2CaCu2Ox, d) MoS2. Scale: 1 microns. Images a and b are received by means of an atomic force microscopy, d — by means of the scanning tunnel microscope, c — by means of an optical microscope

Graphene has unique feature — linear dependence of energy of charge carriers (electrons and holes) — from a quasiimpulse. In the nature there are particles whose energy also depends linearly on an impulse - it is photons. Photons have the zero rest mass, and their speed is equal to the speed of light. Thus, already developed mathematical apparatus for the description of relativistic particles could be applied to the description of behavior of electrons and holes in graphene that immediately led to the following great opening of M.I. Katsnelson — Klein's paradox in graphene. This paradox arises by consideration of a task about penetration of a relativistic particle through a high potential barrier. For a case of a graphener it was shown that any potential barrier in the countess is transparent at normal falling on it of electrons or holes. Important consequence — complexity of localization of carriers of a charge in the countess.

Except remarkable electronic properties, graphene has impressive mechanical characteristics. Strong covalent connections between carbon atoms in graphene do it by the strongest material ever received by the humanity. Longitudinal elastic constants of a graphene considerably surpass similar values of the previous champion — diamond. Graphene durability such is that its meter leaf is theoretically capable to hold a four-kilogram cat. At the same time the film of graphene is lightweight, one gram of graphene can cover the football field!

Graphene scopes

The most various scope of a graphene — electrical and electronic engineering. Such properties of a graphene as high conductivity and high optical transparency, do it by attractive material for production of electronic

components and devices on its basis. For example, it can serve as an external electrode for the liquid crystal screen. And if to consider that the graphene layer is rather flexible material, we can predict emergence of flexible electronic devices which prototypes are already tested. The flexible screen presented by physics of the Cambridge center of studying of a graphene is an example. Works on silicon replacement with material on the basis of a graphene and boron nitride in electronics in progress. The combination of such material and carbon C60 has physical properties similar to silicon, having at the same time the best chemical stability, big flexibility and smaller weight. It does it more durable and steady against influence of external factors that finally increases service life of devices on the basis of graphene.

However there are also difficulties. The main problem consists in absence at a graphene of the band gap necessary for switching of states opened/closed. Nevertheless works on the solution of this problem and giving to new substance all properties of semiconductors in progress that allows to expect emergence of new types of electronic components in the near future. Also the graphene is suitable for creation of new highly sensitive optical sensors, light-emitting diodes, solar panels. For example, present the solar battery which not only will be able to follow the movement of the sun for obtaining the greatest number of energy for light day, but also to bend the surface for achievement of bigger efficiency of transformation of solar energy to electricity. So in China it is put into operation the large-scale solar farm in which the principle described above that allows it to reach power in 40 megawatts is put into practice. Also on the basis of a graphene ionistor are created or — also known as — supercapasitor which capacity surpasses capacity of simple capasitors many times. In total with solar panels on the basis of a graphene, the technology of ionistor will be able to solve a problem with electricity generation. So, the electric power received in a day from the solar panel will be kept by a graphene ionistor for providing consumers with energy in night-time, when there is no sunlight.

Besides electronics and power industry, graphene also approaches for a role of structural material. Its mechanical properties, such as durability surpassing steel to stretch for 2 orders, ability to stretch up to 20% without damage and flexibility allow to use this material for creation of cases and structures. So in 2015 the Spania GTA company presented model of the Spano supercar at the basis of which case there was a graphene alloy with the titan. Thanks to this innovation the power framework (monocoque) of the car weighs less than 80 kg that releases the weight which can be used for installation of more powerful engine.

Also graphene is used in composite materials for giving a durability to them. For example, the composite from copper and a graphene has strength by 500 times the exceeding limit of the copper and for 50% the exceeding strength of the titan, and nickel - graphene alloy is stronger than nickel by 180 times. At the same time the mass fraction of a decanter is very small, less than 0.01% that in total with a high durability offer new prospects in such industries as automotive industry, air and space aircraft and also constructional products. So the group of researchers of MIT presented three-dimensional spongy material on the basis of a graphene which at the density of 5% from density of steel has bigger durability by 10 times.

Prospects and problems in the research of graphene

Of course the graphene is not deprived of shortcomings. The main minus which can be allocated is the lack of the band gap, area of values of energy which electrons and other charged particles, inherent in semiconductors cannot have. It does it useless for creation of transistors of traditional architecture. However developments of new types of transistors are already in progress, for example, experiments on alloying of a graphene layer with atoms of such metals as the titan are made. As it is noted above, a graphene not the only two-dimensional material which properties should be considered. For example, the material which is recently created by scientists from the Drekselsky university in the USA under the name Mxene is capable to accelerate process of battery charging in tens of times. New material consists of a layer of hydrogel and carbide of the titan 1 thick atom. Unlike usual battery membranes which have a small amount of ways for ions new material creates a set of ways, as increases capacity and, therefore, reduces charge time. In addition, Mxene contains a set of places for accumulation of a charge and can be a basis for creation of essentially new batteries on its basis.

Further development of two-dimensional materials considerably will affect all spheres of human life: from increase in speed of electronic devices and reduction of the sizes of electronic components up to construction of spacecrafts of new generation and creation of new sources of renewable energy that will allow mankind to begin to realize one of the most daring ideas, namely conquest of space and exploration of new planets.

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Аннотация. Рассмотрены основные свойства, способы получения, применения в различных областях, в частности, в электронике, энергетике, материаловедении, существующие и возможные технологии, присущие недостатки и перспективы развития аллотропной модификации углерода - графена.

Ключевые слова: двумерный кристалл, углерод, графен, гибкая электроника, графеновые сплавы

Annotation. The main properties, ways of receiving of two-dimensional allotrope (form) of carbon – a graphene, its applications in areas of electronics, materials science, power industry and others, existing and possible technologies on its basis, the main shortcomings and the prospects of development are considered.

Keywords: two-dimensional crystal, carbon, graphene, flexible electronics, graphene alloys.

UDC 62-97/-98

PI TECHNOLOGY METHODS OF VISUALIZATION OF DATA ON A SEARCH OBJECT FOR METAL DETECTORS

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Introduction. Metal detector is an electronic device that detects metal objects due to their conductivity. The metal detector finds metal in the ground, water, walls, in wood, under clothing and in baggage, in foods, in human and animal organisms, etc., However, to know about the existence of the subject, in some cases, is not enough. To study the size, depth, material, shapes we have to know additional information characteristics. Various methods of realization of devices allow to receive different data.

The aim of the article is to analyse methods of visualization of data on a search object for metal detectors based on PI (pulse induction) technology.

Main part. Let's start with the principle of metal detector operation based on the method PI (pulse induction) pulse detector. As in the metal detector of this type the coil is not a part of the resonant circuit, its size can

be different in some cases. This method allows to realize a sufficient high power emitted by the coil.

The search coil is periodically connected to the power source for a short time by means of the switch, that causes an exponentially increasing current to flow through the coil (the first part of the curve *a*, figure 1.).

With a sharp interruption of this current (the second part of the curve *a* figure 1), a self-induction voltage pulse (curve *b*, figure 1) of hundreds of volts arises on the coil.

When located near the coil of a conductive object, the primary magnetic field of the coil, which changes sharply with the interruption of the current, penetrates this object and creates eddy currents in it (curve *c* in figure 1). These vortex currents always oppose the change that caused changes, thus creating a secondary magnetic field. This alternating magnetic field reaches the coils of the search coil and induces an alternating voltage in it (curve *d* in figure 1).

For the detection of pulse edge lengthening the signal is gated using the key (curve *e* in figure 1). This cuts off the signal from the transmitted pulse and a surge in self-induction voltage immediately after it ends. The short gating delay is selected so that the transients caused by the current interruption in the coil are completed during this time (curve *b* in figure 1).

Thus, the transmitted and received signals are separated, and a single coil is used for both transmission and reception of the signal.

After reading more about PI technology, we understand that information about the presence of the target comes with the influence of the magnetic field created by the object, extending the back edge of the pulse (figure 1, curve *d*). Respectively we have 2 parameters namely the time of the trailing edge lengthening and amplitude. In the course of experimental studies and theoretical predictions based on the physics of the PI detector operation, typical changes in parameters depending on the object material were not revealed (i.e. objects of the same thickness and area from different materials showed the same results). On the basis of changes in the pulse front, it was possible to take into account only the size of the object or its distance to the search coil, respectively, the change in the pulse front had the same value for objects of different and the same material, but at different distances, a small object is closer to the search coil, a large object is at a greater distance.

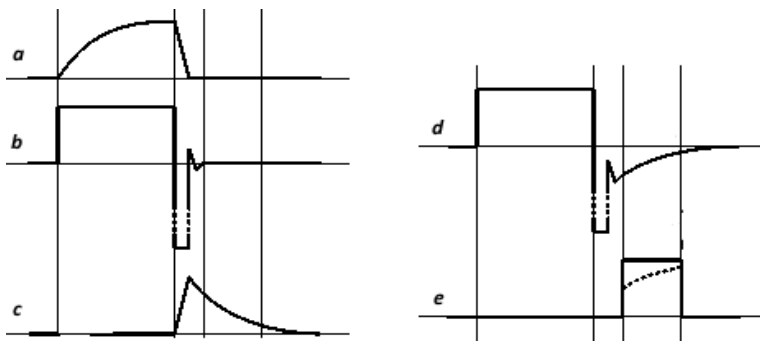


Figure 1 – Voltage and current forms: a) current in the coil; b) surge voltage of self-induction; c) eddy currents in the target; d) voltage induced in the coil; e) gated pulse.

Conclusion. Thus, the visualization of data on the search object in metal detectors built on the basis of the PI method has meaning only in the indication of the signal level (change of the front), which is not informative, but due to its simplicity and cheapness it is often applicable in practice. As practice has shown, it is almost impossible to implement discrimination.

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Аннотация. В статье рассмотрены основные методы представления информации об объекте для металлодетекторов построенных на принципе *PI*.

В заключение отмечается, что визуализация данных об объекте поиска в металлодетекторах, построенных на основе метода Пи, имеет смысл только в индикации уровня сигнала (изменение фронта).

Ключевые слова: металлодетектор, импульсный детектор, резонансный контур, катушка тока, самоиндукция, магнитное поле, поисковая катушка, стробирующий импульс.

Annotation. The article describes the main methods of presenting information about an object for metal detectors built on *PI* principle.

In conclusion it is noted that the visualization of data on the search object in metal detectors built on the basis of the PI method has meaning only in the indication of the signal level (change of the front).

Keywords: metal detector, pulse detector, resonant circuit, current coil, self-induction, magnetic field, search coil, gating pulse.

MEASUREMENT OF TRANSFORMER IDLE LOSSES

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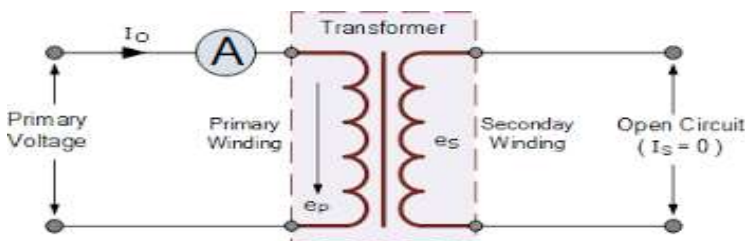
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The mode of operation of the transformer when powering one of the windings from a source with alternating voltage when the other winding is open is called idle mode. The losses occurring in the transformer in idle mode at the rated voltage at the primary winding and at the rated frequency are called the no-load losses. (pict. 1).

The idle loss of a Px transformer consists of:

- magnetic losses, i.e. losses in the active material (steel magnetic system);
- losses in steel elements of the transformer core structure caused by a partial branch of the main magnetic flux);
- the main losses in the primary winding caused by the no-load current;
- dielectric loss in insulation.



Picture 1 – The idle loss of a Px transformer

Source: <https://www.electronics-tutorials.ws/transformer/transformerloading.html>

In the process of transporting electrical energy from production facilities to the final consumer, serious losses occur. The volume of losses during transportation can be up to 18%, moreover, most of these losses fall on transformer equipment. The volume of losses must necessarily be taken into account by designers when creating electrical consumption systems.

The cost of electrical energy, the cost of maintenance and repair of electrical equipment will depend on losses.

At present, the level of no-load losses in transformer equipment has significantly decreased due to the use of more modern and functional steel, improved design of magnetic systems and modernization of cores.

If we consider the features of modern steel used to create plates, then its positive properties are related to the fact that over time, manufacturers have improved the orientation of the domains, reduced the thickness of steel sheets during production.

In addition, the cleaning of domains today is carried out by laser processing, which also affects the technical characteristics of the final products.

Among the main causes of idle losses in various devices are the following factors:

- Corrosion processes on metal elements of transformers. Corrosion on the metal occurs due to the violation of the protective lacquer layer, because of which the equipment increases the eddy currents and there is a significant heating of the metal plates.

- Coil short circuits on the windings, due to which strong voltage surges can occur.

- Low quality insulation.

- Magnetic gaps on metal elements.

- Too many or too few windings.

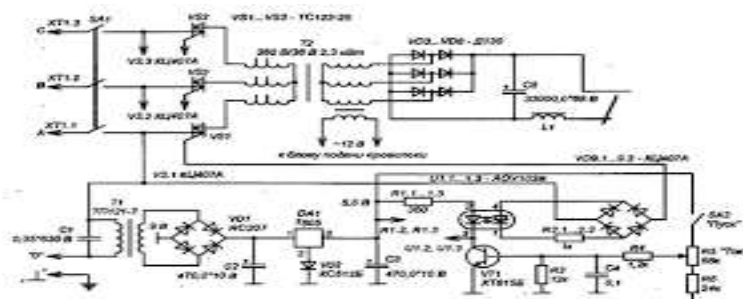
- Overheating of transformer equipment elements.

These are only the most basic causes of loss of idling, which experts face most often. There are other factors due to which the value of no-load losses may exceed permissible limits, which will increase the cost of operation of electrical systems.

To determine the causes of losses on a separate transformer, the owner will need to order the services of professional electrical measurements. Below you can use the online calculator to calculate the cost of the electrolaboratory services.

Energy losses in any case, regardless of the type of production, are the cause of cost overruns and materials. For this reason, it is possible to increase the cost of energy. Therefore, the fight against this factor plays a very important role.

This procedure is based on the maintenance of equipment, thanks to which it is possible to identify any malfunctions that have been formed, which is important for the timely implementation of preventive measures to eliminate the possibility of functional failures. Transformer no-load losses are one of the most common problems.



Picture 2 – Scheme of transformer no-load losses

Source: <http://www.emomi.com/shema-ustrojstvo-remont-svarochnogo-transformatora.html>

To test the no-load current, ammeters are used directly connected in series with the primary winding. This current measurement is performed at a winding voltage equal to the nominal.

Three-phase power transformers operated or commissioned are measured for three phases simultaneously or alternately. Tests are subject to units with a capacity of 1000 kVA and above.

In case of acceptance tests and capital repairs, the data obtained are compared with the protocol on the relevant tests carried out at the plant after the manufacture of the transformer. A discrepancy of more than 5% is not allowed.

For single-phase transformers in the same cases, the power loss should not differ from the initial value by more than 10%.

In operation, only the no-load current is measured on the basis of experience with a rated voltage or power loss at a reduced one. PTEEP does not normalize deviations from the norm.

However, if a transformer is suspected of damage, the loss measurement method using three consecutive tests gives a very valuable result. Since the transformer phase windings are in unequal conditions, it is possible not only to calculate whether there is a defect, but also to determine the defective phase.

Conclusion. Strictly speaking, the measurement is made according to the same schemes that were used at the factory for conducting the experiment. After all, the data will need to be compared with the factory. But, if the three-phase voltage source is unavailable, you can perform three measurements by applying voltage to the two phases of the transformer winding, shorting the third remaining free.

In this case, only linear voltage is used, since the distortion of the curve shape due to nonlinear loads in the network has a minimal effect on it.

According to the same schemes, the experience of idling at a reduced (low) voltage is carried out.

Аннотация. Изложены особенности потери холостого хода РХ-трансформатора. Проанализированы основные причины потерь в различных устройствах, с которыми чаще всего сталкиваются специалисты.

В заключение отмечено, что при повреждении трансформатора дает очень ценный результат метод измерения потерь.

Ключевые слова: потеря холостого хода, трансформатор, трехфазный источник напряжения, линейное напряжение, искажение, метод измерения потерь.

Annotation. The main features of idle loss of a Px transformer are stated. The most basic causes of losses in various devices which experts face most often are analyzed.

In conclusion it is noted that if a transformer is suspected of damage, the loss measurement method gives a very valuable result.

Keywords: idle loss, transformer, three-phase voltage source, linear voltage, distortion, the loss measurement method.

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THE TRIPLE FREQUENCY ANTENNA ON THE BASIS OF THE WIDE RANGE FLAT STRUCTURE

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The physical principles of the operation of broadband antennas had given in the classic monograph [1, p.23]. If we take two metal plates as a basis of the radiating structure, their shape should be described only by the angular coordinates, and the structure should provide the most intensive field radiation from a relatively narrow “active” zone at each working frequency. These conditions are fulfilled for flat self-complementary structure having two infinite triangular metal plates with 90° angle at apex [2, p. 122] (Fig. 1 a).

The structure input impedance is theoretically about 180 ohms, which makes it difficult to match it with the feeding 75 ohms or 50 ohms coaxial cable. In the modified structure [3], the plates near the feeding points are parallel, which decreases of input impedance to acceptable values, but causes an undesirable increase in the capacity between the plates. This capacitance can be reduced by wedge-shaped notches in the plates and additionally compensated by short-circuiting belts with inductive resistance (Fig. 1 b).

To ensure the unidirectional radiation of the antenna based on the considered structure along the z axis, we can use a flat metal screen being parallel to the structure.

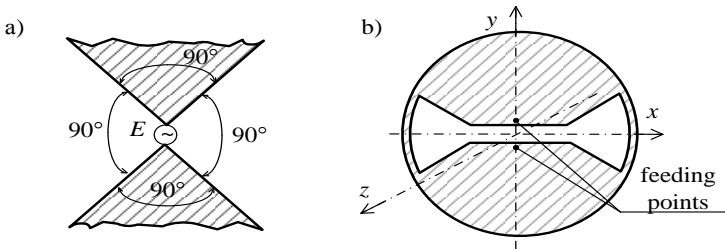


Fig. 1 – Schemes of a self-complementary structure (a) and a modified flat structure (b)

The diameter of the screen must be greater than the diameter of the structure to ensure the suppression of the "backward" radiation. It is more difficult to choose the optimal distance between the structure and the screen, since the phase of the field reflected by the screen near of the structure is determined by the electrical distance, which changes several times in the working frequencies band. If the result of the superposition of the direct and reflected fields provides an acceptable antenna input impedance and the desired pattern at one frequency, then at a frequency, for example, twice as large, the phase of the reflected field will change to the opposite one, that will lead to either mismatch and distortion of a pattern form.

Since the screen is located in the near zone of the field created by the radiating structure, we can assume that the screen and the radiator are forming a half-open resonator, where can exist only modes of certain types [4, p.107] having frequency depended excitation conditions. Therefore, resonances can occur only on a discrete set of frequencies. We can assume that instead of the smooth character of the dependence of the input impedance of a flat broadband structure on the frequency when adding a flat screen antenna to the design, we get a multiband dependence with several

resonances: the screen structure should be considered not as a broadband antenna, but as a multifrequency antenna.

This assumption we have confirmed during designing of the feed for a nonlinear locator mirror antenna [3]: the antenna must radiate the field at the first harmonic frequency f_1 , and receive the reflected field at the frequencies of the second and third harmonics: $f_2 = 2f_1$ and $f_3 = 3f_1$, respectively. As a result of numerical simulation by means of the CST MWS program application, performed for a specific frequency set of 2400 MHz, 4800 MHz and 7200 MHz, it was found that for the distance between the structure and the screen close to a quarter of the wavelength at the lowest frequency, we obtained a satisfactory matching with the 50 ohms cable at all three frequency bands. However, the pattern at the upper frequencies had a multilobe form, which is unacceptable for the feed.

Within the bounds of our view to the antenna as a half-open resonator having height h_1 (Fig. 2a), the optimal form of the pattern (one main lobe without “backward” radiation) can only correspond to the lowest types of modes in this resonator. If one increases the electrical distance between the structure and the screen, higher types of waves can be excited which manifests in a multilobe form of the pattern. To eliminate this possibility one can proportionally reduce the height of the resonator at each operating frequency by using a stepped screen instead of flat screen. For the optimum height h_1 being about a quarter of the wavelength at the frequency f_1 , the height h_2 should be two times less, and the height h_3 should be three times less (Fig. 2 b).

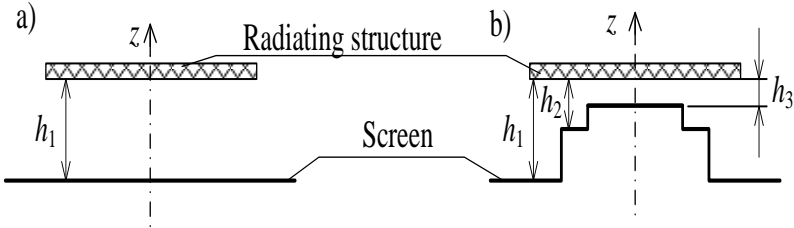


Fig. 2 – Radiating structure above the flat (a) and stepped (b) screen

As a result of numerical simulation, we have selected the optimum values of the heights of the screen steps near the indicated values so that an acceptable antenna matching near the operating frequencies was provided, and the pattern have performed a monolobe type shape (Fig. 3).

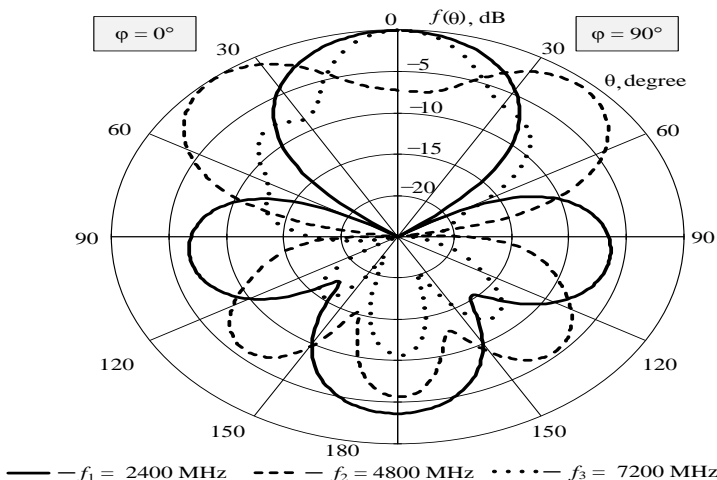


Fig. 3. The radiation patterns of the antenna model with the stepped screen

Thus, we have established that a flat broadband radiating structure with a screen can effectively function only in separated frequency bands, however to optimize the antenna characteristics in each working band, a stepped screen can be used.

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Аннотация. Антенны на основе бесконечных плоских самополнительных структур работают в широкой, непрерывной полосе частот, но имеют неблагоприятные для согласования с коаксиальными кабелями значения входного сопротивления и слабонаправленное излучение. Для улучшения условий согласования можно изменить форму структуры, а для обеспечения однонаправленного излучения — применить ступенчатый металлический экран. При этом оптимизировать характеристики

антенны возможно только в отдельных частотных полосах, так как излучающая структура и экран образуют полукрытый резонатор.

Ключевые слова: самодополнительная структура, широкополосная антенна, многочастотная антенна, металлический экран, полукрытый резонатор.

Annotation. Antennas based on endless flat self-complementary structures operate in a wide, continuous frequency band, but they have unfavorable values of input impedance for matching with coaxial cables and weakly directed radiation. To improve the matching conditions, one can modify the shape of the structure, and to ensure unidirectional radiation, apply a stepped metal screen. In this case, it is possible to optimize the characteristics of the antenna only in separate frequency bands, as the radiating structure and the screen form a half-open resonator.

Keywords: self-complementary structure, broadband antenna, multi-frequency antenna, metallic screen, half-open resonator.

UDC 62-97/-98

METHODS OF DATA VISUALIZATION ON A SEARCH OBJECT FOR METAL DETECTORS BASED ON TR-IB TECHNOLOGY

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Introduction.

Metal detector is an electronic device that determines metal objects due to their conductivity. It detects metal in the ground, water, in wood, walls, under clothing and in baggage, in foods, in human and animal organisms, etc. To know about the existence of the subject, in some cases, is not enough. We have to know additional information characteristics to study the size, material, depth, shapes. Various methods of realization of devices receive various information.

The aim of the article is to consider methods of visualization of data on a search object for metal detectors based on *TR-IB* (*Transmitter Receiver - Induction Balance*) technology.

Main part of the research.

Let's consider the principle of operation of the metal detector based on the *TR-IB* (*Transmitter Receiver - Induction Balance*) method. Search coils **Rx** and **Tx** coils in devices based on the principle of induction balance are reduced to a position where their mutual induction is minimal, ideally equal

to zero. The R_x and T_x coils form a serial and parallel oscillating circuit, respectively. Harmonic signal in the transmitting T_x coil with a frequency equals to the resonant frequency of the circuit.

When the search object is situated in the coil, R_x coil induced signal with a frequency of the T_x coil, but with different phase and amplitude. The signal is not reflected from the object, but it is induced on the receiving coil by Foucault currents excited on the surface of the search object. (Figure 1, B).

In this case phase and amplitude become as information parameters for visualization. In the course of experimental studies, it was possible to identify the dependence of the phase change on the object material and the signal amplitude on the object size and depth. In metal detectors, built on the principles of induction balance various options for visualization of information about the search object are stated. The main methods are called VDI, hodograph, sinograph and various combinations of these ones.

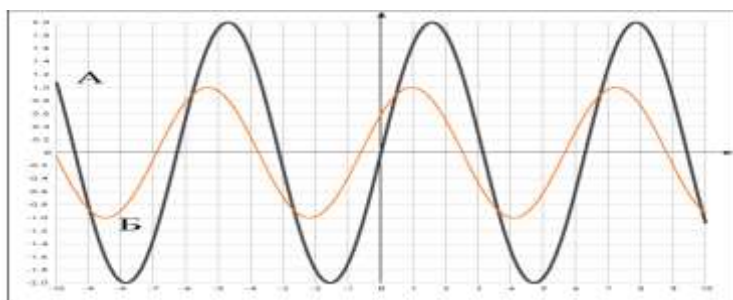


Figure 1 – Voltage forms: A) Signal on T_x ; B) Signal in R_x coil induced by the object

VDI (Visual Digital Index) displays the vector value of the signal, phase channel, and amplitude channel. It is the voltage difference between the channels. These data have a value from 0 to 99, where values up to 30 indicate ferrous metals, above 30 – non-ferrous ones. Thus, it is possible to evaluate the material from which the search object is made.

Hodograph is the methods that detects curves built on graphic displays that show the instantaneous ratio of the phase channel to the amplitude channel, putting the data on the horizontal axis, and the amplitude of the R_x signal on the vertical axis. All values of these points during the passage of the coil over the object are displayed. A phase forms the slope and thickness of the hodograph loop, the amplitude causes the length to increase. Such curves in practice showed high accuracy in the identification of the material, size and even the relative shape of the object (very complex shapes display

ragged curves, regular shapes smooth lines with smooth fillets and transitions).

Sinograph (column chart) is one of the variations displaying all the same channels from which we receive information, but the phase corresponds to the location of the column horizontally, and the amplitude corresponds to the level of the column vertically, respectively, objects of more noble materials are on the right side of the scale of the Sinograph.

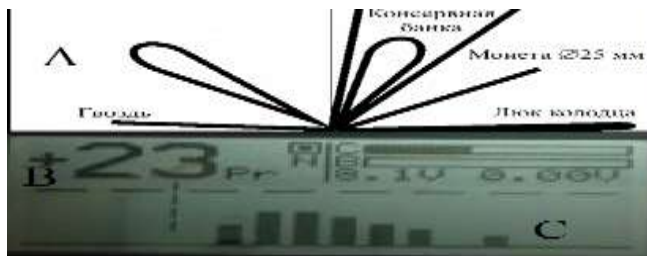


Figure 2 – Example of visualization: A) hodograph; C) the number of VDI; C) Sinograph

Conclusion

Thus, visualization of search object data in metal detectors, built on the basis of the *TR-IB* method allows to obtain extensive information about the search object.

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Аннотация. В статье рассмотрены основные методы представления информации об объекте, для металлодетекторов, построенных на принципе *TR-IB*. Охарактеризованы такие основные методы как VDI, годограф, синограф и различные объединения данных методов.

Ключевые слова: металлодетектор, визуальный цифровой индекс, годограф, синограф, индукционный баланс, благородные материалы.

Annotation. The article describes the main methods of presenting information about an object for metal detectors built on the principle of an *TR-IB*. Such basic methods as VDI, hodograph, sinograph and various combinations of these methods are characterized.

Keywords: metal detector, visual digital index, the hodograph, sinegraph, induction balance, noble materials.

PERSPECTIVE DEVELOPMENT OF ROCKET AND SPACE ENGINES

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For many years, scientists have been working on the creation of alternative space engines that could accelerate ships to record speeds. Let's look at the main ideas in this area. So scientists V.G. Ostrovsky, A.A. Smolentsev, B.A. Sokolov, D.V. Cherashev and others were engaged in the development of an engine running on iodine, comparing with similar parameters using a traditional working fluid – xenon. They showed the advantages of the electric propulsion system on the iodine compared to the installation using xenon.

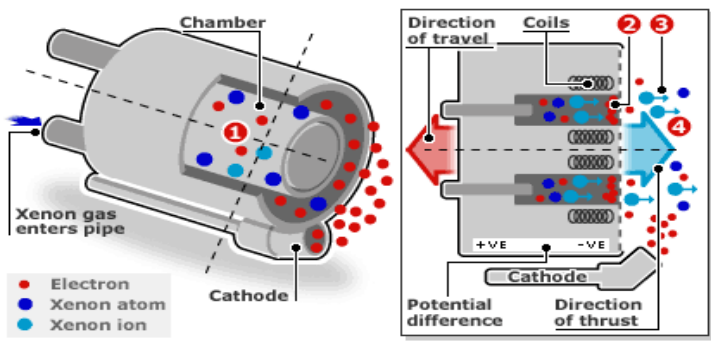
Different types of corrective propulsion systems were investigated by A.V. Gorbunov, V.P., Hodnenko, A.V. Khromov, V.M. Murashko, A.I. Koryakin, V.S. Josan, G.S. Grechin, V.N. Galayko, N.M. Katasonov [4]. Electric rocket engines were studied by S.D. Grishin, L.V. Leskov, N.P. Kozlov [5], A.I. Morozov, A.P. Subin [8]. A.F. Gurov, D.D. Sevruck, D.N. Surnov considered design and strength calculation of space electric rocket engines [6].

V.P. Legostaev, V.A. Lopota, V.V. Sinyavsky studied prospects and efficiency of application of space nuclear power plants and nuclear electric propulsion systems [7]. Electric propulsion system based on motors with closed electron drift on iodine was stated by V.G. Ostrovsky A.A. Smolentsev, B.A. Sokolov, D.V. Cherashev [9]. Power installations of space aircraft were researched by L.A. Kvasnikov, L.A. Latyshev, N.N. Ponomarev-Stepnoi, D.D. Sevruck and V.B. Tikhonov [10].

As part of the work on Hall effect thrusters using xenon as a working fluid, great progress has been achieved in the creation of a stationary plasma engines. "A Hall effect thruster is a small rocket engine that uses a powerful magnetic field to accelerate low density plasma and so produce thrust. The Hall effect thruster, also called a plasma thruster, is a form of electrostatic propulsion, which in turn is a form ion propulsion (a category of electric space propulsion). Like gridded ion engines, such as XIPS, Hall

thrusters are classified as electrostatic thrusters (picture 1). They utilize an inert gas, commonly xenon, as a propellant” [2, www]. Their practical application started in 1972.

Structural diagram of the stationary plasma engine is an annular electromagnet with a ceramic chamber placed in the gap. At the end of the chamber is an anode. Outside, near the cut of the engine channel, there are two cathodes-neutralizer (working and standby). The working substance (xenon) is fed into the chamber and ionized near the anode. Ions accelerate in an electric field and fly out of the engine, creating a jet thrust. Their volumetric charge is neutralized by electrons supplied from the cathode-neutralizer (if this is not done, the satellite will acquire a negative electric charge. As well as the Hall effect thruster itself, four other components are needed to make a complete electric propulsion system: a power source, a power processing unit (PPU), a propellant management system (PMS), and a control computer.

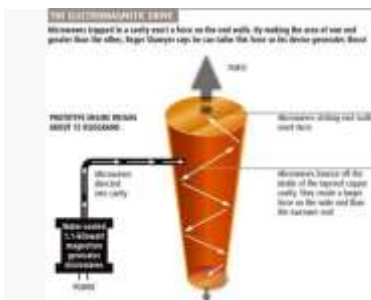


Picture 1 – Movement of the xenon ions and atoms and electrons in the thruster.

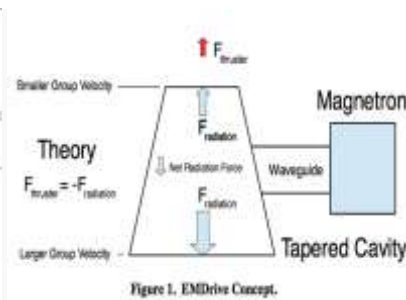
An engineer Roger Shaer, who founded his own company Satellite Propulsion Research in 2001 designed EMDrive in the form of a metal bucket, sealed at both ends. Magnetron emitting electromagnetic waves is situated inside. The author explains the work of his engine through the difference in the pressure of electromagnetic radiation at different ends of the "bucket". This creates a thrust directed towards the narrow end. The possibility of such engine operation has been disputed many times, but in all experiments Shaer's installation shows the presence of thrust in the intended direction (pictures 2, 3).

Organizations such as NASA, the Technical University of Dresden, and Chinese Academy of Sciences were among the experimenters who tested Shaer's "bucket". The invention was tested in a variety of conditions, including vacuum, where it showed the presence of 20 micronewtons thrust.

But given the fact that the engine Shaer can run indefinitely, as it needs no fuel (the operation of the magnetron can provide the solar panels), potentially it is able to accelerate spacecraft to enormous speeds measured in percent of the speed of light.



Picture 2 – EMDrive



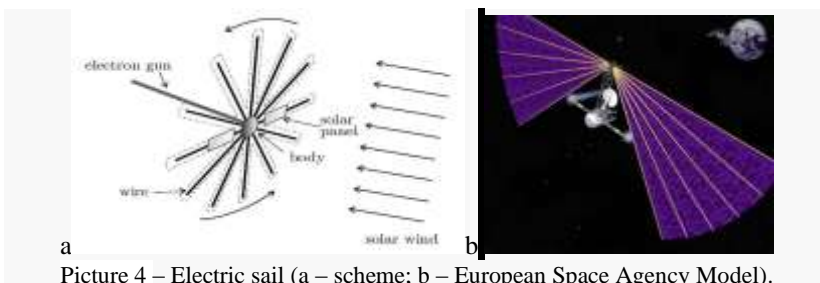
Picture 3 – EMDrive concept

Some scientists believe that the engine can create thrust due to the interaction with the physical vacuum, which at the quantum level has non-zero energy and is filled with constantly emerging and disappearing virtual elementary particles.

Unfortunately, independent tests of the engine with an unknown working principle of EMDrive, seemingly confirmed the existence of "anomalous" thrust, once again ended with very critical feedback from the scientific community. It has come to the point that some theoretical physicists suggest not to consider the results of the experiment at all, because they "do not have a clear theoretical explanation".

Another alternative space engine is an *electric sail*, also known as an electric solar wind sail or an E-sail (picture 4). It is a proposed form of spacecraft propulsion using the dynamic pressure of the solar wind as a source of thrust. It creates a "virtual" sail by using small wires to form an electric field that deflects solar wind protons and extracts their momentum [1].

The electric sail project, created in 2006 by Finnish scientist Pekka Janhunen has little in common with sunny one. This engine consists of several long thin cables, similar to the spokes of a wheel without a rim.



Picture 4 – Electric sail (a – scheme; b – European Space Agency Model).

Due to the electron gun, radiating in opposite direction of movement, these cables acquire a positive charged potential. Since the mass of an electron is about 1800 times less than one of a proton, the thrust created by electrons will not play a fundamental role. The electrons of the solar wind are also not important for such sail. But the positively charged particles – protons and alpha radiation will be repelled from the cables, thereby creating a reactive thrust.

Although this thrust will be about 200 times less than that of the solar sail, the project was of interest to the European Space Agency. The electric sail is easier to design, produce, deploy and operate in space. And since the surface area of such sail is much smaller than that of the sun, it is much less vulnerable to asteroids and space debris.

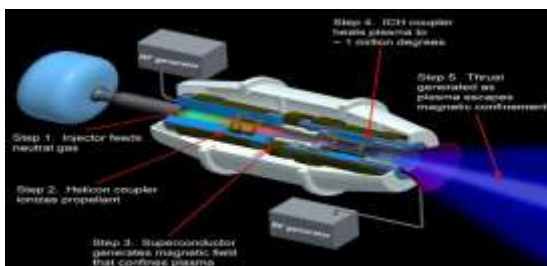
An ion thruster or ion drive is a form of electric propulsion used for spacecraft propulsion. It creates thrust by accelerating positive ions with electricity. The term refers strictly to gridded electrostatic ion thrusters, and is often incorrectly loosely applied to all electric propulsion systems including electromagnetic plasma thrusters.

An inert gas (usually xenon) is ionized by a stream of high-energy electrons in an ion engine (picture 5). “Electrons produced by the discharge cathode are attracted to the discharge chamber walls, which are charged to a high positive potential by the voltage applied by the thruster’s discharge power supply. Neutral propellant is injected into the discharge chamber, where the electrons bombard the propellant to produce positively charged ions and release more electrons. High-strength magnets prevent electrons from freely reaching the discharge channel walls. This lengthens the time and increases the probability of an ionizing event. The positively charged ions migrate toward grids that contain thousands of very precisely aligned holes (apertures) at the aft end of the ion thruster. The first grid is the positively charged electrode (screen grid).

A very high positive voltage is applied to the screen grid, but it is configured to force the discharge plasma to reside at a high voltage. As ions

pass between the grids, they are accelerated toward a negatively charged electrode (the accelerator grid) to very high speeds (up to 90,000 mph)” [3, www]. However, modern ion thrusters have very low thrust – about 50-100 millinewtons.

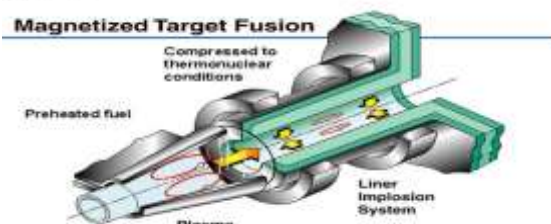
A large specific impulse can significantly reduce fuel consumption in the engine. For gas ionization, the energy obtained from solar panels is used, so the ion engine is able to work for a very long time – up to three years without interruption.



Picture 5 – Ion thruster

“Ion thrusters are being designed for a wide variety of missions—from keeping communications satellites in the proper position (station-keeping) to propelling spacecraft throughout our solar system. These thrusters have high specific impulses-ratio of thrust to the rate of propellant consumption, so they require significantly less propellant for a given mission than would be needed with chemical propulsion. Ion propulsion is even considered to be mission enabling for some cases where sufficient chemical propellant cannot be carried on the spacecraft to accomplish the desired mission” [3, www].

Fusion engine is still very attractive one (picture 5). Controlled thermonuclear fusion is a source of huge energy obtained from very cheap fuel – isotopes of helium and hydrogen.



Picture 6 – Fusion engine

Source: <https://www.nasa.gov/centers/glenn/about/fs21grc.html>

At the moment, there are several projects for the design of a jet engine on the energy of thermonuclear fusion. The most perspective one is a model based on a reactor with magnetic plasma confinement. The thermonuclear reactor in such an engine is a cylindrical chamber 100-300 meters in length and 1-3 meters in diameter. The fuel should be supplied to the chamber in the form of a high-temperature plasma, which, at sufficient pressure, reacts to nuclear fusion. The coils of the magnetic system located around the chamber should keep this plasma from contact with the equipment.

The thermonuclear reaction zone is located along the axis of such a cylinder. By means of magnetic fields, extremely hot plasma flows through the nozzle of the reactor, creating a huge thrust, many times greater than that of chemical engines.

In general, the principle of operation of the *electric rocket engine* is to convert electrical energy into directed kinetic energy of the particles. One of the founders of the idea of accelerating electrical energy in jet engines expressed K.E. Tsiolkovsky.

Inert gases are currently used as the working medium, in particular xenon, which has the largest atomic weight (131.3 a.u.m) and relatively low ionization potential (12.1 eV). According to its characteristics, xenon is superior to other gases, but the volume of its production is very small, and the cost is very high.

The first stage of pressure reduction (from 115 to 10 kg/cm²) is realized when the working fluid passes through the bundle "throttle – heat exchanger – gasifier", the second stage (up to 1.75 kg/cm²) – when passing xenon through the reducer. The scheme uses the principle of duplication (reservation). In the case of using xenon as a working fluid, it is necessary to distribute the supply to the cathodes and anode.

Flow rate regulation of the working fluid into the anode and the cathode-neutralizer TM is carried out in the valve block by means of a thermal throttle, which increases the discharge current reduces the consumption of xenon, and, conversely, with a decrease in the discharge current increases the consumption of xenon.

On this basis, it is of great practical interest is the use iodine as a working body electric jet engine with atomic mass 126,9045.a.u.m. the values of potentials of ionization of the atom of iodine (eV): 10,44; 19,0; 31,4. Taking into account values of the atomic masses of xenon and iodine, we can assume quite similar characteristics of the electric rocket engine. The only disadvantage of using iodine instead of xenon is that iodine is toxic, flammable and explosive, and also, the vapors of iodine are poisonous.

The electric rocket engine on iodine is tested in a vacuum chamber at a pressure of about 10-5 mm.

At the same time with the cathode tubing of the anode-discharge chamber and the anode is heated to a temperature value which must not be above the temperature of the iodine in the tank, but below the melting point of iodine (387 K), which allows to prevent condensation of iodine in the entire range of operating pressures of the engine. The valves are opened and xenon is fed to the cathode and iodine to the engine anode at a given flow rate. After starting the engine and entering its nominal mode, the heating of the cathode and anode is switched off.

It should be noted that some considered thrusters have a specific impulse much higher than the 300 to 400 seconds of chemical rockets. However, they provide a much lower thrust. The high specific impulse enables a spacecraft powered by a thruster to reach a top speed of about 50,000 meters per second (112,000 mph). The low thrust, on the other hand, means that weeks or months are needed to attain this speed.

Conclusion. Based on the conducted reviews of electric motors, it can be said that at present, a new generation of engines have received a great development, that determined the directions of development for the future.

As part of advanced rocket and space engines analysis, electric rocket engines on the working body of iodine, with the Hall effect, at the magnetron work, the Shaer installation, engines capable of creating thrust due to interaction with physical vacuum, the so-called EMDrive concept, the ion engine, as well as the jet engine on the energy of thermonuclear synthesis obtained from the isotopes of helium and hydrogen were considered.

It should be noted that the main characteristics of the engines are their output power, with minimal fuel consumption, as well as the cost of the working material on which the engine operates.

New engine designs are trying to find ways to accelerate ions or atomic particles to extremely high speeds to create thrust more efficiently.

All engines have been recognized for their existence and have been studied at the initial level of experiments. It gives reason to believe that further development has perspectives due to their advantages.

The prospect of further research is a detailed study of the technical data of rocket engines and a deeper analysis of their application in spacecraft.

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10. Теория и расчет энергосиловых установок космических летательных аппаратов / Л.А. Квасников, Л.А. Латышев, Н.Н. Пономарев-Степной, Д.Д. Севрук, В.Б. Тихонов. – Изд. второе, перераб. и доп. — М.: Изд-во МАИ, 2001. – 480 с.

Аннотация. Рассмотрены основные особенности двигателей нового поколения, применяемых в космических аппаратах. В рамках проведённого анализа перспективных ракетных и космических двигателей были рассмотрены электрические ракетные двигатели на рабочем теле йод, с эффектом Холла, на работе магнетрона, установка Шаера, двигатели способные создавать тягу за счёт взаимодействия с физическим вакуумом, так называемая концепция EMDrive, ионный двигатель, а также реактивный двигателя на энергии термоядерного синтеза, получаемой из изотопов гелия и водорода.

Сделан вывод о возможности дальнейшего развития данных образцов, так как каждый из рассмотренных выше двигателей имеет свои преимущества.

Ключевые слова: ракетные двигатели, йод, эффект Холла, магнетрон, гелий, ксенон, термоядерный синтез.

Annotation. The main engines features of a new generation used in spacecraft are considered. As part of the analysis of advanced rocket and space engines, the author considers electric rocket engines on the working body of iodine, with the Hall effect, at the magnetron work, the Shaer installation, engines capable of creating thrust due to interaction with physical vacuum, the so-called EMDrive concept, the ion engine, as well as the jet engine on the energy of thermonuclear synthesis obtained from the isotopes of helium and hydrogen.

It is concluded that there is a possibility of further development of these engines due to their advantages.

Keywords: rocket engines, iodine, Hall effect, magnetron, helium, xenon, thermonuclear synthesis.

UDC 629.12-8

ANALYSIS OF DESIGNS OF SHIP SYSTEMS OF COMBINED PRODUCTION ENERGY

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Recently, one of the main directions of increasing efficiency of ship power plants (SPP) is the technologies of combined energy production usage. These technologies allow the use of secondary energy resources (SER) of the power plant: heat, discharged with the combustion products; water, cooling the internal combustion engine (ICE).

In addition to the main types of energy (mechanical or electrical), the SPPs generate heat in the form of steam or heated water, and, therefore, are installations of a cogeneration type. Subsequent use of the heat energy justifies the type of cogeneration plant (CP). CP can be divided into two types:

- 1) technological purpose with using thermal energy for external consumers (heating, desalination plants, etc.);
- 2) energy purpose, providing appropriate training of the actuating medium of the SPP itself.

Cogeneration plants have the following number of advantages [1]:

- increasing performance of using fuel due to higher energy efficiency;
- reduction of harmful emissions into the atmosphere compared with the separate production of heat and electricity;
- decreasing the cost of transmission electricity transmission, since cogeneration plants are located in places of consumption of heat and electricity, the losses in the networks are practically absent;
- the possibility of work on biofuels and other alternative fuels;
- noiseless and environmentally friendly equipment.

A special case of cogeneration is the process of trigeneration. Trigeneration is the simultaneous generation of electricity, heat and cold from one primary source of energy (fuel, natural gas). This process involves the inclusion of a cold-producing superstructure in addition to the basic cogeneration plant. The superstructure can work on a separate or common with the cycle of basic installation.

Absorption chillers (AC) is a type of device that is used for the production of cold for various purposes (for example, for air conditioning). Using of AC does not have a harmful effect on the environment because these machines run on natural refrigerants [2]. The fuel for AC is oil, gas, bio-fuel, steam, hot water, solar energy, or excess of heat energy from gas turbines. The most famous manufacturers of AC are firms Carrier, Trane, York, Century, Broad.

The principle of operation of absorption chillers (Fig. 1) is that water evaporates at relatively low temperatures under vacuum conditions, thus carrying with it heat from the air conditioning system. Lithium bromide (LiBr) is used as a water absorbent in AC. This solution absorbs the steam that transfers the heat to the cooling water, after which it will be converted into dilute solution, which would be sent to the generator due to the high temperatures from hot steam, water, exhaust gases, solution evaporation occurs. The concentrated LiBr solution is returned to the absorber, and the water steam is sent to the condenser and the cycle repeats.

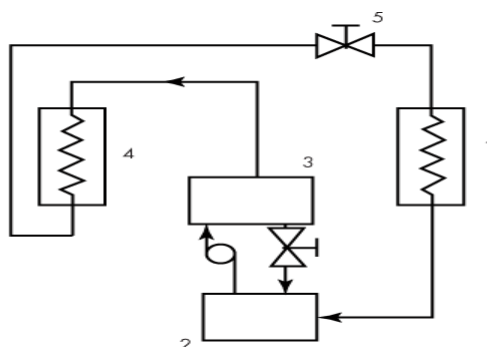


Figure 1 – Schematic diagram of the single-stage absorption chiller:

1 – evaporator; 2 – absorber; 3 – desorber;

4 – capacitor; 5 – expansion valve

According to the principle of operation, absorption chillers are divided into units of direct action and one- and two-stage units on coolants. In the first units the combustion process of various types of fuel (gas, diesel fuel, kerosene) can be used directly, the second units use hot water, exhaust hot air, steam.

Nowadays, electric generators located on the same shaft with the engines power ship trigeneration systems. In turn, the operation of the absorption refrigerating machine is provided by using of low-potential thermal energy SER. The usage of these systems can significantly improve the efficiency of marine engines, however the presence of absorption machines significantly increases the weight and dimensions of the ship's system.

Because the area of the ship's holds (tweendecks) is relatively small, there is a strictly limited space for the installation of the utilization system. Therefore, the reducing weight and dimensions of trigeneration installation is a topical issue.

For solving this problem, it is proposed not to use the absorption machine but an ejector chiller (EC), which works on low-boiling substances (up to -5°C) as a heat insulating refrigerating machine.

Ejector chillers represent a particular case of compressor heat-using chillers, in which a mechanical compressor and a mechanical turbine are replaced by only one element — an ejector. EC have a significant drawback - low efficiency associated with large irreversibility in the processes occurring in the ejector regardless of performance and working substance. However, the results of recent studies show that the efficiency of the system

can be increased up to 0.65. These results allow the EC to better compete with absorption machines, the efficiency of which is 0.7.

EC has several advantages: simplicity of design, durability, low cost and small operating costs. A schematic diagram of the ECM is shown in Figure 2.

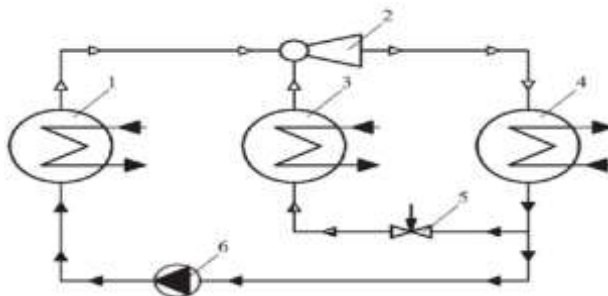


Figure 2 – Schematic diagram of the EC:

*1 – generator; 2 – ejector; 3 – evaporator; 4 – capacitor;
5 – control valve; 6 – feed pump*

These ship's trigeneration installations due to their low weight and dimensions would be able to installed not only in the holds, but also on the upper deck. This system can operate independently of the ship network and produce electricity, cold and heat without interruption under changing operating conditions ship. With the usage of EC the creation of the monoblock trigeneration systems of relatively small sizes for vessels of various purposes is becoming a real thing.

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Аннотация. В статье описана технология тригенерации в судовых энергетических установках, выявлены преимущества и недостатки систем, входящих в состав теплоизолирующих холодильных машин. Проведен анализ конструкций судовых систем комбинированного производства энергии.

Ключевые слова: тригенерационные системы, холодильные машины, вторичные энергоресурсы, когенерация, судовые электростанции.

Annotation. This article describes the technology of trigeneration in ship power plants, identifies the advantages and disadvantages of the systems included heat insulating refrigerating machines. Analysis of designs of ship systems of combined production energy is performed.

Keywords: trigeneration systems, refrigerating machines, secondary energy resources, cogeneration, ship power plants.

UDC 62-97/-98

NEW APPROACHES TO DIRECT DIGITAL SYNTHESIS

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Introduction. Functional generators have been known for a long time. They were considered by many scientists: J.D. Gibson, E.C. Ifeachor, B.W. Jervis, B.P. Lathi, A.V. Oppenheim, A.S. Willsky, J.G. Proakis, D.G. Manolakis and others.

At first they had a few knobs for setting the amplitude and frequency of a sinusoidal output. Function generators now provide wider frequency ranges, calibrated output levels, a variety of waveforms, modulation modes, computer interfaces, and in some cases, arbitrary functions.

Many features added to function generators complicate their design and increase their cost. There is an opportunity for a radical re-design of the familiar function generator using direct digital synthesis (DDS).

Main part. DDS provides remarkable frequency resolution and allows direct implementation of frequency, phase and amplitude modulation. These features which were added to function generators now are handled on the basis of DDS [8].

Direct Digital Synthesis

Many of DDS concepts are illustrated by a sinusoidal wave generation method. The figure below shows a block diagram of a simple DDS function generator. The sinusoidal function is stored in a RAM table. The RAM's digital sinusoidal output is converted to an analog sinusoidal wave by a DAC. The steps signal at the DAC output is filtered by a low pass filter to provide a sinusoidal wave output.

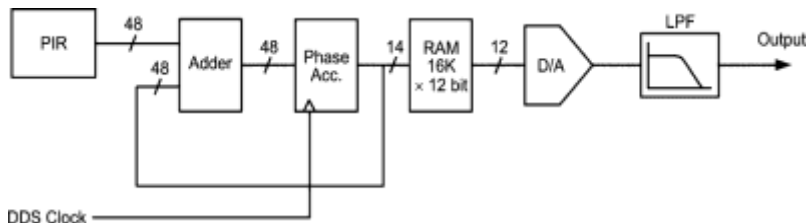


Diagram 1 - Simple DDS Function Generator.

The frequency of the sinusoidal wave depends on adjustable speed of circulation to the RAM table. Functions are generated by adding a constant, stored in the phase increment register (PIR), to the phase accumulator. Usually, the rate of additions is constant, and the frequency is changed by changing the number in the PIR [1].

The frequency resolution depends on the number of bits in the PIR. If the PIR, adder, and phase accumulator support 48-bit additions, then the fractional frequency resolution is one part in 247, or about 1×10^{14} . That means a 48-bit DDS generator can provide better than 1 μ Hz resolution on a 10 MHz output. In order to understand DDS performances one should consider a sample rate, RAM size, DAC resolution, filter characteristics, and spectral output frequency [8].

A large number of samples are required for each cycle of a sinusoidal wave to achieve good spectral output frequency. Three samples are required during each cycle. In fact, if we could make low-pass filter, we would need only two samples per cycle.

Let's consider the case with four samples per sine cycle. The quantized sine wave is compressed into a burst of pulses (or meander if quantization is started at 45 degrees instead of 0 degrees).

The sampling sine is reduced to a pulse train (or a square wave, if we started sampling at 45 degrees instead of at 0 degrees). The Fourier spectra for this pulse sequence consist of f , $2f$, $3f$... etc. If we can arrange the low pass filter to eliminate the harmonic components of the pulse sequence, then we have a fundamental combination (a sine wave at frequency f) [8].

The diagram 2 shows a low pass filter transfer function. As we have seen, the filter must pass the highest generated frequencies (f_{\max}), and reduce the frequencies beginning from $f_s - f_{\max}$. A reasonable compromise when $f_{\max} = f_s/3$, allows you to get a filter with a transition band of one phase [1].

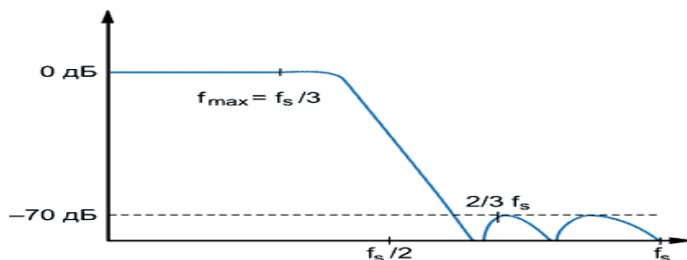


Diagram 2 – Low pass filter for DDS outputs

For a attenuation a function generator application of 70 dBc is needed.

A maximum practical output frequency is $f_s/3$. So the DDS phase accumulator, RAMs, and DACs must run at the maximum desired output frequency.

The DAC resolution depends on the component specification for the output (or the desired arbitrary waveform resolution).

“With the introduction of a phase accumulator function into the digital signal chain, this architecture becomes a numerically-controlled oscillator which is the core of a highly-flexible DDS device. As figure 1-2 shows, an N-bit variable-modulus counter and phase register are implemented in the circuit before the sine lookup table, as a replacement for the address counter. The carry function allows this function as a “phase wheel” in the DDS architecture” [2, www].

Extending Frequency Range

DDS output frequency range may be extended by a variety of techniques. Depending on used technique some of the advantages of DDS may be lost.

Modulation Techniques

DDS power is the most apparent when a modulated source is required. The frequency of the output may be changed instantly to any frequency from DC to f_{\max} by changing the number in the phase increment register [1].

This phase accumulator, which has been optimized for function generator applications, has two phase increment registers: PIRA and PIRB. A 48-bit wide multiplexer can switch between the PIRs in a single clock cycle. The modulation processor can modify the PIRs at a rate of up to 10

million bytes per second, filling one PIR while the other is used as an input to the adder (Figure 1) [8].

More complex modulation programs may be stored, such as frequency modulation by any arbitrary function, linear or log ones, etc. Phase modulation is easily done by programming PIRA with the nominal frequency, and using PIRB, which contains the nominal phase increment plus any desired phase shift, for a single clock cycle.

There are two approaches for amplitude modulation (Figure 2) of the output waveform: digital outputs from the RAM and the analog output from the DAC are multiplied by the desired amplitude. The later approach is better for function generators, so that either an internal or external source may be used for amplitude modulation.

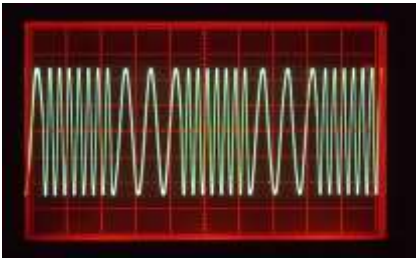


Figure 1 – Frequency shift keying of sine wave.

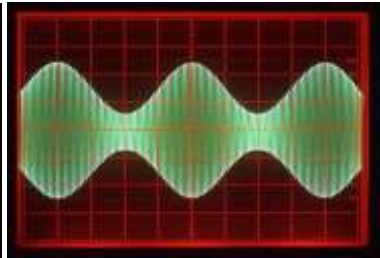


Figure 2 – Amplitude modulation

Output Amplifiers

The output amplifier used in a DDS function generator must meet some requirements. In order to preserve waveforms generated in the arbitrary mode, the amplifier must have a wide and flat pass band, and exhibit a phase linear response well past the cutoff frequency of the Bessel filter.

The amplifier's bandwidth also determines the rise time of the square wave output. A phase linear is required to prevent overshoot on the square wave output.

Finally, the output amplifier must be able to drive 10 Vpp into a 50 Ω load, meet distortion and settling specifications, and be protected against short circuits or connection to external power supplies. The output amplifier should exhibit a 50 Ω output impedance regardless of output level setting.

DDS provides a new design approach for function generators. A TTL prototype of the phase accumulator diagrammed earlier required about 150 ICs. The prototype was just able to work with a clock of 10 MHz. CMOS gate array of the same design was fabricated in a 68-pin PLCC plastic

package. The gate array operates at 40 MHz (worst case), uses about 0.25 watts of power, and has a recurring cost of about \$10 [8].

Conclusion.

It should be noted that DDS based function generators are just beginning to appear in the market. These function generators offer substantial performance improvements, at reduced costs, over conventional analog function generators. As the cost of ASICs, RAMs and DACs decline, while their speed and resolution increase, expect to see DDS based function generators soon replace their analog counterparts.

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Аннотация. Рассматривается передаточная функция фильтра нижних частот. Анализируется расширение частотного диапазона. Исследована частотная манипуляция синусоидальной волны и амплитудной модуляции. Отмечено, что ПЦС предоставляет новый, перспективный подход к проектированию функциональных генераторов.

Ключевые слова: ASICs, RAMs, DACs, функциональные генератор, фильтр, нижних частот, расширение частотного диапазона, частотная манипуляция синусоидального сигнала.

Annotation. A low pass filter transfer function is considered. Extending Frequency Range is analyzed. Frequency shift keying of sine

wave and amplitude modulation are researched. It is noted that DDS provides a new design approach for function generators and AC MOS gate array of the same design has more advantages.

Keywords: ASICs, RAMs, DACs, pass filter, extending frequency range, frequency shift keying of sine wave, amplitude modulation.

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DEVELOPMENT OF A RADIO FREQUENCY IDENTIFICATION SYSTEM OF RECLOSERS

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Currently, training and identification of vacuum circuit breakers (BB) is carried out using bar coding. The barcode contains a unique item number and information about the type of explosives. However, very important information, such as the coefficients of the sensors embedded in this explosive, is only available in the manufacturer's database or in the explosive passport data. It is necessary to enter the coefficients of the sensors in the software, in accordance with the passport data of the explosive, which in turn leads to errors and the time trajectory under the influence of the human factor. To minimize the influence of the human factor, it is proposed to use an identification method that would automate the process of obtaining information about the type of explosives and the coefficients of its sensors.

To minimize the influence of the human factor, it is proposed to use an identification method that would fully automate the process of obtaining information about the type of explosives and the coefficients of its sensors.

When developing a new method of identification, it is necessary to take into account some limitations, so it must remain operational throughout the entire temperature range of the explosives, i.e. from -40 °C to +85 °C. It is unacceptable to use additional wires for data transmission and serious changes in the design of explosives.

The maximum set of reclouser includes 3 current sensors, 6 voltage sensors, 1 zero sequence current sensor and 3 current sensors for commercial metering.

To store the coefficients of the 13 sensors requires 52 bytes (4 bytes per sensor). In addition, the serial number requires 16 bytes, for the type of switch - 2 bytes, for storing the initial parameters 10 bytes.

Therefore, the memory you want to allocate in the identifier is 80 bytes.

To develop a new method of identification, it is necessary to analyze the existing methods and select the most suitable one.

Currently, the most popular identification methods are:

- Magnetic card [1, p.2]
- Smart Card [2, p.2]
- Linear bar coding [3, p.2]
- Matrix coding [4, p.2]
- Radio Frequency Identification

In Table 1, below we can see a comparative description of the identification methods.

Table 1 comparative description of the identification methods.

	Magnetic card	C Smart Card	Linear bar coding	Matrix coding	RFID
Minimum and maximum memory, bytes	1	32	2	3	8192
Ability to change information	+	+	-	-	+
The minimum and maximum distance from the reader to the mark, cm	Contact Device	Contact Device	0,5	0,5	300
The complexity of the fake	High	High	Low	Low	High
Cost	Low	Low	Low	Low	High

From table 1 it is seen that the best performance has a method of radio frequency identification. It significantly surpasses other methods in terms of both memory and reading range.

Therefore, despite the high cost, it is taken as the basis for development. As an identifier is proposed to use the RFID system. The RFID system includes a transponder and reader. As a transponder, a card, key fob, capsule or inlay is used. A separate PC-connected system is used as a reader. The transponder and reader in their design contain antennas that form a transformer connection when the transponder enters the field of the reader coil.

For further development, we need to consider various RFID standards. RFID systems are divided into 3 main groups depending on the operating frequency range:

- LF range labels 125-134 kHz
- HF band labels of 13.56 MHz
- UHF band labels (860-960 MHz)

125–344 kHz LF range labels are passive low cost RFID systems. According to their physical characteristics, they are used to implant subcutaneous marks on animals, people, and fish. They have significant limitations in range and accuracy.

13MHz systems are fairly cheap, have no environmental problems, are well standardized and have a wide range of solutions. Used in payment systems, logistics, personal identification.

As in the LF range, in HF systems, there are problems associated with reading over long distances, in high humidity conditions, surrounded by metal and the appearance of collisions. Метки диапазона UHF обладают наибольшей дальностью действия.

UHF tags are cheaper than tags in the LF and HF ranges, but overall, the UHF RFID system is more expensive due to the cost of the rest of the equipment.

As mentioned above, it is proposed to use an RFID system as an identifier. The RFID system includes a transponder and reader. As a transponder, a card, key fob, capsule or inlay is used. A separate PC-connected system is used as a reader [5, p.2].

To reduce the cost of development, it is proposed to use a microcontroller as a reader. The internal resources of the microcontroller are able to provide a frequency of 125 kHz.

The transponder and reader in their design contain antennas. These antennas forms a transformer connection when the transponder enters the field of the reader coil.

The transponder, in turn, receives power by entering the reader's field. Transponder circuit, depending on the code written to it, connects and disconnects the load. Due to this, amplitude modulation of the magnetic field occurs. The signal arriving at the reader must be demodulated. Data is presented in Manchester coding.

We can see a reader prototype circuit in Figure 1.

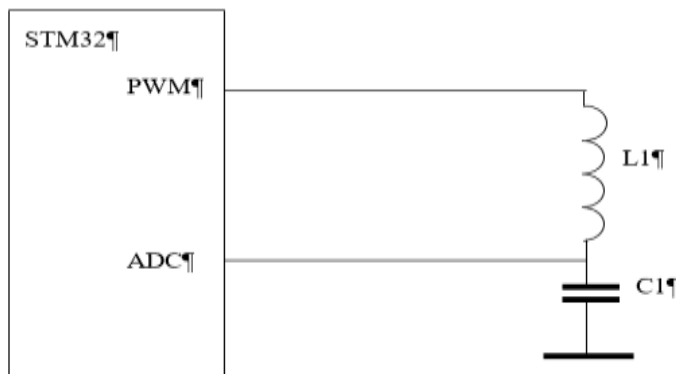


Figure 1 — Reader prototype circuit.

The figure shows the electrical diagram of the reader's prototype. The source of the 125 KHz signal is the output of the microcontroller, which switches at a frequency of 125 KHz. The amplitude of the pulses is 3.3 V. The signal with an amplitude of 3.3 volts is fed to the coil L1, which in turn is the reader antenna, and which enters into a transformer connection with the transponder coil. The coil forms an oscillating circuit with a capacitor C1. The values of the coil and the capacitor must be selected taking into account the resonance at a frequency of 125 KHz.

When a transponder coil L1 enters the field, the transponder chip begins to receive power, as an EMF is induced on the coil. A current begins to flow in the transponder circuit, which in turn feeds the transponder chip.

Transponder circuit, depending on the code stored in its memory, switches on and off the load. Accordingly, the voltage level on the reader coil begins to decrease when the load is connected.

The modulated signal is removed from the capacitor C1, and is fed to the ADC of the microcontroller, which in turn digitizes the signal, and decodes the received data.

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Аннотация. Кодирование штрих-кода в настоящее время используется для идентификации автомата повторного включения. Использование штрихового кодирования приводит к ошибкам в программировании отдельных устройств под влиянием человеческого фактора. Для исключения человеческого фактора предлагается разработать метод автоматической идентификации.

В основе идентификатора автомата повторного включения предлагается использовать методы радиочастотной идентификации. Для снижения стоимости разработки предлагается использовать в качестве считывателя микроконтроллер, который будет генерировать сигнал с частотой 125 кГц, а также получать сигнал, который будет моделироваться.

В настоящее время разработаны схема и прототип считывателя, который будет передавать данные на ПК через COM-порт.

Ключевые слова: читатель Приемответчика RFID микроконтроллера Recloser идентификации

Annotation. Barcode coding is currently used to identify recloser. The use of bar coding leads to errors in the programming of individual devices under the influence of the human factor. To exclude the human factor, it is proposed to develop an automatic identification method. The basis of the identifier of recloser is proposed to use the methods of radio frequency identification. To reduce the cost of development, it is proposed to use a microcontroller as a reader, which will generate a signal with a frequency of 125 kHz, as well as receive a signal that will be simulated.

At present, a circuit and a prototype reader have been developed that will transmit data to a PC via a COM port.

Keywords: идентификация, автомат повторного включения, микроконтроллер, RFID, приемответчик, измеритель

CODESIGN OF MICROWAVE LIMITER AND LOW NOISE AMPLIFIER IN 180 nm SiGe BiCMOS TECHNOLOGY

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1. Introduction

The low noise amplifier (LNA) is an important part in the receiver of microwave system which has to achieve high power gain and low noise performance. However, the poor power handling capability of low noise amplifiers has severely limited their application [1]. Microwave limiters protect power-sensitive elements from damage and prevent system failure.

This paper presents the simulation results of the C-band low noise amplifier with diode limiter (limiter-LNA) which is designed in TSMC 180 nm SiGe BiCMOS technology.

2. Limiter-LNA design

Simplified schematic diagram of the microwave limiter-LNA is shown in Figure 1. LNA protection circuit is a three-stage diode microwave limiter. It has two states: the state of transmission at low power and state of isolation at high power of the input signal. Switching between two states is based on nonlinear properties of the diode clipping circuits. The voltage produced by the input microwave power controls the limiter.

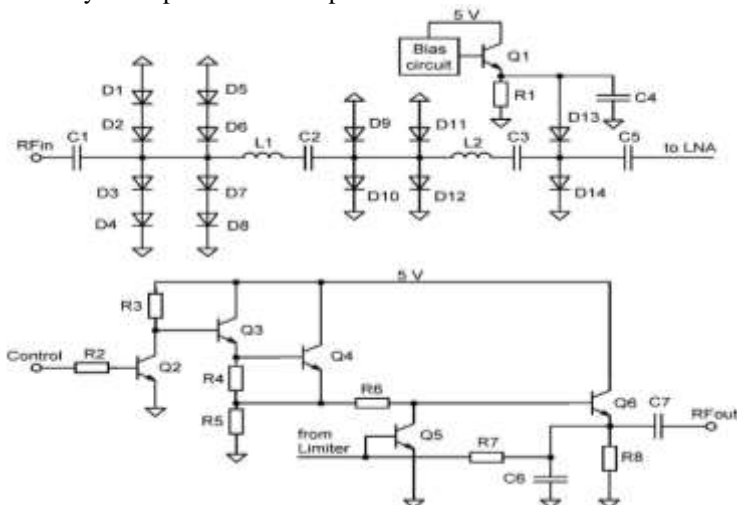


Figure 1 — Simplified schematic diagram of the limiter-LNA

Diodes, which are connected in inverse parallel, limit both positive and negative signal half-cycles at the level of their forward voltage. Diodes D1—D8 in the first stage limit half-cycles of microwave signal at the level of about 1.4 V. Diodes D9—D12 in the second stage — at the level of about 0.7 V. Maximum input continuous power of diode RPC in 180 nm SiGe BiCMOS technology is within hundreds milliwatts [2].

Limiting of the output signal in RPC when the power of the input microwave signal is less than 10 dBm occurs due to the fact that the diodes in the third stage are additionally biased in the forward direction. Additional bias voltage of about 0.9 V is formed on the emitter of the transistor Q1. It is equally divided between diodes D13 and D14.

The first stage transistor Q5 included according to the common emitter circuit is divided into six parts to increase the maximum signal power at the input of the amplifier. The composite transistor Q6 in the second stage is connected according to a common collector circuit for matching the amplifier with 50 Ohm.

The bias of Q5 is set using negative feedback from Q6 emitter which contributes to increasing the stability of the gain when the temperature or supply voltage changes.

The stand-by mode circuit (transistors Q2—Q4) allows to disable the amplifier for example when the transceiver is in transmit mode. When a high logic level (2.5 V) arrives at the base of the transistor Q2, it opens, the potential at its collector decreases, which leads to the closure of the remaining transistors of the circuit and, consequently, to a significant decrease in power consumption.

Layout of the microwave limiter-LNA is shown in Fig. 2. Linear dimensions are 510×800 μm . Layout area — 0.408 mm².

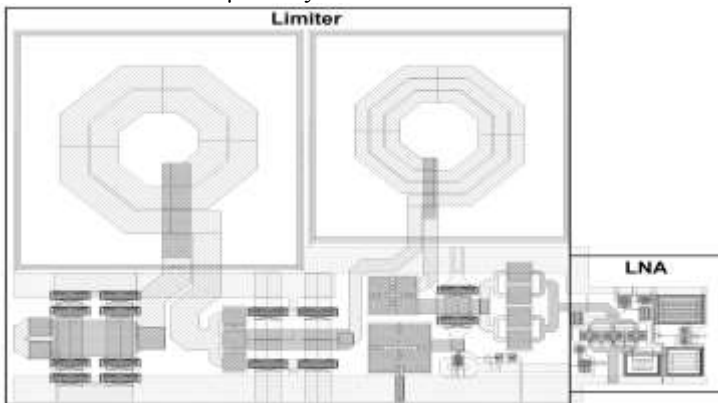


Figure 2 — Designed limiter-LNA layout

3. Simulation results

Dependencies of the microwave limiter output power from input power in dBm (limiting characteristics) for three frequencies are shown in Figure 3. The recovery time simulation results are shown in Figure 4.

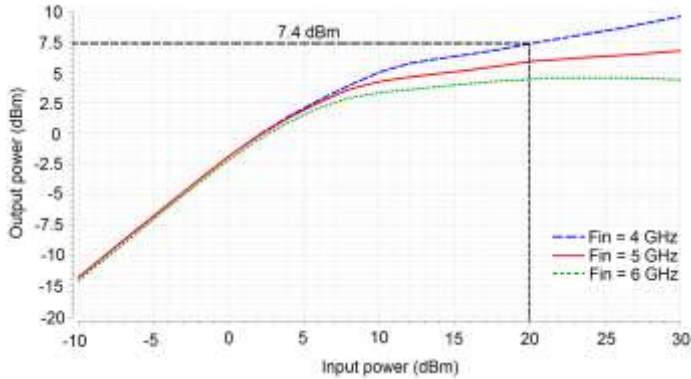


Figure 3 — Output power versus input power for the limiter

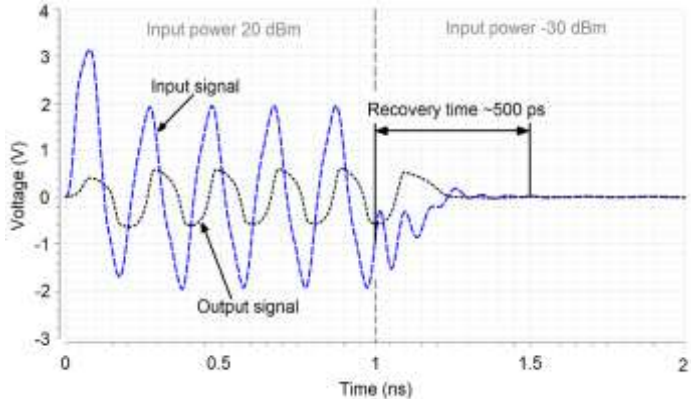


Figure 4 — Transient response of the limiter

The simulated S_{21} has a peak gain of 25 dB at 5.3 GHz with 3 dB bandwidth (BW) of 3.5—6.8 GHz. The S_{11} is -10 dB at 3.6—6.8 GHz. The noise figure (NF) is <5 dB at 2.8—6.8 GHz with a minimum NF of 4 dB at 4.7 GHz. Simulated parameters is shown in Figure 5.

The simulated input 1 dB compression point (IP1dB) is about -30 dBm at BW and input third-order intercept point (IIP3) is about -20 dBm (Figure 6).

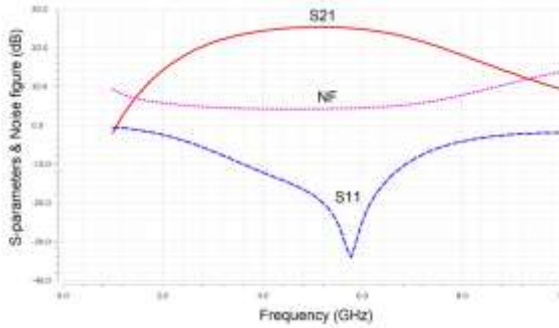


Figure 5 — Simulated S-parameters and NF of the limiter-LNA

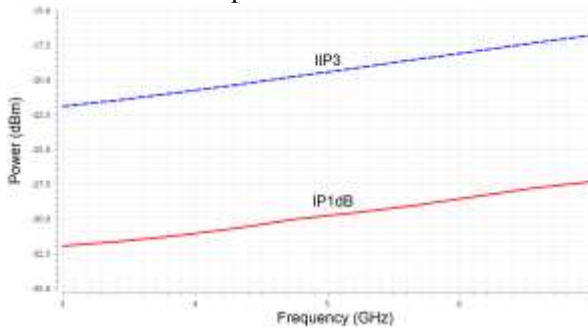


Figure 6 — IP1dB and IIP3 versus frequency

Table 1 summarizes the performance of the presented limiter-LNA, with comparison to previously published LNAs.

Table 1 — Comparison the presented limiter-LNA with previously proposed LNAs

Spec.	This work	[3]	[4]		[5]
Technology	SiGe BiCMOS 0.18 μm	CMOS 0.18 μm	SiGe BiCMOS		CMOS 0.18 μm
BW, GHz	3.5—6.8	3.1—10.6	3.1—10.6		1—5
Peak gain, dB	25	10.4	17	23.5	14
NF, dB	4	4	2.4	3	5
S_{11} , dB	-10	-9.4	-4	-6	-12
IP1dB, dBm	-30	—	-13.5	-19.5	—
IIP3, dBm	-20	-8.8	—	—	—
Power, mW	30	9	55		9
Input continuous power	>20 dBm (100 mW)	—	—		—

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Аннотация. В статье представлены результаты моделирования МШУ с входным ограничителем мощности *C*-диапазона частот, разработанном на основе 180 нм *SiGe* БиКМОП технологии. Усилитель достигает коэффициента усиления по мощности 25 дБ при возвратных потерях по входу более 10 дБ в рабочем диапазоне частот.

Минимальный коэффициент шума — 4 дБ, точка компрессии 1 дБ по входу — около –30 дБм при потребляемой мощности 30 мВт. Максимальная продолжительная входная СВЧ-мощность составляет 100 мВт. Площадь топологии — 0,408 мм².

Ключевые слова: малошумящий усилитель, МШУ, ограничитель, *SiGe*, БиКМОП, *C*-диапазон.

Annotation. This paper presents the simulation results of a 3.5–6.8 GHz low noise amplifier with diode limiter (limiter-LNA) which is designed in 180 nm SiGe BiCMOS technology. The amplifier achieves a power gain of 25 dB with an input match of –10 dB over the band, a minimum noise figure of 4 dB and input P1dB of –30 dBm while consuming 30 mW. Maximum continuous input power is above 20 dBm (100 mW). Layout area — 0.408 mm².

Keywords: low noise amplifier, LNA, microwave limiter, SiGe, BiCMOS, C-band.

DEVELOPMENT AND RESEARCH OF A RING ANTENNA ARRAY OF A CAR DIRECTION FINDER

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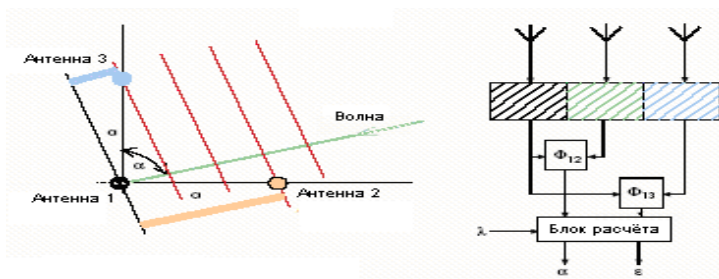
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An interferometric method was used to develop the antenna array of a car radio finder, thanks to which the angle of arrival of the wave is determined by directly measuring the phase difference between the signals received by individual elements of the antenna system located at different points in space [1] (picture 1).

Unambiguous determination of the azimuth and elevation angle of the radiation source is possible only with the help of at least three antennas, the distance between which does not exceed half the wavelength.

With the development of digital signal processing, the efficiency of systems based on an array of sensors has increased due to the following reasons.

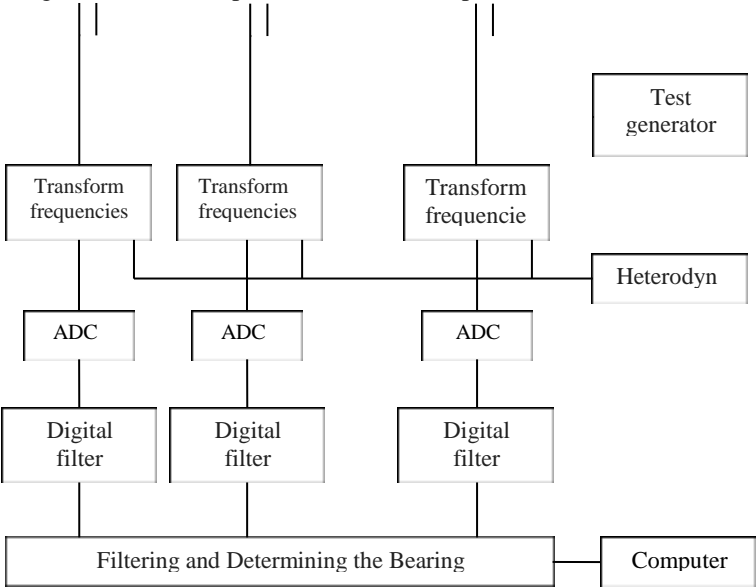


Picture 1 – Three element interferometer

The emergence of high-speed digital processors. When using them, there are no requirements for the speed of processing the received information. Even very complex mathematical relationships for determining

bearing are processed in relatively short periods of time or can be simplified for faster and more economical processing [2].

The development of calculation methods, which made it possible to divide several waves coming from different directions even when using low-base antenna systems (high resolution, super-resolution, and resolution with multi-wave reception) [3]. A typical configuration of a radio finder integrated with a computer is shown in the picture 2.



Picture 2 — Block diagram of a radio finder combined with a computer.

The outputs of the individual antenna elements are connected to a circuit containing:

- test inputs for the generator
- multiplexers, if the number of antenna outputs N is more than the number of receiving channels
- tuner and analog-to-digital converter

The signals are converted to an intermediate frequency, which is a priori suitable for a given analog-to-digital converter, and digitized [4]. The digitized data is filtered to the band required for the calculation, and sent to the bearing calculation sector.

As a rule, antennas for car direction finders contain at least nine elements, which can be either dipoles or horn radiators.

The use of omnidirectional antennas is preferable, since they allow you to receive an electromagnetic wave from any direction, thereby increasing the characteristics of the direction finder.

Such a radiator will have different radiation characteristics and input characteristics at different frequencies of the operating frequency range [5].

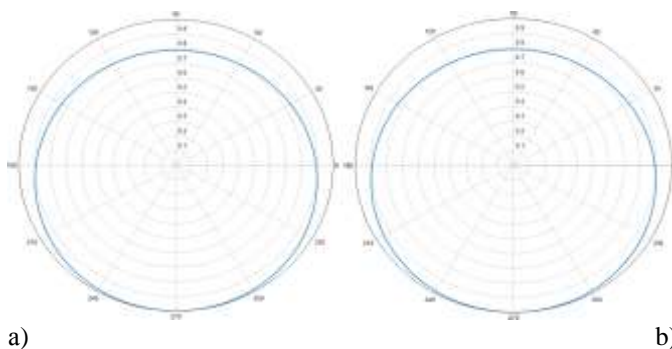
Due to the fact that the operating frequency range of the car direction finder is in the range from 30 MHz to 3000 MHz, at frequencies below

The 1 GHz dipole radiator will be a virtually dipole antenna. There is no need to achieve perfect matching of the emitter, since the dip of the vibrator gain in the direction finder will be compensated by the amplifier following it.

Due to the design features of the antenna array, it is easier to perform with printed-circuit radiators. Since such a printed emitter can be placed on a single printed circuit board with a power line, balun, amplifier and other digital information processing devices. In this case, the configuration of the printed emitter, the thickness of the substrate, its relative dielectric constant, etc., will significantly affect the characteristics of the emitter and the entire antenna array.

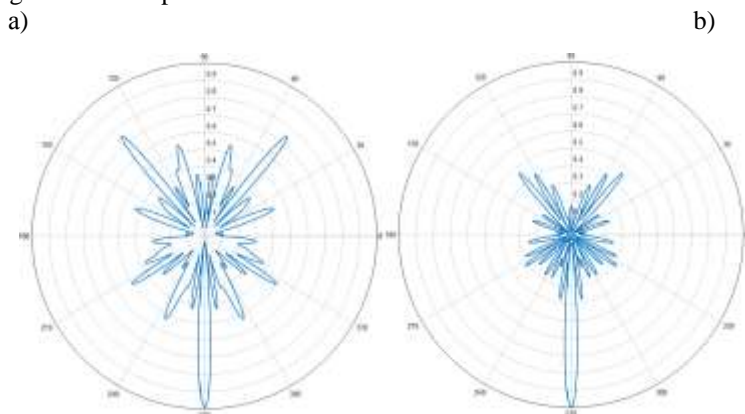
In the Feko 7.0.2 software package, calculations were made of the characteristics of the radiation patterns for various numbers of radiators and antenna array sizes.

In picture 3 the radiation patterns of a circular antenna array at a frequency of 30 MHz for nine and eighteen elements are showed. The grating diameter is 1.5 m. From the figure it can be seen that for 9 and 18 emitters the antenna forms the same radiation pattern with a back radiation level of 0.78 from the maximum.



Picture 3 — Direction finding pattern of the antenna array with a diameter of 1.5 m for nine (a) and eighteen (b) emitters, calculated at a frequency of 30 MHz

In Picture 4 the radiation patterns of a circular antenna array at a frequency of 1500 MHz for nine and eighteen elements are shown. The grating diameter is 1.5 m. From the figure it can be seen that for 9 and 18 radiators the antenna forms a radiation pattern with a pronounced maximum, clearly indicating the direction of arrival of electromagnetic radiation. In this case, for the case of 9 emitters, the radiation pattern has a higher level of spurious emission.



Picture 4 — Direction finding pattern of the antenna array with a diameter of 1.5 m for nine (a) and eighteen (b) emitters, calculated at a frequency of 1500 MHz

Thus, the analysis allows to draw the following conclusions:

- at the lower frequency of the working range of 30 MHz, the lattice parameters practically do not depend on the number of emitters, while with increasing lattice diameter the quality of determining the direction of arrival of an electromagnetic wave significantly increases, since the level of the back radiation of the lattice decreases significantly;
- at the average frequency of the working range of 1500 MHz, the best parameters in terms of determining the direction of the electromagnetic wave and the level of side maxima are circular antenna arrays with a diameter of 1 m, 1.5 m and 2 m with 18th radiators;
- at the upper frequency of the operating frequency range for all the calculated options for constructing antenna arrays, both the resolution and the level of spurious emission differ little when the geometrical parameters change;
- to build an annular antenna array for a car direction finder, it is necessary to choose the following geometrical parameters: the number of radiators 9 (for the case of simplifying the antenna and direction finder

design) or 18 (for the case of obtaining the best direction finding characteristics); antenna array diameter 1.5 m (for the case of simplifying the antenna design) or 2 m (to increase the resolution at the minimum frequency of the working range).

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Аннотация. Целью работы является разработка и исследование антенной решетки для автомобильного пеленгатора, имеющей минимальное количество излучателей и приемлемый вес, габаритные размеры, позволяющей однозначно определять направление прихода электромагнитного излучения в широком диапазоне частот. Разработанная антенная решетка построена по кольцевой схеме из девяти излучателей и позволяет определить направление прихода электромагнитной волны в диапазоне частот от 30 МГц до 3000 МГц. Эффективность антенной решетки подтверждается моделированием в программном пакете Feko 7.0.2

Ключевые слова: антенная решетка, интерферометр, цифровая обработка сигнала, автомобильный радиопеленгатор, дипольный излучатель, угол прихода волны.

Annotation. The aim of the work is the development and study of an antenna array for a car direction finder, having a minimum number of emitters and an acceptable weight, overall dimensions, allowing unambiguous determination of the direction of arrival of electromagnetic radiation in a wide frequency range. The developed antenna array is built according to a ring pattern of nine emitters and allows determining the direction of arrival of an electromagnetic wave in the frequency range from 30 MHz to 3000 MHz. The efficiency of the antenna array is confirmed by modeling in the Feko 7.0.2 software package

Keywords: antenna array, interferometer, digital signal processing, a car direction radio finder, dipole radiator, the angle of arrival of the wave.

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FULL-CHIP ESD PROTECTION SCHEME DESIGN FOR C-BAND AESA CORE CHIP

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Introduction

Recent years have been associated with the active development of standards and equipment for fifth generation (5G) telecommunication networks. Fast evolution of this industry requires such type of antennas as multi-element active electronically scanned arrays (AESA). Radiation pattern of AESA can be electronically changed without changing the antenna structure. Multi-element antenna can form multipath radiation pattern which is necessary for tracking user by a base station of the network.

The main and the most expensive part of any AESA is transceiver module. It performs switching between receive and transmit modes, control the amplitude and phase of processed signal. The number of transceiver modules corresponds to the number of elements in AESA. Today, all developers and manufacturers of AESA aim to reduce the cost of whole antenna and transceiver in particular. Integration of all transceiver functional modules into one crystal is one of the ways to reduce antenna cost [1]. Fully integrated transceiver module called Core Chip.

Integration of novel electronic devices including AESA Core Chips causes significant size decreasing of semiconductor structures. As a result junction width, oxide isolation thickness and contacts size become smaller and smaller which leads to decreasing of device electrostatic discharge (ESD) robustness and causes additional difficulties in electrostatic discharge protection schemes design [2].

Full-chip ESD protection scheme design is one of the essential steps of AESA Core Chip design flow. This work is a part of research project «Design of microwave integrated circuit for AESA beam forming modules based on silicon technology», project code: 8.3962.2017/ПЧ which is held in Engineering center of micro- and nanoelectronics devices, Sevastopol State University.

Overview

A. Full-chip ESD protection principle

To ensure AESA Core Chip electrostatic discharge robustness with 2 kV level (typical value of high-voltage pulse) its structure should include special protection scheme. This scheme should provide path for ESD current between any two pins of Core Chip. Full-chip ESD protection based on current drainage from the pad to the power or ground bus and from them to the other pad [3]. Such approach requires protection devise (PD) for every pad and every power bus. ESD protection design becomes more difficult because Core Chip includes several supply voltages, separate analog and digital ground pins. A Full-chip ESD protection block diagram is shown in Figure 1.

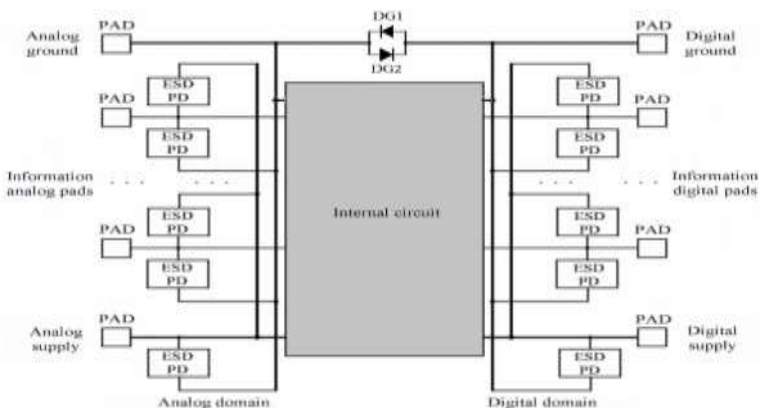


Figure 1 — Full-chip ESD protection block diagram

While developing protection schemes it is important to find a balance between crystal area, the amount of shuntable ESD current, the parasitic capacitances and inductances value, which are inevitably introducing into the Core Chip scheme. To date as ESD protection devices are used [4]:

- ESD diodes;
- thick field oxide metal-oxide-semiconductor (MOS) transistors;
- grounded-gate n-channel MOS transistors;
- bipolar transistors;
- silicon controlled rectifiers.

Design of PD which based on the avalanche breakdown principle (thick field oxide MOS, grounded-gate NMOS and silicon controlled rectifier) requires specially programs for determine their characteristics within the framework of used technology.

B. Schematic Diagrams

In this development, it was decided to use as PD for information digital and analog pads the ESD diodes (Figure 2.1, a). As supply buses PD transient-triggered bipolar clamp [5] are used (Figures 2.1, a and b).

Diode protection circuit includes two ESD diodes, which are connected to the pad, ground and power buses. While ESD event occurs one of the diodes opens and ESD current flows from pad to supply or ground bus. Diode junction area must be selected in accordance with required protection level (for 2 kV HBM model junction area is $800 \mu\text{m}^2$).

Value of RC-circuit time constant (C_0 , R_0 —2) is chosen such that transistor Q1 (M0) does not open when exposed to a typical supply pulse front of the chip (from 1 to $100 \mu\text{s}$ [5]). At influence a shorter pulse front (at the ESD event), transistors Q0 and Q1 (M0) are opening and ESD current flows through PD from supply bus to ground.

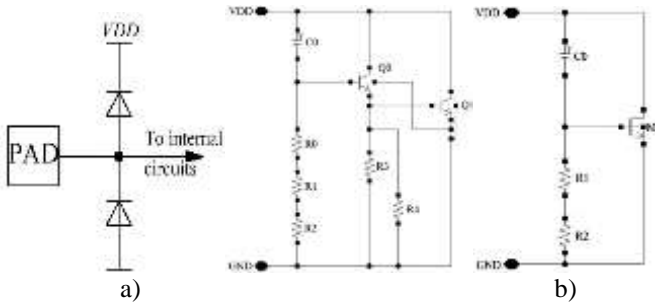


Figure 2 — Scheme diagrams of the diode-based PD (a) and transient-triggered bipolar clamp for 5 V (b) and 2.5 V (c) supply

C. Layout

Designed layout of ESD protection diode are shown in Figure 3. Linear dimension of diode is $17 \times 45 \mu\text{m}$. Layouts of PD for power supply buses 5 V, 2.5 V and 1.8 V are presented in Figure 4.

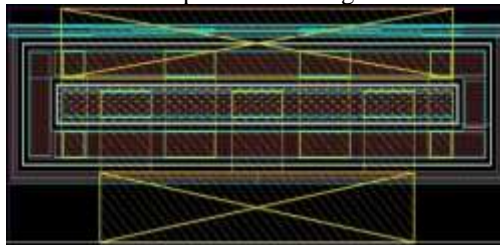


Figure 3 — ESD protection diode layout

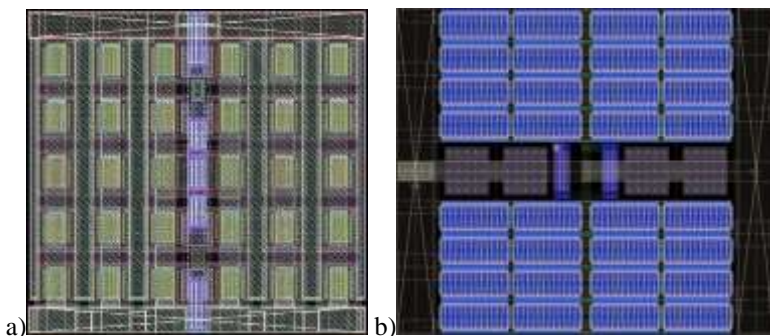


Figure 4 — Layout of PD for 5 V (a) and 2.5 V (b) power supply

All topologies have been developed with considering the amount of current flowing through protection scheme during ESD event. Transistors Q1 and M0 are divided into several parts (see Figure 4) and are arranged in such way to ensure the most efficient current flow through them. Timing chains (RC-circuits) are located in the middle of the topology. Linear dimension of 5 V protection circuit is $127 \times 122 \mu\text{m}$ (area — 0.016 mm^2) and 2.5 V protection circuit is $102 \times 81 \mu\text{m}$ (area — 0.008 mm^2).

Simulation results

For simulation of designed ESD protection devices Human Body Model (HBM) are used. 2 kV HBM assumes series connection of the circuit under test, a 1.5 kOhm resistor and a 100 pF capacitor with 2 kV initial voltage. Figure 5 shows simulation result of designed ESD protection devices with described conditions.

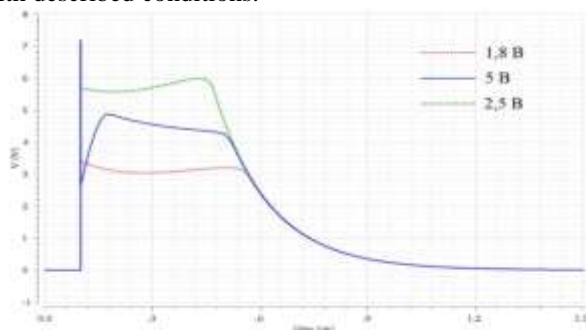


Figure 5 — ESD protection devices simulation result from 2 kV HBM for 5, 2.5 and 1.8 V devices

Conclusion

The paper presents full-chip ESD protection design for C-band AESA Core Chip. For full-chip protection several types of protection devices have

been designed: diodes for information analog and digital pads, transient-triggered bipolar clamp for 5 V supply bus, MOS clamps for 2.5 V and 1.8 V power supply buses.

According to post-layout simulation results with using of 2 kV human body model, maximum voltage at the protection devise output is less than 7.2 V for 5 V supply. Peak current during electrostatic discharge is 1.3 A. Time of ESD current flow through protection devise less than 1 μ s.

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Аннотация. В статье представлены результаты разработки комплексной схемы защиты от электростатического разряда для приёмо-передающего модуля активной фазированной антенной решетки. При разработке использовались правила проектирования и библиотеки *SiGe* БиКМОП технологического процесса с проектными нормами 0,18 мкм. Приведены результаты пост-топологического моделирования разработанных устройств защиты. Разработка и моделирование проводились с использованием программного пакета *Cadence Virtuoso*.

Согласно результатам пост-топологического моделирования, уровень защиты разработанной схемы составляет 2 кВ по модели тема человека. Максимальное напряжение на выходе схемы защиты составляет 7,2 В, максимальны ток составляет 1,3 А, время срабатывания составляет менее 1 мкс.

Ключевые слова: электростатический разряд, устройство защиты, приемо-передающий модуль АФАР, монолитная интегральная схема, БиКМОП.

Annotation. The paper presents design results of full-chip electrostatic discharge protection scheme for an active electronically scanned arrays transceiver module. In a design process rules and libraries of a 0.18 μm SiGe BiCMOS technology were used. Post-layout simulation results of designed protection schemes are shown. Cadence Virtuoso software package were used in the design process.

According to the post-layout simulation results protection level of designed scheme is 2 kV under human body model. Maximum output voltage of protection scheme is 7.2 V, maximum current is 1.3 A, response time is less than 1 μs .

Keywords: electrostatic discharge, protection device, AESA transceiver module, monolithic integrated circuit, microchip.

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BROADBAND HF THE ANTENNA WITH THE REDUCED LINEAR SIZES

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Main part

The discone antenna which is vertically polarized radiator with the horizontal pie chart of orientation is taken as a basis [1]. The main advantage of the discone antenna consists in big frequency bandwidth within which it can be fed on the coaxial cable at the corresponding symmetry and an impedance. It is rather simple on the device and is insensitive to deviations from the nominal sizes. Therefore, such antennas are widely used in commercial broadcasting, mainly in the ranges of decimeter and metric waves.

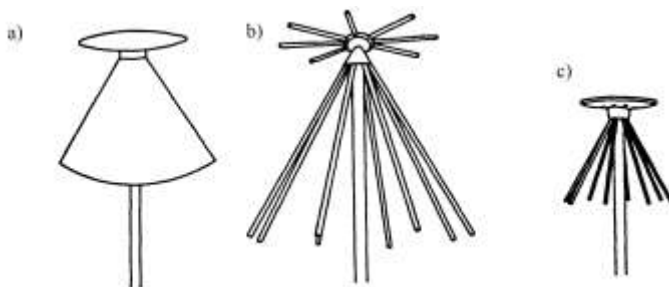


Figure 1 — Discone antenna and its versions:
a) homogeneous, b) skeletal, c) mixed

The discone antenna consists of a metal cone with a disk at top (figure 1, a). It is carried to antennas with an upper power supply which are supplied with end capacity in the form of a disk and a cone-shaped outer conductor.

In the initial look discone antennas are used only in the decimeter range. In the ranges of HF and metric waves mainly "skeletal" forms when metal surfaces are replaced with figures from metal bars, bands, tubes or wires are used.

Approval of the discone antenna of a "skeletal" form on all HF range is not possible.

One of possible options of reduction of dimensions of the antenna and improvement of approval is a bend of the radiator to an exponential look (figure 2, a). Still to reduce the linear sizes of the antenna it is also possible to twist radiators in a spiral (figure 2, b). The similar solution was considered [2, p. 106].

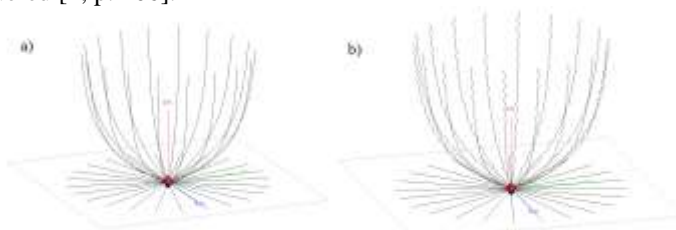


Figure 2 — Models of the first (a) and second (b)
stage of conversion of the discone antenna

Such construction though has good characteristics, but is difficult in production therefore the option is suggested to approximate radiators to the look presented on figure 3.

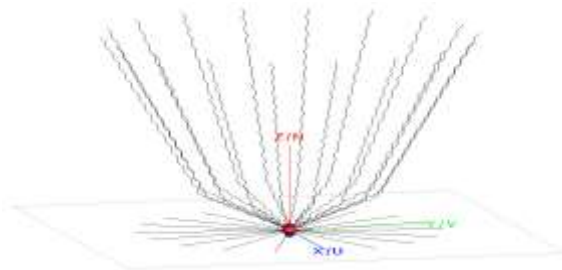


Figure 3 — Model broadband HF the antenna with the reduced linear sizes

The presented Short-wave antenna was a simulated in FEKO CAD, results of modeling are presented on figure 4 and 5.

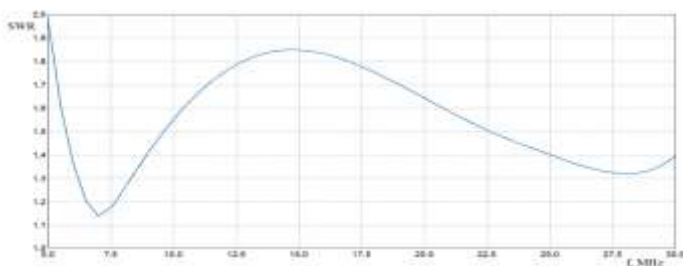


Figure 4 — The SWR modified discone antenna

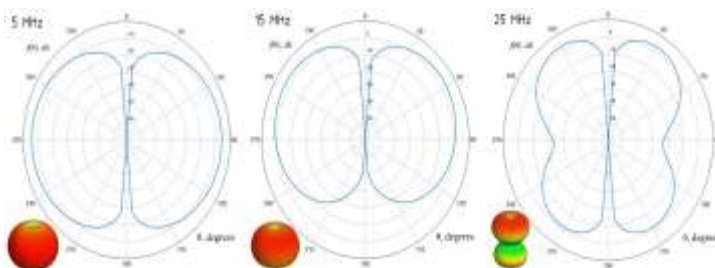


Figure 5 — Directional patterns of the modified discone antenna on 5, 10, 15 MHz

Conclusion

On the basis of a research of parameters of the discone antenna the model was constructed and characteristics are received. For reduction of the linear sizes of the wideband antenna HF of range the following measures

were proposed: first, to bend a wire of the radiator in a form exponent; secondly, to twirl a crimped wire of the radiator in a spiral form; thirdly to approximate the received radiator. Similar geometrical conversions allowed to reduce antenna dimensions. The received wideband antenna HF of range works range from 5 MHz to 30 MHz.

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Аннотация. Сейчас короткие волны (СВ) используются в основном для связи на больших расстояниях по той причине, что короткие волны *sky wave* могут распространяться на многие тысячи километров, и для этого не требуются передатчики большой мощности. Антенны, работающие в диапазоне SW, имеют внушительные размеры, что, несомненно, является одним из основных недостатков. Целью доклада является разработка широкополосной антенны ВЧ диапазона с уменьшенными линейными размерами.

Ключевые слова: короткие волны (СВ), дисконная антенна, излучатель, спираль, гармонизация.

Annotation. Now the short waves (SW) are used mainly for communication on long distances for the reason that sky wave short waves can extend to many thousands of kilometers, and transmitters of big power for this purpose are not required. The antennas working in SW range have the impressive sizes that undoubtedly is one of the main shortcomings. The purpose of the report is development of the wideband antenna HF of range with the reduced linear sizes.

Keywords: short waves (SW), discone antenna, radiator, spiral, harmonization.

RESEARCH AND ANALYSIS OF CAD ADAPTATION IN DIMENSIONAL CHAINS CALCULATION

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A dimensional chain is a set of interrelated dimensions that form a closed contour and are directly involved in solving the problem. There are three types of dimensional chains: engineering, technological and measuring. Each of these types solves problems of accuracy assurance on the different production stages. Dimensional chains calculation can be considered as a necessary part of design preparation for production and technological preparation for production.

Today every machine-building company aims to minimize the cost of production and the amount of expending time, and thereafter to maximize income. CAD system is the most effective technology to help solving all the above problems.

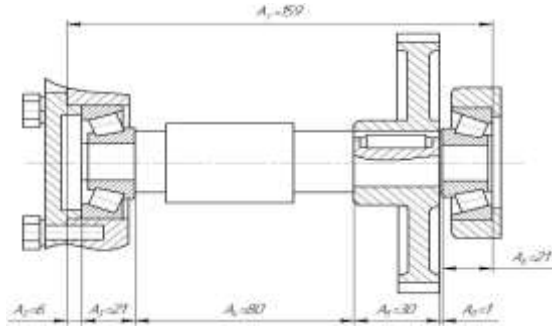
Most industrial enterprise leaders are now aware of requirement in automatization of all stages of design, pre-production and production. CAD is one of the many tools used by engineers to solve these problems. CAD is mainly used for 3D and 2D models drawing as well as for engineering and production process support from conceptual design and layout of products to definition of manufacturing methods.

Nowadays, computer-aided automation is the only way to accelerate the dimensional chain calculation and different CAD developers are trying to create the best possible way to solve the problem. The most successful decision is applied dimensional chain library in CAD “Compass 3D”.

First of all, it should be noticed, that considered library can only solve inverse problem of chain calculation, when all the dimensions are known, and there is a goal to find the parameter of closing element. Such problem is definitely found much more frequently than direct problem, but this one can't be solved using CAD yet.

There is a comparison of two calculation methods below: first without any software and second – using applied library in CAD “Compass 3D”. As

an example it will be used the gearbox assembly drawing section (pic. 1). Optimal accuracy of axial dimensions – 10th grade. The task is to find closing link tolerance.



Picture 1 - Dimensional chain of the drawing section

1. Manual calculation algorithm

1.1. Analyze drawing, choose dimensional chain and determine increasing and decreasing links. There is a condition that must be ensured [1, p. 252]:

$$A_0 = \sum_{j=1}^n A_{jinc} - \sum_{j=n+1}^{n+p} A_{jdec} \cdot$$

$$A_0 = A_1 - A_2 - A_3 - A_4 - A_5$$

$$1 = 159 - 6 - 21 - 80 - 30 - 21$$

$$1 = 1$$

1.2. Appoint tolerances to each dimension:

$A_1 = 159^{+0,160}$ mm; $A_2 = 6_{-0,048}$ mm; $A_3 = 21_{-0,084}$ mm; $A_4 = 80_{-0,120}$ mm; $A_5 = 30_{-0,084}$ mm; $A_6 = 21_{-0,084}$ mm.

1.3. Closing link tolerance determination using the equation [1, p. 253]:

$$TA_0 = \sum_{j=1}^n TA_{jinc} + \sum_{j=n+1}^{n+p} TA_{jdec} \cdot$$

If the whole number of links in chain is m, and the number of component links is:

$$m - 1 = n + p,$$

then we can modify the equation to the next form:

$$TA_0 = \sum_{j=1}^{m-1} TA_j,$$

where TA_0 - closing link tolerance;

TA_j - component link tolerance;

After substitution of values we get the tolerance of closing link:

$$TA_0 = 160 + 48 + 3 \cdot 84 + 120 = 580 \text{ mcm.}$$

1.4. Calculation of midpoint tolerance coordinates of closing link and maximum deviations using equations [1, p. 253]:

$$E_c A_0 = \sum_{j=1}^n E_c A_{jy6} - \sum_{i=n+1}^{n+p} E_c A_{jyM} ;$$

$$E_c A_0 = \frac{160}{2} - \left(\frac{48}{2} + 3 \cdot \frac{84}{2} + \frac{120}{2} \right) = -130 \text{ mcm.}$$

$$E_s A_0 = E_c A_0 + \frac{TA_0}{2} ;$$

$$E_i A_0 = E_c A_0 - \frac{TA_0}{2} ;$$

$$E_s A_0 = -130 + \frac{580}{2} = 160 \text{ mcm;} ;$$

$$E_i A_0 = -130 - \frac{580}{2} = -420 \text{ mcm.}$$

Suchwise, there is the closing link dimension with deviation:

$$A_0 = 1_{-0,420}^{+0,160}$$

2. Dimensional chain calculation algorithm with the use of «Compass 3D» applied library.

2.1. Composing dimensional chain using CAD system;

2.2. Using library manager, find and open dimensional chain library.

In property panel the number of dimensional chains is to be made, as well as current number. The next step is to select all links, but the closing link should be selected last. Also, while selecting links, it's possible to get linear dimension projection, convert dimension to radius, diameter or opposite deviation and impose angular deviations.

After selecting all links, chain closes and deviations are assigned to closing link in the table 1. This table can be easily exported from Compass to txt file.

Table 1 – Calculation results using CAD library

Link №	Type of link	A_j	Max. Deviation	Min. Deviation
1	increasing	159	+0,160	0
2	decreasing	6	0	-0,048
3	decreasing	21	0	-0,084
4	decreasing	80	0	-0,120
5	decreasing	30	0	-0,084
6	decreasing	21	0	-0,084
7*	closing	1	+0,160	-0,420

As expected, closing link deviations are the same as in the first calculation. Closing link dimension with tolerance presented below.

$$A_{7*} = 1_{-0,420}^{+0,160}$$

To summarize, there is a list of advantages and disadvantages presented below.

Advantages:

1. Amount of time spent on calculation is relatively small;
2. High accuracy level;
3. Simple and ergonomic interface of CAD «Compass 3D»;
4. Ability to export or save results in an electronic archive available in program.
5. Extremely fast adaptation of the method in companies, which already use CAD «Compass 3D» without library.

Disadvantages:

1. It should take a time to pay back software purchase costs;
2. Impossibility to solve direct problem of dimensional chain calculation.

In spite of minor flaws it should be recommended to apply such calculation approach to solve the dimensional chain problem on machine-building enterprises.

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Аннотация. В статье проводится сравнительный расчет, чтобы рассмотреть лучший способ решения задачи размерной цепи. Текущий анализ определяет возможность и целесообразность использования САПР "КОМПАС 3D" при расчете размерных цепей и определяет качество, точность и время реализации по сравнению с классическим методом. В заключении приведены преимущества и недостатки предложенной методики расчета, чтобы показать актуальность применения метода САПР на современных предприятиях.

Ключевые слова: Размерные цепочки, анализ, САПР, "КОМПАС 3D", библиотека приложений.

Annotation. Comparative calculation is taking place in the article to consider the best way of solving the dimensional chain problem. Ongoing analysis determines possibility and advisability of using CAD «Compass 3D» in dimensional chains calculation and defines quality, precision and time spent on implementation compared to classical method. In the conclusion advantages and disadvantages of suggested calculation

technique are given to show the relevance of applying CAD method on modern enterprises.

Keywords: dimensional chains, analysis, CAD, «COMPASS 3D», application library.

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TRAFFIC LIGHT CONTROLLER DESIGN USING VERILOG AND FPGA

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Introduction

Nowadays any big city has significant amount of traffic lights. They are a main part of traffic control and road safety systems. Each traffic light has a controller which determines its operation logic. Controller can be made as special control chip. Disadvantage of such approach is fixed operation algorithm which cannot be change without chip replacing. Another approach is using reprogrammable chips such as microcontrollers or Field-Programmable Gate Array (FPGA) chips. For traffic lights it is recommended to use FPGA as operation controller as they have a fixed logic structure and cannot hang in some state of its operation.

The bulk of traffic lights work fully automatically according to synchronous algorithm based on equal time intervals between operation iterations. But in some individual cases it is advisable to use asynchronous traffic lights which can be controlled by pedestrians. It is relevant for crosswalks with low-level pedestrian flow and high-level traffic.

Overview

A. Traffic Light Algorithm

Controller developed for traffic light with three-section traffic part, two-section pedestrian part and user button for crossing request. Traffic part has green, yellow and red sections, pedestrian part has «--» and «GO» sections with seven-segment indicator (for transition time countdown).

Designed traffic light algorithm for asynchronous crosswalks has a seven operation stages which are described in the Table 1.

B. Finite State Machine Description

The most convenient implementation of the described in section A algorithm on FPGA is Finite State Machine (FSM). FSM comes from the automata theory and is implemented as automata by computer-aided mathematical model [1].

Table 1 — Traffic lights operation stages description

Stage #	Traffic part state	Pedestrian part state	Duration, seconds	Description
0	green	«← →»	—	initial state; waiting for crossing request
1	green	«← →»	3	delay after crossing request
2	Green blinking	«← →»	3	warning for drivers
3	yellow	«← →»	3	—
4	red	«GO»	7	—
5	red	«GO» blinking	3	warning for pedestrians
6	red+yellow	«← →»	3	—

It has a several states which change according to a specific algorithm. The most convenient description of FMS is a graphical representation of its states called transition relationship chart. States of traffic light FSM is directly described by operation stages which are presented in the Table 1. Figure 1 shows transition relationship chart for designed traffic light controller FSM.

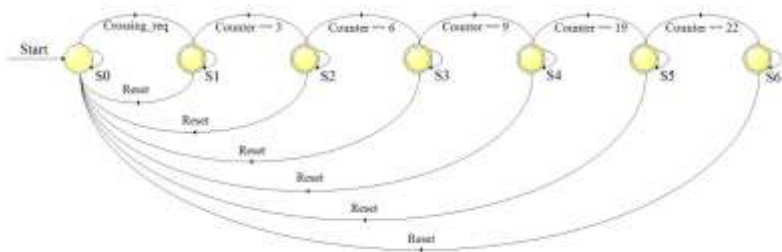


Figure 1 — Transition relationship chart of designed FSM

For creation FPGA firmware, Quartus design software are used. It includes design entry, synthesis to optimization, verification, and simulation of designed projects [2]. Traffic light FSM are designed using State Machine Wizard in Quartus. This tool allows to easily and quickly develop Verilog description of FSM by setting type of FMS, input and output signals, states, transitions and actions on each state. Verilog file with FSM description is generated as result of Wizard operation and includes into current project.

C. Project description

Block diagram (RTL view) of designed controller is presented in the figure 2.

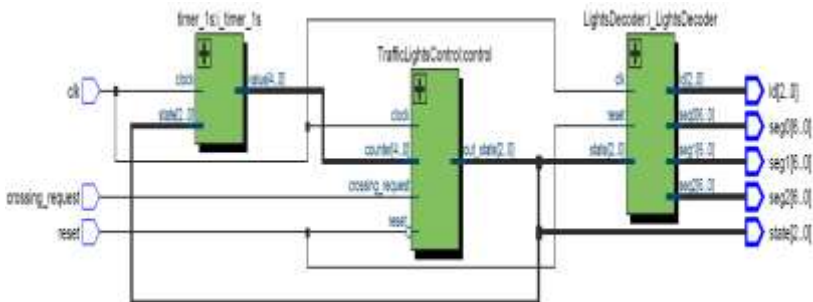


Figure 2 — Traffic light controller block diagram in Quartus

Controller has three functional blocks:

- TrafficLightsControl implements finite state machine that describes operation algorithm of traffic light (Figure 3);
- timer_1s creates one-second intervals for correct work of FSM (counter in the Figure 1);
- LightsDecoder performs decoding of FSM current state and output signal generation.

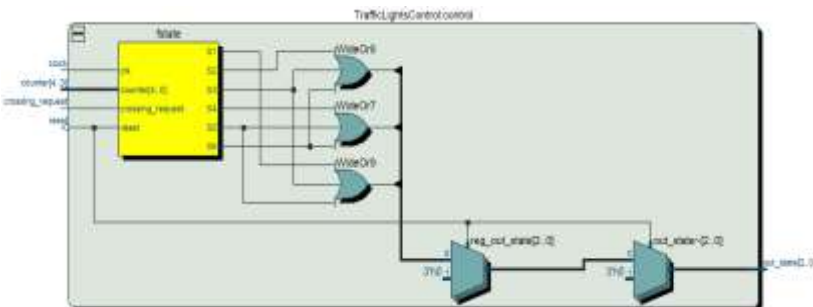


Figure 3 — RTL-view of TrafficLightsControl module

Input signals of the controller are clock signal (clk), reset signal (reset) and signal from user button (crossing_request). Output signals are three-bit signal to traffic part (ld[2:0]), three seven-bits signals to pedestrian part (seg0—2) and three-bit current state number (state[2:0]) for debugging purposes.

D. Hardware Verification Result

For hardware verification, DE1-SoC Development Kit [3] are used (Figure 4).



Figure 4 — DE1-SoC Development Kit with Cyclone V FPGA during hardware verification of designed controller

In the Figure 4 traffic light controller is in state #4 (see Table 1). First digit of seven-segment indicator shows transition time countdown for pedestrians. Second and third digits show combination «GO» for pedestrians. First three red LEDs under indicators shows current state of FSM (combination «100» in binary code for state #4). Last three red LEDs match to traffic part of the traffic light. Buttons «KEY0» and «KEY3» corresponds to the user button for crossing request and reset, respectively. Contact bounce of used buttons suppressed by software.

Conclusion

Designed controller can be used in asynchronous traffic light with three-section traffic part and two-section pedestrian part with transition time countdown. FPGA implementation of controller allows to quickly changing traffic light operation algorithm without changing hardware. In addition, FPGA shows better operation stability and less power consumption in comparison with microcontrollers, which can be very useful for self-powered traffic light.

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Аннотация.

В статье представлены результаты разработки контроллера асинхронного светофора с трехсекционной автомобильной частью и двухсекционной пешеходной частью с обратным отсчетом времени перехода. Контроллер разработан на языке описания аппаратуры Verilog и содержит синхронный конечный автомат, таймер для формирования необходимых интервалов времени и дешифратор состояний. Представлена структурная схема контроллера и описан его алгоритм работы. Проведена аппаратная верификация его работы.

В ходе разработки использовалась среда разработки Quartus и комплект разработки DE1-SoC с ПЛИС Cyclone V.

Ключевые слова: контроллер светофора, Verilog, конечный автомат, FPGA, Quartus, Cyclone V

Annotation. The paper presents design results of asynchronous traffic light controller with three-section traffic part and two-section pedestrian part with transition time countdown. The controller is designed by hardware description language Verilog and contains synchronous finite state machine, timer for necessary time intervals creation and state decoder. Controller block diagram are shown and its operation algorithm are described. Hardware verification of controller is held.

Quartus design software and DE1-SoC Development Kit with Cyclone V FPGA were used during development.

Keywords: traffic light controller, Verilog, finite state machine, FPGA, Quartus, Cyclone V

UDC621.86

EXOSKELETON AS A WAY TO IMPROVE HUMAN ABILITIES

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Modern advances in robotics allow people to significantly expand the human physical abilities. Wearable robotic tools are currently becoming one of the most dynamically developing technologies in this area. The exoskeleton is needed in order to combine the intelligence, adaptability and learning ability of a human worker with the strength, endurance, and accuracy of a robotic worker. These devices will gradually become an indispensable part of our daily life.

Exoskeletons are robotic means designed to replenish lost functions, build up the strength of human muscles and expand the amplitude of displacements because of the outer frame and leading parts. Wearable robotic tools act as a linker between completely manual labor and robotic systems. The exosuit works by using sensors that monitor the state of a person's body, the movement of his arms, legs, muscles, a mechanical skeleton with a limb drive system and a computer program that works on a base of a mathematical model of the movement of human body that controls all of this mechanism on a base of sensor data. Recently functional development of exoskeleton is being carried out, which is necessary for creating systems of a person's vertical position and enhancing human physical abilities [1, p. 24].

Currently, the leading areas of application of exoskeleton modules and complexes based on them can be divided into: military and special purposes, rehabilitation and compensation of the lack of mobility of disable people, and the usage in industry. The purpose of military use is to install difficult armor and weapons, assault and sapper operations, increase of mobility and speed in order to help soldiers carry more weight over long periods of time.

Medical exoskeletons can be used to help injured people and disable people, senior people who, due to their age, have problems with their locomotor system. Special robotic suits can be both equipment for rescuers, and mechanized diving or protective suits [2, p. 253]. The building exoskeleton has the ability to carry on itself building equipment or to be used as a loader.

The most promising are industrial exoskeletons. Exosuits for work and industry can be used on construction sites, in dry docks, in factories, warehouses and even in surgical rooms. The introduction of such devices provides a solution to the three most important business tasks: increasing labor productivity and reducing the labor intensity of manufacturing operations performed manually, reducing the amount of social and

compensation payments caused by industrial injuries, providing additional motivation of employees, achieved by creating more comfortable working conditions.

Industrial exosuits are much less sensitive to technological limits that are typical to the whole exoskeleton industry.

If we decompose the wearable robotic tool into components, we get: power supply, a frame and a software. The level of requirements to the control system of the industrial mechanism is lower than to a similar solution of medical or military usage. Unlike military exoskeletons, intended for field and marching use under conditions of complete energy autonomy, most of the industrial ones are supposed to be used in workshops, thereby we will get the reducing of the requirements for autonomous energy sources [3].

Mechanical systems are widely distributed in modern technology and exoskeletons are the most popular direction. With the development of new technologies, new opportunities will be opened in the sphere of improvement of exosuits, which will lead to spread them everywhere for industrial applications all around the world. These devices will significantly reduce industrial injuries, as well as significantly improve productivity and give a chance to any person to work in such place where the great physical strength was needed before.

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Аннотация. Тема научной статьи – «Экзоскелет как способ расширения возможностей человека» - в рамках которой были рассмотрены составляющие экзоскелета и принцип его работы, а также трудности, которые механизм помогает преодолеть работнику-человеку за счет значительно расширения физических возможностей. Был произведен анализ сфер применения и перспектив развития экзокостюмов. Отмечено, что робототехнические средства необходимы в военном и особенном назначении, в медицине, в промышленной сфере.

Ключевые слова: Экзоскелет, каркас, привод, датчик, промышленность.

Annotation. The topic of the scientific article is “Exoskeleton as a way to improve human abilities” - in which we discussed the components of the exoskeleton and the principle of its work, as well as the difficulties that the mechanism helps the human worker to overcome by significantly expanding physical abilities. An analysis of areas and prospects for the development of exosuits was made. It is noted that robotic tools are necessary for military and special purposes, in medicine, in industrial sphere.

Keywords: exoskeleton, frame, drive, sensor, industry.

UDC 62-1/9

MICROCHIPS DEVELOPMENT TRENDS. SMALLER, FASTER, CHEAPER

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Introduction

The most perspective direction of electronics at the moment considering the nanoelectronics which forms on the basis of last achievements in the fields of solid state physics, quantum electronics, physical chemistry and semiconductor electronics technology. Researches in the field of a nanoelectronics are important for development of the new principles, as well as a new generation of superminiature maximum speed circuits (microchips) for information processing.

In 1975, Gordon Moore, a pioneer in the field of electronics, formulated his famous assumption that the amount of transistors placed on a microcircuit chip will double each two years. Technological progress will continuously reduce the size of the transistors in the chips, so that the information processing of electrical signals will need to pass smaller distances. For the electronics industry and consumers, this claim, called Moore's law, meant that computerized devices would constantly become smaller, faster, and cheaper. Thanks to continuous innovation in the design and technology of semiconductor devices, the microchips have followed Moore's prediction for nearly 35 years with remarkable accuracy.

However, engineers have always understood that it is impossible to constantly follow this trend. The thickness of the transistors will be reduced to a value of only tens of atoms, and then the fundamental laws of physics will put a limit to the process. However two practical problems are possibly to arise even earlier. Providing a high percentage of high-quality microchip production at close proximity of super-small transistors can become unacceptably expensive, and the intensity of heat generated by a set of transistors during operation can reach the level of temperature breakdown.

At the moment, the computational capability of modern microprocessors (in fact, the most complex and sophisticated varieties of chips) have already reached the values of 3 – 4 GHz (109 operations per second), analysts believe that this is their limit, because further miniaturization and integration are not able to cope with parasitic phenomena affecting such small objects.

Calculation with light speed

So one of the solutions to these problems can serve as a deviation from the concept of the use of electrons as the main charge carriers and reference to photons — particles of light. The advantages of such devices can serve as a much higher speed of transmission and processing of information due to the higher carrier frequency and the possibility of parallel operation of multiple channels.

Currently, the phenomenon of photoelectric effect is actively used in the development of chips. The internal photoeffect is used for substances - photoconductors, which under normal conditions are insulators. The external photoelectric effect is applied to video playback, photometry and automation.

In April 2018, a group of American scientists proposed an advanced version of the world's first photon microprocessor, which uses light instead of electric current to transmit data.

The processor is constructed on architecture of RISC - V, it has two compute cores and one MB of SRAM. It is made on the basis of an electron-photon system containing 70 million transistors and 850 light I / o ports that perform the functions of logic, memory and interaction with each other. The new compromise solution is suitable for almost any microprocessor without a significant difference in their cost.

Progress in miniaturization. «Crossroads»

Today the most miniature transistors of mass production have width only 32 nanometers - approximately in 96 atoms of silicon. Objectively further miniaturization and manufacture of elements the sizes less than 32 nanometers with use of lithographic technique which was enhanced decades will be exclusively difficult process.

One of the version of microchips are crossbar systems. These systems are using structural elements of approximately the same size as in today's chips, but at the same time provide higher computing capabilities.

In this construction transistors are located not in one plane (like cars on the overloaded silicon highway), and the system of the parallel nanoconductors lying in one plane which are crossed by the conductors of a similar system located in other plane is used (as two mutually perpendicular highways of different levels). Between these planes the buffer layer thickness in one molecule is located. Conductors form a set of the intersections called memristors. They can play a role of switches, just as transistors. However memristors can store information. The combination of both opportunities allows to solve a row of computing tasks. In practice one memristor can perform work of 10-15 transistors.

Hewlett-Packard Labs manufactures crossbar systems with titanium and platinum conductors 30 nm wide, using materials and methods similar to those already optimized for the semiconductor industry. The company's researchers believe that the width of the conductors can be reduced to 8 nm. Some research teams also produce crossbar systems made of silicon, titanium, and silver sulfide.

Hewlett-Packard memristor is a new type of circuit element formed at the place of each raised intersection of overlapping nanowires.

Heat removal. «Wind»

When up to a billion transistors are placed on a silicon crystal, the task of removing the heat released during their switching becomes intractable. In personal computers there is a place for the fan, but it is able to take no more than 100 watts per crystal. Therefore, designers are considering several new opportunities. So, in MacBook Air laptop the role of heat sink (radiator) plays a thin aluminum body with high thermal conductivity. In the Apple Power Mac G5 personal computer, cooling provides fluid flowing through the microchannels at the bottom of the microprocessor crystal.

However, the combination of liquid and electronics can be risky, and in small portable devices like smartphones there is no room for channels or fans. Intel's research team built a thin-film superlattice of bismuth telluride into the body of the chip. This thermoelectric material converts the temperature gradient into electricity, thus cooling the microchip crystal.

The cooling "patch" from bismuth telluride removes heat from the much larger chip above it to a thin dispersing layer. The "patch" and the dispersing layer take less places than the existing radiators and consume less energy.

The company Ventiva, using the results of research at Purdue University, develops a miniature solid-state «fan» without moving parts,

which creates a flow of air with the help of the effect of electric wind - a principle that is used in silent household air purifiers.

The slightly concave grating contains live conductors that create the microplasm. The ions of this gaseous compound carry the air molecules from the conductors to the neighboring plate, producing «wind». This «fan» gives a stronger flow of air than a conventional mechanical device and have a much smaller size.

Other developers design fans based on the Stirling machine, while still somewhat bulky, but creating wind without consuming electricity, due to the temperature difference between the hot and cold areas of the crystal.

Conclusion

At this stage of development of nanoelectronics Moore's law loses its relevance. Trends can be traced to the rejection of the usual architectures of circuits and the development of novel nanomaterials. Considered a number of innovations, many of which are already at the stage of prototypes, in the next two decades will be able to continue to move computer devices on the way «smaller, faster, cheaper».

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Аннотация. В данной статье рассматриваются некоторые нововведения в архитектурах микросхем и разработке наноматериалов, которые в ближайшем будущем позволят продвигать компьютерные устройства в направлении повышения быстродействия, миниатюризации и снижения стоимости.

Сделан вывод о том, что на данном этапе развития наноэлектроники закон Мура теряет свою актуальность.

Ключевые слова: наноэлектроника, микросхема, перспективы, миниатюризация, быстродействие, вычисление, теплоотвод.

Annotation. This article discusses some tends in microchip's architectures and nanomaterials development, which will allow to promote computer devices in the direction of improving performance, miniaturization and cost reduction in near future.

It is concluded that at this stage of development of nanoelectronics Moore's law loses its relevance.

Keywords: nanoelectronics, microchip, trends, miniaturization, speed, calculation, heat removal.

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SIMULATION OF A BUMPER INFLUENCE ON A RADAR ANTENNA USING C# APPLICATION AND FEKO MODELS

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Introduction

Nowadays in automotive applications various driving aid systems are widely used: parking assistant, cross-traffic alert, junction assistant, adaptive cruise control, blind side detection and other. All of these systems requires distance sensors for determining distance from a car to different objects on the road: other cars, pedestrians and obstacles. Ultrasonic sensors are widely used as distance sensors in many cars. However, with increasing requirements to sensors operation range, distance and velocity resolution, operation speed and functionality ultrasonic sensors replaced by radar distance sensors. Such sensors can be mounted without holes in the bumper or another car body element.

Installing radar sensor behind the bumper leads to a significant change in the radiation pattern of transmitting and receiving antennas. As a result, the radar detection performance significantly deteriorates. To avoid this effect a complex automotive radar simulator should be developed. With using of the simulator, system designers can determine optimal bumper parameters or radar location in a car in terms of required radar detection performance.

This paper describes first iteration of a radar simulator application. Control application and graphical user interface (GUI) are designed using of c# cross-platform language. Electromagnetic simulation of antennas radiation patterns with bumper influence are carried out by specially developed Altair FEKO models.

Overview

A. Radar simulator application

Radar simulator is developed as classic c# windows forms application using free Visual Studio Community environment [1]. It contains three

main parts: GUI, 3D visualization of bumper model and back-end processing of calculated data.

The main window of the simulator GUI is shown in the Figure 1. At the «Radar parameters» field of the window user can choose antenna and bumper model, set their parameters and run simulation of constructed structure in FEKO. 3D visualization of antenna, bumper and radiation pattern models are presented at the «Visualization» field of the window and are implemented using Helix Toolkit [2]. The simulation log is displayed in the «Output» subwindow.

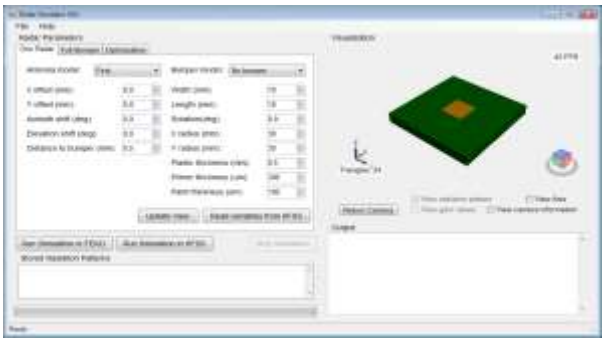


Figure 1 — Radar simulator graphical user interface

The radar simulator allows to choose one of three bumper models: flat, rounded in one axis and rounded in two axes. Each bumper model is described by number of parameters: width, length, angle of rotation, plastic thickness, primer thickness, paint thickness and distance to antenna. In addition, models of rounded bumpers allow to set radiuses values along X and Y axis. Flat, rounded in one axis and rounded in two axes bumper models are presented in Figure 2.

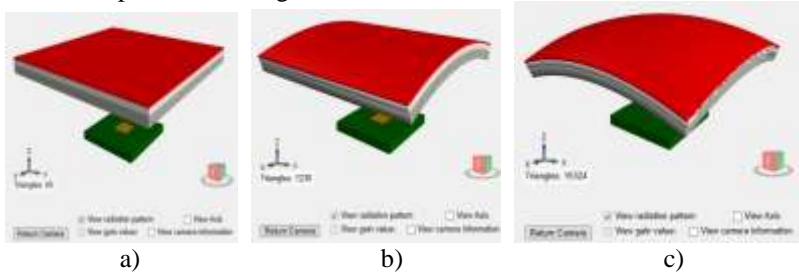


Figure 2 — Flat (a), rounded in one axis (b) and rounded in two axes (c) bumper models in radar simulator

Antenna and bumper parameters are set first. Then a modelling is performed in FEKO according to the selected bumper model. FEKO starts as separate process without GUI. Bumper model parameters transmitted to FEKO as list of process attributes. Simulation progress is displayed at the bottom part of the simulator window in progress bar and «Output» subwindow.

B. FEKO bumper models

Used for calculation antennas and bumper models are separately designed in Altair FEKO. It makes an opportunity of antennas and bumpers mixing — to choose a required antenna and add different bumper model. Antenna models are traditionally designed in CADFEKO graphical interface.

Otherwise bumper models are described by *.lua scripts integrated to FEKO. These scripts can be used as FEKO macro commands, which allow to add required bumper to any antenna model. All of the antenna and bumper parameters are set using special variables, which can be changed in the radar simulator later.

The macro commands include adding variables, bumper materials (such as plastic, primer and paint) and bumper geometry. Any materials are described by their dielectric properties: relative permittivity, loss tangent and mass density. At the following stage bumper materials properties are taken from the article [3], executing polish because of its small thickness of 20 μm .

The main parameter affecting the FEKO simulation results is a model mesh size. It determines solver speed and accuracy. To ensure the correct radiation field of antenna its mesh is set automatically by FEKO according to the required frequency range. From the other side to speed up the calculation is required grow up the mesh value. As a result, the model includes standard mesh size of antenna, and custom mesh of all structure (bumper and antenna). In the Figure 3 is shown designed FEKO model with different meshes.

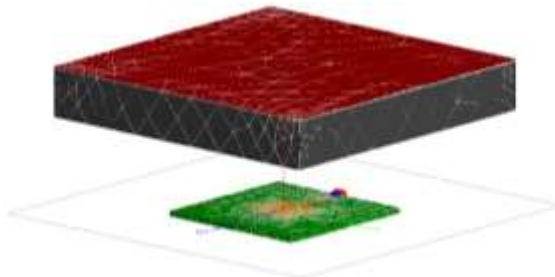


Figure 3 — Antenna and bumper model in CADFEKO

In order to estimate the bumper influence on the radiation characteristics, firstly it is necessary to make an evaluation of the dimensions that must be taken into account. For this it is required to make calculations with large dielectric objects. At the same time in the working frequency range the mesh size is very small, while the number of computing units is extremely large. To solve this problem, it is necessary to use not only current Method of Moments but also other techniques such as the Multilevel Fast Multipole Method (MLFMM) or Physical Optics (PO). These methods can be applied to most large models that were previously treated with the Method of Moments without having to change the mesh.

C. Visualization of simulation results

When the simulation completed FEKO generates the *.out log file. This file includes information about antenna radiation pattern, simulation settings and output messages. From *.out file c# application reads matrix of antenna total gain that depend on phi and theta angles. Simulator converts obtained values to Cartesian coordinate system and shows antenna radiation pattern as number of thin lines (Figure 4).

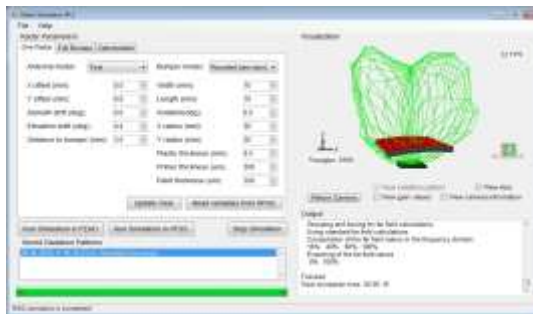


Figure 4 — FEKO simulation result in radar simulator application

Conclusion

The developed simulator allows to simulate the bumper influence on an automotive radar antenna radiation pattern. It is performed by choosing an antenna location on a bumper, specifying the required design parameters and visualizing results in the designed graphical user interface. At the same time, there is unnecessary to change the structure of models in Altair FEKO. Only its computational capabilities are used. This approach can significantly reduce time to determine an optimal radar location on the bumper.

Further research is aimed at realizing a possibility of placing several radars on one bumper. Another task is to optimize the solver method in order to reduce the calculation time, keeping an accuracy. Thus, it is

planned to move on one of the high-speed calculation method, such as, MFLMM or PO.

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Аннотация. В статье представлены результаты первого этапа разработки симулятора автомобильного радара с использованием языка программирования `c#` и моделей в программе электромагнитного моделирования Altair FEKO. Симулятор радара позволяет учесть влияние материала и геометрии бампера автомобиля на диаграмму направленности антенны при помощи электромагнитного моделирования. Форма, размер и параметры бампера задаются в приложении с графическим интуитивно-понятным пользовательским интерфейсом.

Описан механизм обмена данными между приложением `c#` и FEKO. Представлены упрощенные модели трех бамперов: плоского, скругленного по одной оси и скругленного по двум осям.

Ключевые слова: электромагнитное моделирование, приложение `c#`, FEKO, влияние бампера, диаграмма направленности

Annotation. The paper presents the first stage results of automotive radar simulator design. It is made using `c#` program language and models in electromagnetic simulation software Altair FEKO. Radar simulator allows to take into consideration bumper material and geometry influence on antenna radiation pattern by means of electromagnetic simulation. Bumper shape, size and parameters are set in the application with user-friendly graphical user interface.

Data exchange mechanism between `c#` application and FEKO is described. Simplified models of three bumpers: flat, rounded in one axis and rounded in two axes are presented.

Keywords: electromagnetic simulation, `c#` application, FEKO, bumper influence, radiation pattern

THE LABORATORY BENCH FOR THE RESEARCH WEBCAMS

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Main part. The main elements of the projected scheme are: LEDs, transistors, *ATmega32u4* microcontroller, current sensor, buttons, LCD display, power supply. The schematic diagram of a prototype is provided in a figure 1.

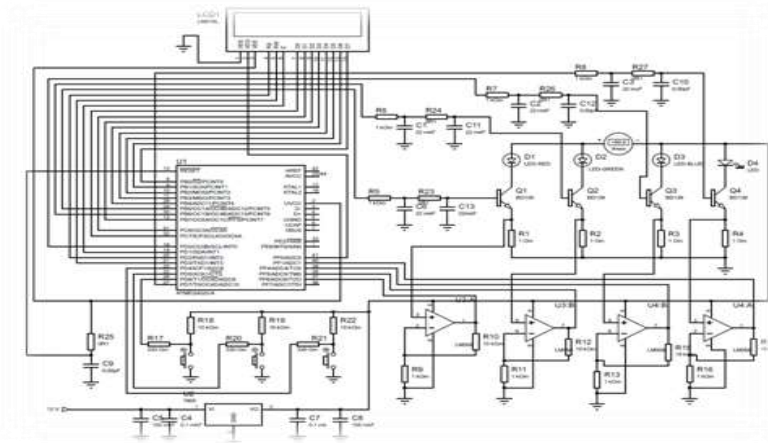


Figure 1 — The schematic diagram of a prototype

When programming the *Arduino Micro*, the *FLProg* programming environment was used. This environment allows encoding with the help of specialized blocks that represent certain functional actions or operations: addition, subtraction, shift, conditional action, counting, trigger, display representation, etc.

The part of the block diagram that is responsible for controlling the level of pulse-width modulation (PWM) using an encoder, as well as switching between PWM channels is shown in Figure 2.

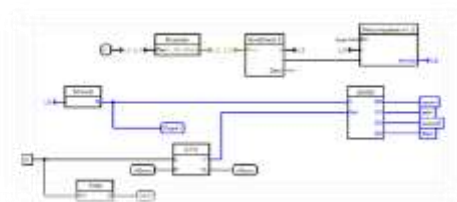


Figure 2 — Block diagram for controlling the level of PWM

This block consists of an encoder (Encorer and EncDirect2 blocks) level controller (leveling ± 2), a counter, a demultiplexer (DMS), a scaling block (CTU), a timer (TON). The encoder signal is fed to the level controller. The signal comes to the scaling unit, and then to the demultiplexer, where the level of the selected PWM channel is regulated. When the button is pressed, a signal passes through the counter to the multiplexer, where the PWM channel is selected. Reset extends parallel with the change of channel; the signal passes through a timer, which is required for debounce.

The luminosity determination unit of the LED (Fig. 3) consists of a scaling unit (CTU), a switch and comparison unit ($I1 == I2$). The signal from the PWM control unit (Fig. 2) goes to the scaling unit, and then goes to the switch where it is determined whether the button was pressed and whether a reset is necessary. Then the signal is fed to scaling block number, where it is determined what level PWM currently exhibited by means of the encoder and is recorded in the variable

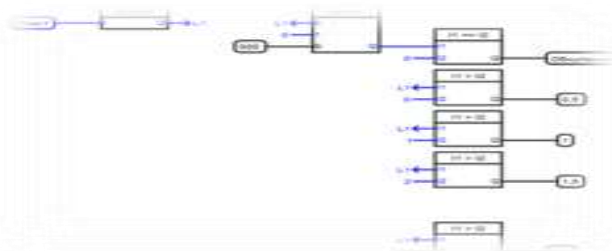


Figure 3 — The luminosity determination unit of the LED

The information display unit on the LCD display (Fig. 4) consists of variables, a logical OR (OR) and a display (DISP). After recording data from the luminosity determination unit of the LED, the signal passes through the logical element OR. In accordance with its operation logic, the level of luminous flux in lumens is displayed.

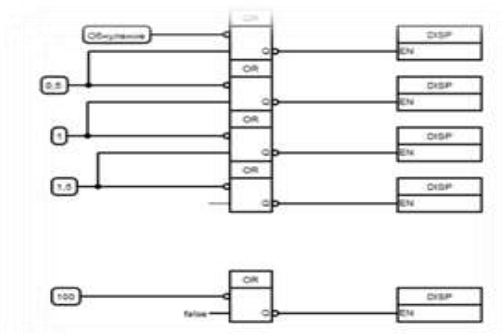


Figure 4 — The information display unit on the LCD display

Conclusion As a result, a part of the laboratory layout was designed - an electrical circuit. This project provides for the management of each of the components (separately and jointly), the system of protection against overheating of LEDs, the maintenance of brightness and its smooth change with nonlinear pitch. The laboratory layout was modeled in the Proteus8 Professional environment, and the microcontroller was programmed in the FLProg environment, which was divided into blocks to simplify programming.

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Аннотация. Структура макета состоит из: эталонной мишени, которую будут освещать управляемые источники света (светодиоды), схемы с управлением светодиодами, веб-камеры, которая снимает эталонную мишень в определенный момент времени. Вся измерительная установка накрывается непрозрачным защитным колпаком для исключения попадания на объект передачи света от внешних источников. Все используемые в ходе экспериментов испытательные изображения и таблицы размещаются на фиксированном расстоянии от видеокамеры через щелевое отверстие в защитном колпаке.

В процессе проведения измерений необходимо определить следующие параметры цифровой видеокамеры: минимальная освещенность (пороговая чувствительность); динамический диапазон; разрешающая способность камеры; уровень шума.

Ключевые слова: управляемые источники света, веб-камера, широтно-импульсная модуляция, энкодер, сигнал.

Annotation. The structure of the model consists of: a standart target that will be illuminated by controlled light sources (LEDs), circuits with LED control, a web camera that shoots the standart target at a specific time (makes a printscreen). The entire measuring installation is covered with a protective cover to prevent light external sources. All test images and tables are placed at a fixed distance from the video camera through the opening slot in the protective cover.

In the process of making measurements it is necessary to determine the following parameters of a digital video camera: minimum illumination (threshold sensitivity); dynamic range; the resolution of the camera; noise level.

Keywords: controlled light sources, webcam, Pulse width modulation, encorer, signal.

UDC 62-9

INFLUENCE OF THE DISCHARGE CHAMBER VOLUME ON THE SYNTHESIS OF SINGLE-LAYER CARBON NANOTUBES

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Introduction

Improvement of existing technologies, as well as the development of new ones can not be imagined without the development of functional and structural materials. One of the newest and most promising are carbon nanotubes (CNT) and composites based on them.

General information on CNT

Carbon nanotubes (CNT) — are long cylindrical structures with a diameter of one to several tens of nanometers and a length of up to several centimeters, consisting of one or more hexagonal graphite planes rolled into

a tube and ending usually with a hemispherical head, which can be considered as half of a fullerene molecule.



Pic.1 — An example of CNT

The ideal CNT is a cylinder obtained by folding the graphite plane. The most common is the representation of a nanotube by two integers (n,m) . The sum of these numbers is equal to the number of hexagons that make up the diameter of the cylinder. Non-chiral tubes: tubes $(n,0)$, in which two hexagonal connections are oriented along the axis of the cylinder, and tubes (m,m) , in which two connections are perpendicular to the axis of the cylinder.

Methods for the synthesis of single-layer carbon nanotubes (SLCNT)

Carbon nanoclusters - fullerenes or carbon nanotubes are obtained in an arc discharge by laser evaporation or catalytic method using clusters of transition metals.

One of the traditional approaches to the synthesis of single-layer carbon nanotubes (SLCNT) based on the use of the arc discharge with a graphite anode. In this case, the thermal decomposition of the anode material at high currents (about 100A) leads to the formation of a significant number of carbon atoms, the subsequent cooling of atoms in the presence of a catalyst is accompanied by condensation and the formation of single-layer CNT.

The main mechanism of carbon vapor cooling is connected with convective motion from the hot near-electrode area to the colder, peripheral area of the discharge chamber. Therefore, it can be assumed that the size of the chamber, which determines the conditions of convection, should affect the nature and effectiveness of the formation of CNT.

Recently, the influence of the size of the camera for the output CNT were investigated by scientists from Univ. of Toulouse (France). The synthesis of SLCNT was performed in an electric arc under helium pressure of about 400 Torr. The volume of the discharge chamber could be varied using a glass nozzle was 60, 25, or 18 liters Used vertical configuration of

the electrodes (cathode on top). As an anode, a graphite rod with a diameter of about 5 mm and a length of 50 mm was used, in which a coaxial hole with a diameter of 3 mm and a depth of 30 mm was drilled. This hole was filled with a mixture of graphite powder with a grain size of 1 or 100 μm and a nickel-yttrium catalyst ($\text{Ni:Y:C} = 0.6:0.6:98.8$). The density of the material filling the hole was (depending on the size of graphite grains) 1.71 g/cm³ and 1.50 g/cm³, for grains of size 1 and 100 microns, respectively.

Table 1 — The results of TEM study of soot obtained in chambers of different volumes using anodes with different grain sizes of graphite

Size of graphite grains, μm		Chamber volume, l		
		60	25	18
100	Output carbon nanotube, volume%	5	12-17	<0,5
	Observations	Atmospheric carbon, polyaromatic compounds, anions Fullerene; small carbon nanotube	Bundles practically do not contain impurities	there are multi-layered nanotubes
1	Output carbon nanotube, volume%	7-10	60	<0,5
	Observations	all types of impurities; small carbon nanotube	Bundles do not contain impurities	polyaromatic compounds, anions, there are multi-layered nanotubes

The table shows the results of a study using a transmission electron microscope (TEM) soot obtained in chambers of different volumes using anodes with different grain sizes of graphite.

Conclusion

The data obtained indicate significant dependence of the yield of SLCNT and the degree of purity of the product, as the volume of the discharge chamber and the grain size of the graphite included in the anode.

The most favorable conditions for the synthesis of SLCNT are implemented with the chamber volume of 25 l and a grain size of 1 μm . The role of the chamber volume is to establish optimal conditions for gas convection, while the grain size determines the conditions of heat removal from the front surface of the anode.

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Аннотация. В данной статье показаны общие сведения об углеродных нанотрубках, а также рассмотрен один из традиционных подходов к синтезу УНТ. Сделаны выводы о наиболее благоприятных условиях для синтеза ОСУНТ, роли объема камеры и размера зерна графита.

Ключевые слова: углеродные нанотрубки, разрядная камера, графит, синтез, способы.

Annotation. This article shows the general information about carbon nanotubes, as well as one of the traditional approaches to the synthesis of CNT. Conclusions about the most favorable conditions for the synthesis of SLCNT, the role of chamber volume and grain size of graphite.

Keywords: carbon nanotubes, discharge chamber, graphite, synthesis, methods.

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REMOTE CONTROL DEVICE ON THE BASIS OF NEURAL INTERFACE

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Currently, appeared a trend of development of neural interfaces for their use in living conditions. A neural interface is a system designed to exchange information between the brain and an electronic device. In the near future, neural interfaces will be relevant for almost every person, as it opens up tremendous opportunities, such as: electronics management, development of mind control, mental state analysis, and neural interfaces in everyday life, at appropriate configuration and training, will significantly simplify life for people with disabilities [1, p. 463].

The principle of the remote control device based on the neural interface is to convert the rhythms of the brain into the control command code [2, p. 545].

The functional diagram shown in Figure 1 displays the principle of operation of the neural interface.

To obtain the rhythms of the human brain, it is necessary to connect the electrodes to the surface of the scalp [3, p. 216]. Next, the received signal must be amplified, which occurs in the gain block. Then the amplified signal is fed to the filtering unit, to highlight the desired frequency. At the next stage, the signal is digitized in the analog-to-digital converter unit, fed to the control unit, where the brain waves are assigned a digital code to control the end device, after which the signal goes to the transmitter, which is an infrared channel.

In addition, the diagram shows a communication unit with a PC that provides connection to a computer for further calibration of the device, after which the accuracy of determining the command is improved.

The schematic diagram of the device is not included in the article due to its bulkiness.

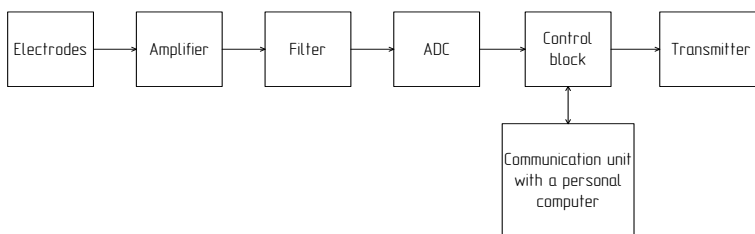


Figure 1 – Functional diagram of the device

As a result of research, a device has been developed for remote control of external executive devices, which is based on the analysis and interpretation of brain waves into digital control commands

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Аннотация. Разработано устройство дистанционного управления на основе нейронного интерфейса. Произведен анализ ритмов

головного мозга человека. Разработаны функциональная и принципиальная схемы устройства.

Ключевые слова: Нейроинтерфейс, дистанционное управление, ритмы головного мозга, инфракрасный канал, электроды, блок управления.

Annotation. A remote control device based on neural interface has been developed. Analyzed the rhythms of the brain Developed functional diagram and schematic diagram of device.

Keywords: Neural interface, remote control, rhythms of the brain, infrared channel, electrodes, control block.

UDC 621.389

ELECTRONIC BRACELET FOR THE ELDERLY PEOPLE

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1. Introduction

The problems of providing timely health care and comfortable living environment for elderly people and people with disabilities are among the most important and relevant in modern society. The situation of late provision of first aid to persons of such categories arises, often due to the fact that they can not timely report their health condition (fainting, high blood pressure, etc.) in time to relatives or to a health facility.

At present, modern communication technologies deliver great prospects for expanding the capabilities of the health care system, improving diagnostics and monitoring, as well as ensuring maximum independence for older people in nowadays. For example, the use of wearable sensors for obtaining bioinformation, environment sensors allow to provide monitoring functions and physiological parameters control in such people [1]. The use of modern communication technologies allow to

transmit the physiological parameters data of a patient, the occurrence of critical situations, etc. to medical center.

Thus, the construction of a "smart" environment, based on modern technologies, will provide older people and people with disabilities, additional opportunities to control their environment and physiological parameters control.

2. Main part

Considering availability of smartphones, the use of mobile Internet has greatly simplified the development of devices based on the use of portable sensors that provide the collection of physiological and motion data in real time. The General structure of such system for remote monitoring of basic vital functions is shown in the figure 2. The Sensors located on a person are used to collect physiological and motion data. Monitoring of vital signs may include heart rate, respiration rate, pulse rate, etc. Wireless communication is based on data transmission from sensors via a mobile phone (smartphone) communication system or an access point to a remote center via the Internet [2].

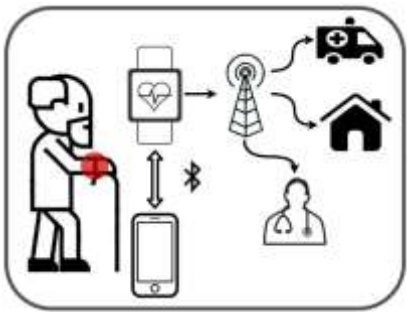


Figure 1 — Communication scheme

To solve the problem of timely medical care, a wrist smart bracelet (medical bracelet) was developed for the elderly and people with disabilities, which allows to provide a rapid response to poor health, track the location of the carrier and monitor the basic physiological parameters such as blood pressure, pulse, free fall, counting the number of steps and other functions [3].

The functional scheme of this bracelet consists of a control device, pulse monitor, location tracking, monitoring device, pedometer, alarm button, the wireless communication module is shown in the figure 2.

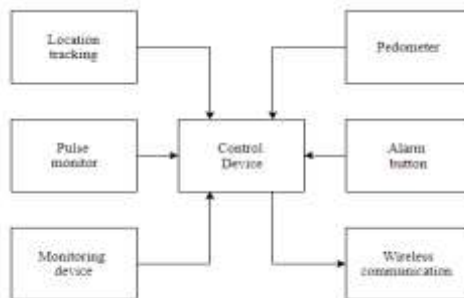


Figure 2 — Functional scheme

Based on the above is described the algorithm of the device. At the first serious signs of malaise (low/high blood pressure, pulse, dizziness, etc.), the patient can press the alarm button. The system receives a signal to form a message about the patient's health.

Next stage is to read data from sensors (heart rate, location) and message preparation to send to the predetermined contacts. In case the data exceed the limit, the dialing of emergency numbers occurs. The template of the message sent when the button is pressed is shown in the figure 3.



Figure 3 — The template of the message to be sent when the button is pressed

Also, the bracelet has a number of additional features that help elderly and people with disabilities to monitor their health:

— alarm clock for taking medication, which will help to take medicines in a timely manner, with the help a notification on the bracelet and a sound notification;

— pedometer, for counting the number of steps;

— smart alarm clock monitors sleep phases;

— activity monitoring.

For convenience, this device can be connected to a smartphone, so that close people and relatives can always monitor the health of the carrier of this device [4]. The application interface is shown on the picture 4.



Figure 4 — Application interface

This application has a simple and human friendly interface. Along with that, can easily adjust and change personal data, alarm for medication, sleep mode and also view statistics. An important feature of the interface is simple, large, contrasting icons and font, allowing people with disabilities, and older people to quickly understand it as well.

3. Conclusion

Modern electronic and telecommunication technologies make it possible to build a more comfortable environment for the elderly and people with disabilities. The paper presents a medical bracelet—a personal aid device for the elderly and persons with disabilities in emergency situations, as well as monitoring their life condition. With the help of smartphones and mobile Internet, the device allows at the first serious signs of illness to notify close people, relatives, call an ambulance, just pressing one button, which minimizes the amount of time spent.

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Аннотация. На сегодняшний день наука не стоит на месте, и внедрение умной техники позволяет нам компенсировать физические недостатки, а также оказать ряд услуг, от напоминания о необходимости принятия лекарств до вызова скорой помощи.

На фоне этого представлено персональное устройство помощи, а именно «умный» браслет, для пожилых людей и лиц с ограниченными способностями в экстренных ситуациях. Также данное устройство, благодаря встроенным датчикам, позволит следить за жизнедеятельностью носителя браслета. Для более удобного наблюдения за личными данными «умный» браслет можно связать со смартфоном.

Ключевые слова: умное устройство, интерфейс, тревожная кнопка, пульсометр, шагомер, «умная» бытовая среда.

Annotation. Today, rapidly develops, and the introduction of smart technology allows to deliver for physical disabilities, as well as to provide a number of services, start from a reminder of the need for medication to call an ambulance.

A personal aid device is presented, namely a "smart" bracelet, for the elderly and persons with disabilities in emergency situations. Also, this device, at the expense the built-in sensors, also provide monitoring the vital activity of the wearer of the bracelet. For more convenient monitoring of personal data "smart" bracelet can be conjugated with a smartphone.

Keywords: smart device, interface, alarm button, pulsometer, pedometer, smart home environment.

TECHNOLOGY AND DEVELOPMENT PROSPECTS OF BANK CARDS

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Empowerment is one of the signs of our time, quickly and conveniently pay for various goods and services.

One of the most important tasks in ensuring the safety of the banking system is to protect the payments made by clients at remote terminals via plastic cards. The most frequently payment in stores, organizations, and withdrawals from ATMs is used.

The **aim** of our research is to consider the main types of cards.

Credit card with a magnetic strip today remains the most widespread in Russia. The magnetic strip - a storage medium with limited storage capacity, has three tracks for recording information: the first track is applied to a sequence of digits and letters (name of the owner, the card number, expiry date, etc...). The second and third ones are only digits. In the absence of encryption they are easily copied and reproduced, it is extremely unsafe.

The simplest contact cards also have the ability to keep information open. Information is transmitted by contact. Smart card or smart card: used memory chips, hard logic and microprocessor, these devices have their own operating system, which significantly expands their opportunities. Cards with a microprocessor can perform more complex tasks. For example, to download a complex authentication algorithm with data exchange protocols and provide cryptographic protection of information while reading and data transmission. These cards are currently the safest option.

Cards with contactless payment technology. This NFC technology cards - near field communication is a technology of wireless data short-

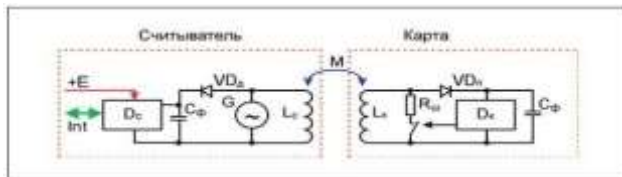
range transmission via radio to a contactless terminal payment information. These cards also have built-in processor for data encryption and require confirmation from the owner (PIN). However, since they have been introduced for greater convenience of users, then a restriction - such technology is applied when the payment amount exceeds a fixed value, and the smaller pass without confirmation PIN code. To protect against unauthorized removal using unregistered readers a limit is imposed on the amount of such payments: when you try to make a short period of time, two or more non-confirmed payments. For data cards developed ISO / IEC 14443 standard:

- frequency range of 13.56 MHz with amplitude modulation and deviation of 850 kHz;
- typical range of reading cards and readers - 5-15 cm;
- exchange rate - from 106 to 848 kbit / s.

For data protection backup card readers used encryption algorithm AES-128 during communication between the reader and the identifier - a symmetrical block encryption algorithm with 128-bit key; diversification of the encryption key; CMAC signature ID.

The physical principles of operation are similar to RFID systems or transformer coupled circuits. As you know, if you take two coils and place them not very far from each other, they have a mutual influence (see picture).

The reader comprises a high-frequency generator G , which powers the antenna - coil L_c . Due to the presence of the electromagnetic coupling M between the reader antenna and the antenna identifier (card) in the latter L_k alternating voltage is induced, which value depends upon the design and the distance between the card and the reader. The induced voltage is used to supply D_k chip card through a rectifier formed by a diode VD_d and filter capacitor C_Φ . The chip card modulates the D_k voltage in the antenna L_c through its bypass resistor $R_{ш}$. Due to communication antennas and modulation appears at the antenna of the reader L_c , is detected by diode VD_d and D_c is supplied to the chip reader, which card decrypts the code and outputs it to the controller through interface Int .



Picture 1 – Card readers

When calculating distances reliable interaction as well as in the analysis of safety measures it should be taken into account dependence of the distance scanner (terminal) and a map of characteristics of the medium there between, transmitter power and other factors.

Let's consider the risk to bank cards in more detail and compare these security technologies.

For information, the following methods are used with the smart card.

- Skimming - this is data theft with special electronic readers that copy information from a magnetic stripe card. This type of attack is applicable to a contact card, but smart cards are less vulnerable to this method.

- Friendly man-in-the-middle, with an additional built-in equipment is intercepted by PIN-code request and replies that he is true, whatever code was.

- Physical breaking - obtaining access to the electrical circuits of the smart cards after the chemical removal of the protective layers of the crystal. It allows to analyze the smart card device and connect to it using microelectrodes.

- This two attacks are applicable to the Smart-cards. It is required to store the card in a safe place.

- Differential power analysis – evaluation of waveforms of consumed electricity smart card at the time of performing the cryptographic algorithm. Unusual operating conditions of the smart card. For example, a non-standard temperature, voltage and frequency of the signal at the terminals. This may lead to failures in the algorithms followed by obtaining access information. Such methods are intended to intercept information for reuse, or blocking operations of committing an authorized user and replacing it with a malicious action. It is important to inform the user of the committed transactions (SMS) and control of the bank.

- Seller fraud, is removed from the card more money than is needed to pay for goods or services. All cards are vulnerable to this method and it will help protect against your attentiveness. It checks the receipts of payment of the appropriate amount of payment.

- POS-terminal used without the knowledge of the contactless card holder. It protects against such threats to help special protective case for the card, or the presence of several NFC cards.

It should be noted that the main reason is the desire to reduce the safety of the customers to make transactions faster and without any additional effort. Banks implement such a request to the possibility of the transactions and, unfortunately, often adopting appropriate technologies "simplified" default payments, limiting the ability of the conscious part of

customers to protect their finances. Now it is necessary for them to perform additional actions. Obviously, in the future it will be the development of contactless payment functionality, providing a larger set of services provided by a single device - the card, and the replacement of physical media this technology more user-friendly - keychain, bracelet, smartphone, connected to the card.

At the moment, Smart-card WORLD requiring confirmation PIN code is the safest option of making payments. In addition, we believe that the user must limit the funds on the card daily necessity, and with considerable means cards responsibly to keep in a special place.

In conclusion it should be noted that NFC-technology, is widely implemented at the moment, very comfortable, however, still not protected. Therefore, to avoid a substantial loss it is combined with the PIN code protection or used by devices that allow for rapid personal authentication features (e.g., smart phones with access via a fingerprint).

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Аннотация. В работе рассмотрены различные виды банковских карт, приведен принцип действия карт с возможностью бесконтактной оплаты и возможные препятствия в их работе, проведен анализ известных уязвимостей и способов обеспечения безопасности. Определены перспективы платежной системы с помощью карт. Основные направления развития связаны с применением многофакторной строгой аутентификации проведения платежных операций с одновременным упрощением действий пользователей, усложнению и расширению функциональных задач таких систем.

Ключевые слова: платежные карты, смарт-карты, RFID – расшифровать, NFC, расшифровать, защита информации

Annotation. The paper discusses the different types of credit cards, is a principle of action cards with contactless payment, the analysis of known vulnerabilities and ways to ensure security. The prospects of a payment system using cards. The main directions of development associated with the use of multi-factor strong authentication of payment transactions with simultaneous simplification of user activity, complexity and expansion of the functional tasks of such systems.

Keywords: payment cards, smart cards, RFID – to decipher the NFC, decrypt, information security

PROSPECTS OF THE ACCESS CONTROL SYSTEMS CARDS

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The access control system (ACS) solves the problem of controlling and managing visits to premises, as well as the operational control of the movement of personnel. The access control system allows to fundamentally increase the level of security in enterprises, prevent unauthorized access by intruders, and delineate the possibilities of visiting various parts of the facility. Physical security is provided by identifying users to allow or limit access to objects.

Identification in the access control system - determination of the subject permission, as well as for recording actions. Authentication is the process of verifying the authenticity of the identifier being presented, namely, whether the identifying subject is the person it claims to be. Authorization - providing the person with opportunities in accordance with the rights assigned to him or checking the availability of rights when trying to perform an action.

The access control system is classified according to three principles of identification: attributive, personal and informational [1].

Let's discuss the attribute methods in more detail. Attributive access control tools include user IDs that contain some information - a key that opens the door or access to resources. The identifier can be in the form of a key fob, tag, and you can also use mobile phones or other devices that support NFC technology.

In modern access control systems, RFID (Radio Frequency IDentification) most often uses radio frequency identification. Passive RFID cards re-emit a modulated reader signal, identifiers of this type have the minimum distance. Active RFID cards are endowed with their own power source, due to which their distance of action increases. The improvement of this characteristic entails an increase in the size of the card and also an increase in its value. Semi-passive RFID cards, like active ones, have their own power source, but the purpose of its use is not to increase the distance, but to ensure the operation of sensors, protection systems, etc.

Contactless (proximity) cards are produced for three ranges. Low-frequency proximity cards operate at a frequency of 125 kHz and have the lowest cost, can be used in difficult climatic conditions. The card interacts with the reader using an open protocol, which is a significant vulnerability for intruders.

High-frequency RFID cards operate at a frequency of 13.56 MHz. They provide a wider bandwidth, a greater level of security and speed. These access cards allow mutual authentication between the identifier and the reader, and use of data encryption algorithms. Ultra-high-frequency cards operate in the frequency range of 860-960 MHz, have increased the reading distance. Such access cards are used as combined solutions for entering the territory and entering the building with one identifier, ones can be used as transportation cards.

Smart cards are cards with a built-in microchips. The microprocessor with an operating system is used to ensure strong encryption, use and store large amounts of information. Such identifiers have the highest degree of protection, but they are also more expensive than previous ones. Smart cards are used in ACS, public transport, banking, etc.

Nowadays, a common identifier can provide access both to the building and service premises, as well as to corporate information and IT-environment management. Such solve requires more secure high-frequency RFID cards or multi-technology cards which allow you to implement a two-factor authentication system.

Multi-technology or combined access cards use integrated identification technologies. They can combine several chips that are used in low and high-frequency cards, or have a magnetic strip at the same time with an integrated microcircuit and a radio frequency chip. Combined cards are resorted to for a gradual transition from an aging access control system to a newer one.

Thus, the user will be able to pass through the readers of two different technologies at the same time, having only one identifier.

All types of cards have disadvantages of the attributive method:

- physical loss or theft of the carrier;
- the threat of remote copying of unprotected data and the possibility of making duplicates;
- the use of attributes "under duress" of the owner.

In the future, the access control technology will be actively developed. The possibilities of card falsification today are significantly reduced by the introduction encryption of the response and request of the reader, by mutual authentication of these devices. Biometric information analysis technologies are being introduced (for example, Zwipecards). The

possibility of loss can be excluded by the implantation of the elements of ID cards.

Thus, now cards are becoming widespread since they have the following advantages:

- contactless work can be read without any physical contact between it and the reader;

- the data on the card can be overwritten a large number of times;

- the distance of reading can be different, namely, from millimeters to several meters;

- the cards can significantly withstand harsh environmental conditions;

- the reader can automatically read several cards in its reading zone in a very short period of time.

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Аннотация. Системы контроля доступа (СКД) решают проблемы контроля и управления доступом в здания и служебные помещения, а также к информационным ресурсам и системам. Рассмотрены три принципа идентификации системы контроля доступа. В докладе обсуждаются преимущества и пути развития таких систем.

Ключевые слова: Система контроля доступа, аутентификация, атрибутивные методы, технологии идентификации, мультитехнологичные карты.

Annotation. The access control system (ACS) solves the problem of controlling and managing visits both to the building and service premises, as well as to corporate information and IT-environment management. Three principles of access control system identification are considered.

The paper discuss the advantages of such systems and ways of development.

Keywords: access control system, authentication, attribute methods, identification technologies, multi-technology cards.

DIGITAL CAPACITANCE METER

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1. Introduction

During the development and maintenance of complex electronic devices it is became necessary to verify whether the actual capacitance of the capacitor with matches it's face value. The difference between the rated and the actual values of the condenser capacity can be due to several factors: the obsolescence of the component, due to the drying of electrolyte; breakdown of the dielectric due to the use of the element beyond the operating voltage range; mechanical damage during maintenance; and deliberately overestimated value of the capacitor face value.

In this regard, a module for the Arduino platform was developed, that allows to determine the actual capacitance of capacitors.

2. Main part

Since the Arduino UNO Board has become very popular among AVR microcontrollers, it was decided to develop a module compatible with this microcontroller. The developed capacitance meter consists of three blocks: microcontroller (MCU); the connector for the capacitor and indicator, which includes a seven-segment three-digit indicator and a shift register.

The algorithm for the capacitance meter is shown in Fig. 1.

The microcontroller measures the voltage at the zero analog input MCU (A0), to which the capacitor is connected. If there is no voltage at A0, it discharges the capacitor through the resistor R2 and set 0 on fourth digital output.

After, the microcontroller turns on a timer and sets 1 on third digital output, which corresponds to a voltage of 5 V, charging the capacitor through the resistor R1. MCU measures constantly the voltage on the capacitor using the analog input A0.

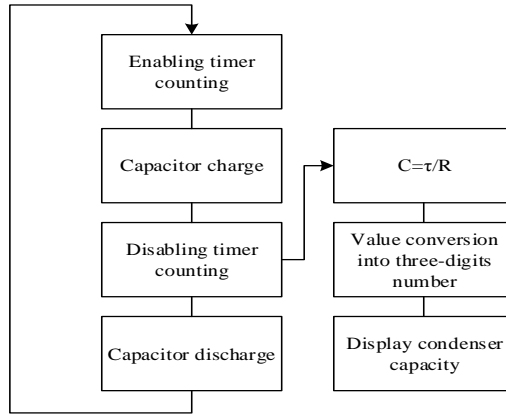


Fig. 1 – Algorithm for the capacitance meter

When the voltage on the capacitor reaches 63% of the voltage at the digital output 3, which corresponds to the capacitor charge time equal to τ for the RC-circuit [1, p. 122], the microcontroller stops the timer and sets 0 on third digital output. After, MCU calculates the measuring capacitance according to the equation 1 and, converting the capacitance value, displays it on the indicator in the form of three digits corresponding to the coding table of the capacitors.

$$C = \frac{\tau}{R} \quad (1)$$

Electrical scheme of the measuring part of this device shows on Fig. 2.

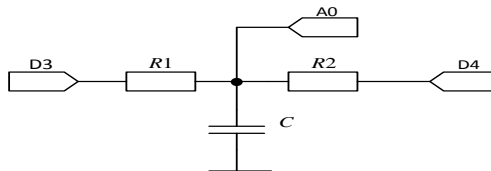


Fig. 2 – Electrical scheme of the measuring part

The described algorithm for measuring the capacitance of the capacitor was implemented using C programming language for the microcontroller on Arduino UNO.

3. Conclusion

The developed device allows to measure the capacitance of the capacitor and display the actual capacitance value. The device is made in the form of a detachable module compatible with Arduino UNO. The finished working device is shown in Fig. 3.



Fig. 3 – Finished working device

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Аннотация. Рассмотрен принцип цифрового измерителя ёмкости конденсатора на платформе *Arduino* и приведены функциональная и электрическая принципиальная схемы измерительной части устройства. Разработан прототип устройства.

Ключевые слова: Измерение, Ёмкость, Ардуино, Конденсатор, Съемный модуль

Annotation. The digital capacitance meter operation principal, based on Arduino, along with functional and electrical circuit of the measuring part of this devise is presented. A prototype of the device was developed.

Keywords: capacitor, capacitance, Arduino, to measure, detachable module.

UDC 621.3

SIMPLEST ALTERNATING VOLTAGE GENERATOR'S FULL LOAD DEVICE AND IT'S MAIN PARAMETERS

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Alternating voltage generator's full load device (FLD) allows increasing an average power consumption, while instantaneous power won't be exceeding the value of rated power.

FLD is a combined load consisting of the main resistive load and one or more numbered additional resistive loads connected by electronic switches to the main load in parallel so that resistance of combined load may vary by “opening” and “closing” switches [1] (fig. 1).

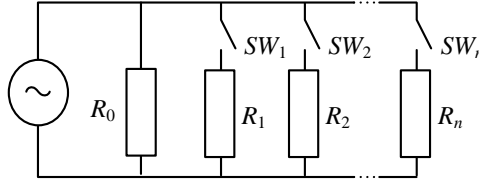


Fig. 1 – Opening and closing switches

When a switch completes a parallel branch, the total resistance of the circuit decreases. Maximum resistance of the combined load equals to the value of the main resistor and corresponds to the “closed” state of all switches. Using FLD only makes sense if the value of the main resistor can't get reduced without generator's overload when all switches are “closed”. In other words, maximum load power on the main resistor connected to an alternating voltage generator must be equal to the generator's rated power P_{\max} (point A in fig. 2c).

The main idea is to decrease the combined load resistance by “opening” switches from first to the last when the value of the input voltage is decreasing and to increase it by “closing” switches when the value of the input voltage is increasing. Thus, the average combined load power increases, but the input voltage value must be low enough so that “opening” another switch does not cause the generator's overload. The commutation voltage value of switch is the greatest value of input voltage at which “opening” the switch does not cause the generator's overload. The switch is “open” when the absolute value of input voltage is less than the commutation voltage value U_k and is “closed” otherwise (in fig. 2b “1” is for “open” and “0” is for “closed”). At the moment of switching the combined load's instantaneous power value equals to the value of rated power.

The commutation voltage value U_k of a switch on the n th parallel branch is a function of resistance values of every parallel branch with a smaller number inclusive because power is a function of voltage and resistance and must be equal to the value of rated power. In the case of the simplest FLD, there is a main resistive load R_0 on the main line, an electronic switch SW_1 and additional resistive load R_1 are on the parallel branch and the dependence of U_k on the resistance values R_0 and R_1 is given by:

$$U_k = U_m \sqrt{R_1 / (R_0 + R_1)}$$

where U_m is the alternating voltage semi-amplitude value [2].

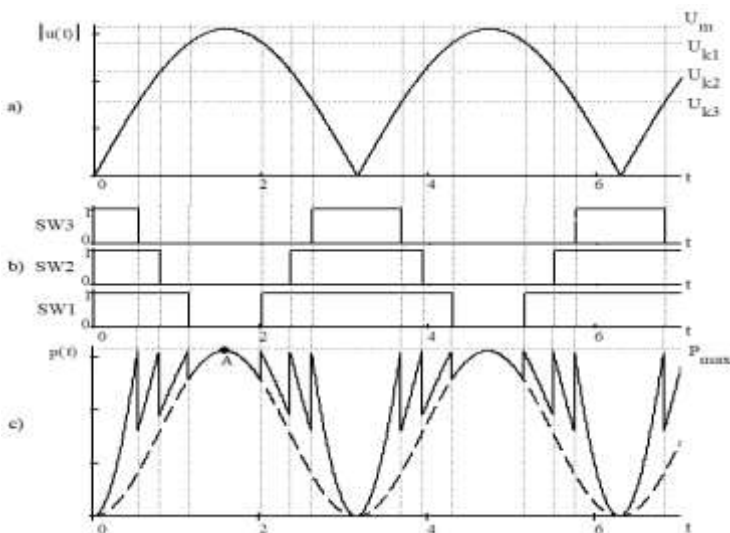


Fig. 2 – The commutation voltage value of switch

The value of the relative average power increase K is the ratio of the average power of combined load to the average power of the main resistive load. In fig. 2c the ratio of the area under the solid curve to the area under the dotted curve equals to K . From the graph it is clear that K is a function of commutation voltages U_k of every switch is combined load. For the simplest FLD, the maximum value of K is ≈ 1.19 . It corresponds to the resistors' resistance ratio $R_1/R_0 = 0.678$ and $U_k = 0.651 \cdot U_m$ [2]. By adding more parallel branches to the FLD one could increase the relative average power increase value. With no parallel branches the combined load is identical to its main resistive load, so $K = 1$. In the limit, the instantaneous power becomes constantly equal to the rated power of generator, so $1 \leq K \leq 2$.

The FLD can be useful for increasing heat energy generation if the generator's rate power isn't enough for one's tasks. The difference between the area under the solid curve and the area under the dotted curve in fig. 2c is an additional energy E consumed from the generator through the use of FLD. For the simplest FLD if $U_m = 220\sqrt{2}$ V, alternating voltage frequency $f = 50$ Hz and rated power $P_{\max} = 6.5$ kW, the maximal additional energy for the period is $\Delta E = 12.093$ J and a generator of rated power $P_{\max} = 6.5$ kW becomes equivalent to the generator of rated power $P'_{\max} = 7.7$ kW.

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Аннотация. В данной статье изложен и рассмотрен принцип работы установки форсированной загрузки электрогенератора переменного тока с одной и более дополнительными нагрузками. Разъяснено значение параметров установки форсированной загрузки, таких как напряжения открытия электронных ключей и относительное увеличение средней мощности.

Для простейшей схемы установки форсированной загрузки, состоящей из одной основной и одной дополнительной нагрузок, приведен результат расчёта основных параметров. Описан основной способ применения установки форсированной загрузки электрогенератора переменного тока.

Ключевые слова: Электротехника, установка форсированной загрузки, комбинированная нагрузка, переменная нагрузка, увеличение мощности потребления.

Anotation. The paper is concerned with the principles of operation of the alternating voltage generator's full load device with one or more additional resistive loads and it's main parameters such as commutation voltage values of each electronic switch and the relative average power increase.

Much attention is given to epy description of the role of main parameters of alternating voltage generator's full load device.

For the simplest full load device, the commutation voltage value, the ratio of the additional resistor's resistance to the main resistor's resistance and the relative average power increase are calculated. The main way of use of the full load device is described.

Keywords: Electrical engineering, full load device, combined load, varying load, power consumption increase.

CAR BLIND SPOT MONITORING SYSTEM

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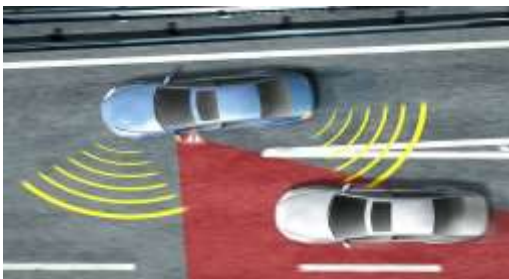
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The monitoring system of "blind" zones watches that maneuvering from of the same kind in another was among other things and safe. The specifics of side rear-view mirrors are that they have a limited viewing angle – in are mute there are so-called "blind sectors". You are going to be rebuilt on the multiband road on the next band, are convinced by means of mirrors that "the operational scope" is free, and changing the lane directly in the next machine! On its place there can be a normal car, and also the machine of the swindlers who are well knowing features of "a blind zone" can. Anyway troubles are guaranteed.

"Blind zones" – feature of flat mirrors with their limited viewing angle. If the mirror was hemispherical, the problem would not be. But a spherical mirror, increasing a corner, distances the reflected objects – therefore the convex form they are given extremely restrictedly.

The system works by the same principle, as the Parctronic. Behind and sideways the car are installed special ultrasonic sonars which warn the driver about obstacles [2, p.52].

In picture 1 is represented the typical situation— the driver did not monitor a road situation and while it wanted to change the lane, the machine in the left row was already in the "blind" zone marked in the red color. The warning signal of a control system of "blind people/dead" of zones saved from accident.



Picture 1 – Illustration of a road situation.

The most widespread version of blind spot monitor of the car – a system with use of 2-4 ultrasonic sensors. In such systems the notification is made by means of light and sound indication, versions of the notification depend on the speed of the vehicle and inclusion of pointers of turn. From shortcomings it is possible to select a possibility of false operations in difficult meteorological conditions (snow, a heavy rain, fog) or at hit of dirt for sensors, and need to break integrity of body elements of the car for installation of sensors.

Operation algorithm of systems of "blind" zones with four sensors:

- if an obstacle is seen at the same time both the front sensor and back - the system is silent (allows a system not to react to the chippers parked by a car, in parallel a moving stream of cars, etc.);

- if the obstacle is seen at first the front sensor, then back - the system is silent (we overtook the car, we saw it and we know that it is sideways from us);

- if the obstacle is seen at first the front sensor, then back and an object is in a visibility range of the back sensor more than 5 seconds, the system will begin to signal about an object in a "blind" zone;

- if in a visibility range of the front sensor freely, and in a visibility range of back an object appeared - the system will signal about an obstacle in a "blind" zone (that dangerous case on which the system also should inform the driver).

Car blind spot monitor is developed. The system consists of three parts: two ultrasonic sensors located in a rear bumper of the car, the block of reception and signal processing of sensors, the indication block.

From the electronic block on the sensor radiator the pack of impulses with a frequency of 40 kHz periodically moves. If on the way of an impulse the obstacle meets, then it is reflected and caught by the microphone. Further it is transferred to electronic processing unit of a signal which measures a period between the moment of radiation of an impulse and time of its return from an obstacle [1, p.24]. As a result the reflected signal is

digitized and transferred to control box where on the basis of data retrieved it is processed and in the subsequent forms the basis for the following indicators:

- control of moving cars;
- definition of motionless objects where barriers, columns, cars on the parking etc. can enter.

After information processing from sensors and decision-making the signal of existence of a noise in a blind zone is transmitted by the microcontroller to the indication block.

Informing the driver can be made:

- a LED in a front strut;
- sound signal.

The control box processes and monitors moving objects, can also recognize motionless objects, thereby, excepting them as a noise. In case of big danger in the block of indication the corresponding indicator as a danger level indicator turns on.

At inclusion of the pointer of turn towards a noise that is in a blind zone, the LED indicator is added to informing by a sound signal.

The microcontroller of control box and processing carries out the following tasks:

- reads out a signal of ultrasonic sensors;
- makes the analysis of the received signal;
- output to the block of indication of information on existence of danger in a blind zone.

Proceeding from the carried-out review of systems and devices we will designate what functions should perform the projectible device — car blind spot monitor:

- receiving and data processing from ultrasonic sensors;
- receiving and data processing with the relay of pointers of turn;
- storage of the programmed settings;
- output to the block of indication of information on existence of danger.

In conclusion it should be noted that proceeding from the offered functionality of a system we will select functional assemblies of a projectible system. The system should include:

- block of sensors;
- information processing device;
- a non-volatile memory for saving of settings and information;
- information input/output device;
- indicating devices.

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Аннотация. Представлена система контроля слепых зон автомобиля. Применение систем контроля слепых зон автомобиля в настоящее время становится всё актуальнее. На мировом рынке существует достаточное количество выпускаемых систем контроля слепых зон автомобиля, различной конструкции и стоимости, однако систем бюджетных и универсальных не так много. Существующие системы, в большинстве своём, являются стандартными (заводскими) для автомобилей средней и верхней ценовых категорий.

Ключевые слова: автомобиль, безопасность, датчик, микроконтроллер, система.

Annotation. Car blind spot monitor which can be integrated into any car is presented. Use of blind spot monitor of the car becomes more relevant now. There is enough the released blind spot monitor of the car, different construction and cost, however budget and universal there is not a lot of systems. The existing systems, in the majority, are standard (factory) for cars of average and upper price categories.

Keywords: car, safety, sensor, microcontroller, system.

UDC 62-5/520

CONSTRUCTION OF THE SPACECRAFT SPAN

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Introduction. The program of building of the span of the spacecraft allows a graphical display of the span of the spacecraft and track its change depending on the parameters of the onboard equipment of the spacecraft. The observation strip of the spacecraft on the maps is laid during the observation from space.

Observation from space is conducted: radiotechnical; photographic; television; infrared.

At radio engineering supervision the band of the review of the earth's surface is defined by viewing angles ε . Value ε amounts 7-10° [1].

For a spacecraft with optoelectronic equipment, the field of view of the earth's surface is determined by the viewing angles Ψ , the value is:

- photographic $\Psi \approx 60^\circ$;
- television, within $\Psi = 80^\circ \dots 100^\circ$;
- infrared, in the range of $\Psi = 80^\circ \dots 120^\circ$.

One of the main components in the construction of the band of the earth's surface is the altitude of the spacecraft.

Main part. This program is implemented in C++ and Delphi [2]. The program has two Windows "Parameters", "two-Dimensional map". In the "Parameters" window, you can select a spacecraft from the list and set it manually parameters: longitude, inclination, eccentricity, perigee argument, apogee height, perigee height.



Figure 1 – Working window "Parameters".

In the "two-Dimensional map" window you can see the local time, as well as set the date and time manually and see the change in the trajectory of the spacecraft. Given the choice of the active space of the device and known to NIP (KOS-E, KOS-D). You can also change the angle of view.

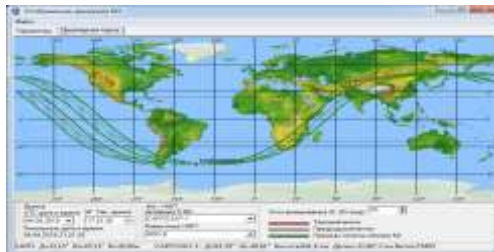


Figure 2 – Working window "two-Dimensional map".

Conclusion. you can see the movement of the spacecraft relative to the planet by means of this program, which clearly demonstrates the trajectory of the spacecraft and ease of operation.

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Аннотация. Производить графическое отображение полосы обзора космического аппарата и проследить её изменение с учётом изменения угла визирования позволяет программа построения полосы обзора космического аппарата.

Ключевые слова: Delphi, траектория, космический аппарат, C++, C, космос, орбита, полоса обзора, визирование, угол, радиотехника, долгота, широта, эксцентриситет, программа, земная поверхность, аппарат, параметры, высота перигея, высота апогея.

Annotation. The program of building of the span of the spacecraft allows a graphical display of the span of the spacecraft and track its change with changes in the angle of sight.

Keywords: Spacecraft, C++, C, Delphi, trajectory, space, orbit, field of view, sight, angle, radio engineering, longitude, latitude, eccentricity, program, earth surface, vehicle, parameters, perigee height, apogee height.

UDC 621.3

SMART ELECTRICITY METER

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1. Introduction

Every day we enjoy the benefits of one of the most important discoveries of all time - electricity. Despite the fact that people for many centuries lived without electricity, the probability of economic development tends to zero without it.

Electricity used in all spheres of life. Its value is difficult to overestimate, both in the context of private goals, for example, to ensure comfort (in everyday life it is necessary for room lighting), and for society as a whole (the entire industry is based on electricity).

So electrical energy is indeed an integral part of modern life and is necessary for economic development. As a result, both the public sector, represented by governments, and the private sector, through housing and utility companies, are showing increasing interest in innovations in the field of electricity metering systems. One of them is a smart electricity meter.

2. The main part

A smart electricity meter is an automated electronic device that determines the indicators of electrical energy consumption and transmits information to the electricity supplier for monitoring and billing [3, p. 241]. Servers for collecting and storing user testimony are located in special data centers.



Figure 1 — Smart electricity meter

As a rule, smart meters store information on electricity consumption hourly and transmit this data to the central system at least daily. A smart meter itself monitors how much electricity a consumer spends, remotely transmits data to the company at a distance, and if the consumer doesn't chronically pay the bills, he restricts the power supply [3, p. 243].

The implementation of such an electric energy meter requires specialized microcircuits capable of multiplying signals and providing the obtained value in a convenient form for the microcontroller. For example, the active power converter - to the pulse repetition rate. The total number

of incoming pulses, counted by the microcontroller, is directly proportional to the electricity consumed.



Figure 2 — The principle of remote collection of readings from an electricity meter

The presence of a digital display, controlled by a microcontroller, allows you to set programmatically different modes of displaying information, for example, display information about the energy consumed for each month, at different rates, and so on.

To perform some non-standard functions, such as level matching, additional information systems (IS) are used. We have now begun to produce specialized IS - power converters to frequency - and specialized microcontrollers containing similar converters on a chip. However, often, they are too expensive to use in household induction meters. Therefore, many global manufacturers of microcontrollers are developing specialized chips designed for such an application. The structural diagram shown in Figure 3.

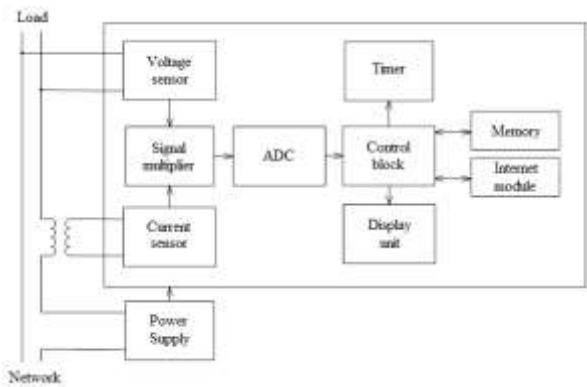


Figure 3 — Structural diagram

The advantages of a smart meter include transparency, availability and accuracy of information on electricity consumption, reducing the number of interruptions in power supply and their timing, the ability to control the use of resources and their cost and improve the quality of service. For the industry, such a solution will become a tool for technological development by reducing the time and frequency of technological violations, controlling the quality of electricity at the consumer, optimizing the schemes and modes of operation, as well as increasing the payment discipline [4, p. 1].

However, one should not idealize the technology under consideration, because it also has negative aspects. One of the drawbacks of a smart electricity meter is security vulnerability [5, p. 83]. It not excluded, that hackers can hacked the smart counter in order to disable subsequently individual sources of energy [1.]. In addition, in the UK there have been cases of ignition of smart electricity meters that caused fires due to improper installation of devices [2.]

Moreover, the availability of a communication system is a critical technological requirement for smart meters: each meter must transfer reliably and safely the collected information to a central database. For data transmission from smart meters, the use of cellular and paging networks or radio channels is proposed. As a result, there is a possibility that the smart meter will not be able to work properly in areas with a weak telephone signal: due to interruptions in operation, the device will send readings.

3. Conclusion

Today, energy bills depend on meter readings provided by consumers themselves.

Without a meter reading, your supplier will simply wonder how much energy you have consumed and how much you should pay. Smart meters are designed to eliminate this uncertainty by taking readings automatically and sending them daily to the supplier. Thanks to this, you will receive the most accurate bills in an automated mode, without wasting your time on it.

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Аннотация. сегодня электричество играет ведущую роль в обществе - это наиболее универсальная и удобная форма использования энергии. Одним из наиболее значимых нововведений в электроэнергетике последнего времени стало внедрение в эксплуатацию интеллектуального счетчика электроэнергии. В статье представлен комплексный анализ данной технологии: изложены особенности ее функционирования, описан метод передачи данных, а также представлены как положительные, так и отрицательные стороны интеллектуального счетчика.

Ключевые слова: инновации, информационные системы, интеллектуальный счетчик, электроэнергия, перспективы и угрозы.

Annotation. Today, electricity plays a leading role in society - it is the most universal and convenient form of energy to use. One of the most significant innovations in the power industry of recent times has been the introduction to the use of a smart electricity meter. The article presents a comprehensive analysis of this technology: outlines the features of its operation, describes the method of data transmission, and presents both the positive and negative aspects of a smart counter.

Keywords: innovations, information systems, smart meter, electricity, prospects and threats.

UDC 537.2

LIMITS OF APPLICABILITY OF FORMULA FOR ELECTRIC FIELD OF DIPOLE

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The electric dipole is a system of two equal and opposite charges $\pm q$ separated by the small distance d called dipole's length. If the point is at a distance r from the negative charge of a dipole and $r \gg d$ the theory of Electromagnetics gives the following formula for the field of an electronic dipole in Electrostatic units (ESU) [1, p. 26]:

$$\mathbf{E}(\mathbf{r}) = q \frac{3(\mathbf{r} \cdot \mathbf{d})\mathbf{r} - |\mathbf{r}|^2 \mathbf{d}}{|\mathbf{r}|^5} \quad (1)$$

where \mathbf{d} is displacement vector pointing from the negative charge to the positive charge, \mathbf{r} is position vector.

The formula for the electric field \mathbf{E} for the dipole can be derived from Coulomb's law [1, p. 5]:

$$\mathbf{E}'(\mathbf{r}) = q \left(\frac{\mathbf{r} - \mathbf{d}}{|\mathbf{r} - \mathbf{d}|^3} - \frac{\mathbf{r}}{|\mathbf{r}|^3} \right). \quad (2)$$

Unlike formula (1) the formula (2) is valid for any distance r if the field is considered to be generated by a point charges. The approximations required to get the formula (1) are causing an absolute error $\Delta\mathbf{E} = \mathbf{E} - \mathbf{E}'$:

$$\Delta\mathbf{E}(\mathbf{r}) = q \left[\left(\frac{3(\mathbf{r} \cdot \mathbf{d})}{|\mathbf{r}|^5} + \frac{1}{|\mathbf{r}|^3} - \frac{1}{|\mathbf{r} - \mathbf{d}|^3} \right) \mathbf{r} - \left(\frac{1}{|\mathbf{r}|^3} - \frac{1}{|\mathbf{r} - \mathbf{d}|^3} \right) \mathbf{d} \right].$$

The problem of calculating the value of relative error $\varepsilon(\mathbf{r}) = |\Delta\mathbf{E}|/|\mathbf{E}'|$ for every point in the three-dimensional space has axial symmetry, so it can be reduced to the two-dimensional task. For further calculations we assume that the origin of a Cartesian coordinate system coincide with the position of the negative charge and the displacement vector \mathbf{d} is pointing in the x -direction. In such coordinate system the position vector's components are $\mathbf{r} = (x, y)$, the displacement vector's components are $\mathbf{d} = (d, 0)$, and the scalar components of $\Delta\mathbf{E}$ and \mathbf{E}' are:

$$\begin{aligned} \Delta E_x &= q \left(\frac{3x^2d}{\sqrt{x^2 + y^2}^5} + \frac{x-d}{\sqrt{x^2 + y^2}^3} - \frac{x-d}{\sqrt{(x-d)^2 + y^2}^3} \right); \\ \Delta E_y &= q \left(\frac{3xyd}{\sqrt{x^2 + y^2}^5} + \frac{y}{\sqrt{x^2 + y^2}^3} - \frac{y}{\sqrt{(x-d)^2 + y^2}^3} \right); \\ E'_x &= q \left(\frac{x-d}{\sqrt{(x-d)^2 + y^2}^3} - \frac{x}{\sqrt{x^2 + y^2}^3} \right); \quad E'_y = q \left(\frac{y}{\sqrt{(x-d)^2 + y^2}^3} - \frac{y}{\sqrt{x^2 + y^2}^3} \right). \end{aligned}$$

And the formula for the relative error ε is:

$$\varepsilon(x, y) = \sqrt{\frac{(\Delta E_x)^2 + (\Delta E_y)^2}{(E'_x)^2 + (E'_y)^2}}. \quad (3)$$

The graph of the function of relative error ε for the dipole with charge $q = 4.8 \cdot 10^{-10}$ Fr and $d = 0.1$ cm is illustrated in fig. 1.

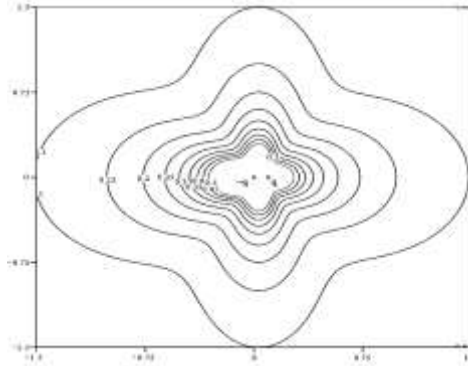


Fig. 1 Graph of the function of the relative error ε

The graph shows that on a circle of radius r centered at the origin the maximum relative error takes place at point $(-r; 0)$. It means that for every point at the distance r from the origin the relative value error ε is less than or equal to $\varepsilon(-r, 0)$.

The formula (3) is very difficult to use and since $\varepsilon(x, y) \leq \varepsilon(-\sqrt{x^2 + y^2}, 0)$ it can be replaced by the formula of the *maximal relative error* ε_m at the distance r :

$$\varepsilon_m(r) = \varepsilon(-r, 0).$$

Thus scalar components of $\Delta \mathbf{E}$ and \mathbf{E}' at point $(-r, 0)$ are:

$$\Delta E_x = q \left(\frac{2d - r}{r^3} + \frac{r + d}{(r + d)^3} \right); \quad E'_x = q \left(\frac{1}{r^2} - \frac{1}{(r + d)^2} \right);$$

$$\Delta E_y = 0; \quad E'_y = 0.$$

Hence,

$$\varepsilon_m(r) = \left| \frac{\frac{2d - r}{r^3} + \frac{r + d}{(r + d)^3}}{\frac{1}{r^2} - \frac{1}{(r + d)^2}} \right| = \frac{2d/r + 3}{2r/d + 1}. \quad (4)$$

The graphs of ε and ε_m for same dipole are illustrated if fig. 2 for comparison.

The formula (4) can be written as follows:

$$t^2 + \frac{3 - \varepsilon_m}{2} t - 2\varepsilon = 0$$

where $t = d/r > 0$.

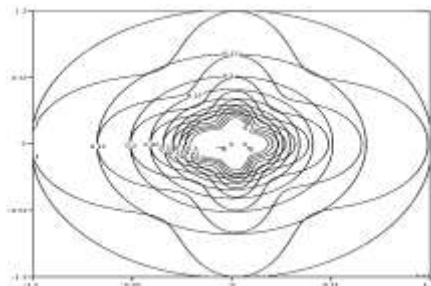


Fig. 2

The positive solution of this quadratic equation is:

$$t = -\frac{3-\varepsilon_m}{4} + \sqrt{\left(\frac{3-\varepsilon_m}{4}\right)^2 + \varepsilon_m}.$$

Therefore the closest distance r to the negative charge of the dipole of length d at which the relative error ε is less than or equal to ε_m is:

$$r(\varepsilon, d) = \frac{d}{-\frac{3-\varepsilon_m}{4} + \sqrt{\left(\frac{3-\varepsilon_m}{4}\right)^2 + \varepsilon_m}}.$$

Thus, for example, to ensure relative error value $\varepsilon \leq 0.03$ one could use formula (1) at the distances $r > 50.17 \cdot d$.

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Аннотация. Статья посвящена определению границ применимости аппроксимированной формулы для нахождения величины электрического поля электрического диполя в точке пространства. Получена формула для абсолютной и относительной погрешностей аппроксимированной формулы. Получена упрощенная формула для расчета максимальной относительной погрешности аппроксимированной формулы на заданном расстоянии от диполя, обосновано её применение вместо точной формулы для относительной погрешности. Получена связь между расстоянием от точки измерения до диполя, длиной диполя и относительной погрешностью измерения величины электрического поля.

Ключевые слова: электромагнетизм, электрический диполь, абсолютная погрешность, относительная погрешность, применимость формулы, величина погрешности.

Annotation. The paper is concerned with determining the limits of applicability of the approximated formula for the electric field of the electric dipole. The formulas for the absolute error and the relative error of

the approximated formula are obtained. The transition from the exact relative error formula to the simpler formula of the maximal relative error of the approximated formula is justified. A mathematical dependence between the point of calculation of the electric field of the dipole by the approximated formula, the length of the electric dipole and the value of the relative error is obtained.

Keywords: electromagnetics, electric dipole, absolute error, relative error, error magnitude, formula applicability.

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COMPARISON OF ELECTRIC VEHICLE BATTERIES: NCA VS LFP

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Introduction

Electric cars (EV) become more popular today. But for the time being it is impossible to talk about the complete replacement of classic gasoline cars and there are several reasons for this, the main one is batteries. The challenge is to create a lightweight, high capacity, safe and cheap battery for electric vehicles.

Despite this, some companies – world leaders in electric vehicles production industry have achieved high results. Let's compare the approaches to creating EV batteries of companies Tesla Motors and the Chinese giant BYD Auto. Both companies have EV models with a range of more than 350 km, which is considered sufficient for the full comfortable use of a vehicle in everyday life, including long-distance trips out of cities. In addition, the BYD brand cars are actively used even as a taxi [1, 2], and Tesla electric cars are operated by Tesloop, a company focusing on the city-to-city travel experience [3, 4].

The *aim* of our research is to describe and compare the achievements of a Tesla and BYD and their battery packs for some of these parameters.

Main part.

As mentioned earlier, EV batteries have a set of key parameters, so to compare the achievements of a Tesla and BYD, we should consider their battery packs for some of these parameters.

Battery types

We need to start with the fact, that both companies use lithium-ion batteries, but the types of these batteries are different, Tesla – uses Lithium Nickel Cobalt Aluminum Oxide (NCA) batteries [5], and BYD – Lithium Iron Phosphate (LFP) batteries [6].

Energy density, weight, composition

The energy storage efficiency of batteries is usually expressed in terms of energy per unit mass (Wh/kg) or volume (Wh/l) of the battery. This parameter is called energy density (fig.1).

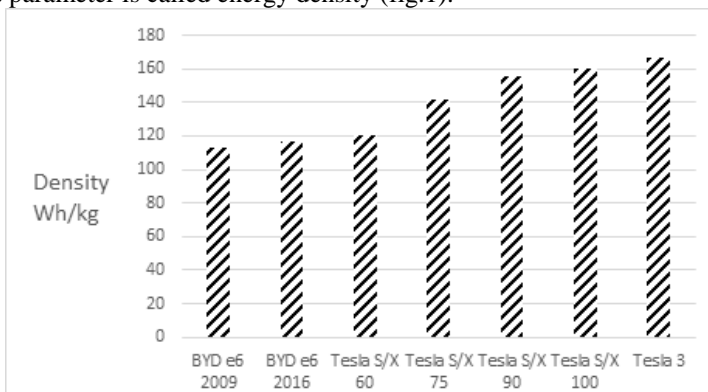


Figure 1 – Comparison of EV batteries energy density

NCA batteries have specific energy density of 200-260 Wh/kg [7]. Even so, Tesla cannot use full potential of the energy density of its batteries, because, as show in Figure 2, structurally the battery consists of 15 modules, each of which contains hundreds of cylindrical cells 18650. Each small cell has its own body, which reduces the overall battery pack energy density. Thus, as show in Figure 1, the newest Tesla batteries (for Model 3) with capacity of 80 kWh and a weight of 480 kg have a maximum density about 165 Wh/kg.

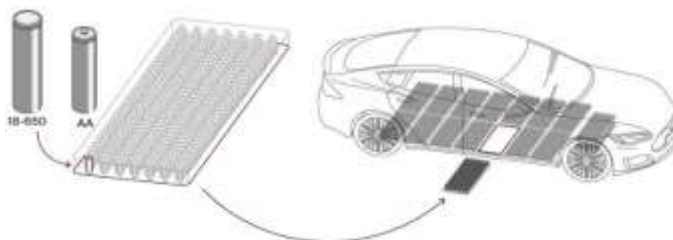


Figure 2 – Tesla battery structure

Of course, BYD batteries have an even lower energy density, because the specific energy density of LFP batteries is 90-120 Wh/kg [7]. However, BYD was able to achieve a density of about 115 Wh/kg. Such values can be achieved through the use of large prismatic cells and similar modular layout (Figure 3). This approach reduces the effect of the cell body mass on the total energy density.



Figure 3 – BYD battery structure

Safety and cost

One of the main causes of danger for lithium-ion cells is related to the fact of thermal runaway [8]. Thermal runaway describes a process which is accelerated by increased temperature, in turn releasing energy that further increases temperature [9]. It can be caused by the specific conditions, such as overcharge or overload.

LFP batteries is slightly subject to thermal runaway phenomena (possible only on high temperature, about 270 °C), with a temperature rise of barely 1.5 °C per minute. Thus, thermal runaway of the Lithium Iron Phosphate technology is intrinsically impossible in normal operation, and even almost impossible to artificially trigger [8]. In addition, these batteries are very stable for mechanical damage. High safety results in a high cost, which is about \$ 530 per kWh [7].

In opposite to LFP, the NCA type is one of the most dangerous batteries from a thermal runaway point of view [8] with possibility of thermal runaway at lower temperature, about 150 C, and a temperature rise of about 470°C per minute. This process is also often accompanied by the ignition of a damaged cell, which can lead to the destruction of neighboring cells. To reduce the impact of this feature on safety, Tesla assembles its batteries using several of physically isolated modules. Here it should be noted that the cost of this type of battery is almost half the price of LFP and is about \$ 350 per kWh [7] (fig. 4).

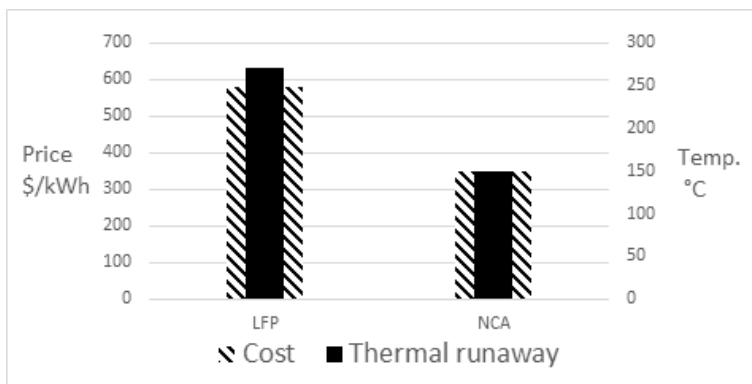


Figure 4 – Comparison of batteries thermal runaway temperature and cost

Lifespan and other characteristics

Both types of batteries have a good discharge power, and also support the technology of fast charging, which allows you to charge in 15 minutes to 80%. Fast charging is done only up to 80% of the volume of the battery to allow you to increase battery life. Lifespan of LFP batteries is more than two times higher than that of the NCA, and amounts to 3000-4000 charge-discharge cycles against 1000-1500, under similar operating conditions. Despite the fact that in past Tesla was provided an unlimited mileage warranty for batteries, in reality one battery pack provides mileage of about 500,000 km [10], while BYD cars can drive up to 1 million kilometers on the original battery, while retaining 75% of the battery capacity [11].

Conclusion

In conclusion, we would like to summarize that the approaches to the design and production of batteries for electric vehicles by Tesla and BYD are different, but lead to the achievement of similar results. Thus, both technologies are worthy of being used today. The trend in the development of energy storage technologies for EV shows that already soon enough the required level of performance will be achieved and electric vehicles will be distributed everywhere.

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Аннотация. Статья посвящена сравнению различных подходов к созданию аккумуляторов для электромобилей. Авторы рассматривают технологии двух производителей электромобилей - Tesla Motors и BYD Auto. Обе компании используют литий-ионные аккумуляторы, но разных типов: литий-никель-кобальт-алюминиевый (NCA) в Тесле и литий-железо-фосфатный (LFP) в BYD. Батареи сравниваются по основным параметрам, таким как плотность энергии, безопасность, стоимость. В заключение авторы отмечают, что, несмотря на различия, рассмотренные подходы позволяют добиться сходных результатов.

Ключевые слова: электромобиль, аккумуляторы для электромобилей, литий-ионный аккумулятор, плотность энергии, батарейный модуль.

Annotation. The article deals with a comparison of various approaches to the creation of batteries for electric vehicles. Authors consider the technologies of two manufacturers of electric vehicles – Tesla Motors and BYD Auto. Both companies use lithium-ion batteries, but different types: lithium-nickel-cobalt-aluminum-fluoride (NCA) in Tesla and lithium-iron-phosphate (LFP) in BYD. Batteries are compared in basic parameters such as energy density, safety, cost. In conclusion, the authors note that despite the differences, the approaches considered allow to achieve similar results.

Keywords: electric vehicle, EV batteries, lithium-ion battery, energy density, battery pack.

UDC 621

DEVELOPMENT OF A PROMISING CONTROL SYSTEM FOR IONOSPHERIC STATIONS

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Introduction

Changes in the world geopolitical and economic situation taking place are reflected in most public services and organizations of the Russian Federation, including Roshydromet. So the head of the Federal Service for

Hydrometeorology and Environmental Monitoring A.V. Frolov said in an interview: “The most important event in 2014 was the return of the Republic of Crimea and the city of Sevastopol to the Russian Federation. In this regard, Roshydromet solved the problems associated with the organization of hydrometeorological activities in the Republic of Crimea and the city of Sevastopol in accordance with the legislation of the Russian Federation. The Roshydromet Department for the Crimean Federal District, the Crimean Hydrometeorology and Environmental Monitoring Department and the separate division of the State Oceanographic Institute in Sevastopol were established. In the near future, Roshydromet will address issues of equipping observation points of the Crimean UGMS with automatic complexes, upgrading communication channels, and installing automated workplaces for specialists in various areas ”[1]. In addition, a significant climate change in the Arctic areas in the direction of warming allows us to consider the northern sea route as the most promising for ensuring cargo transportation between Europe and Asia. Navigation in this area is fraught with a number of difficulties, including navigation support [2, 3].

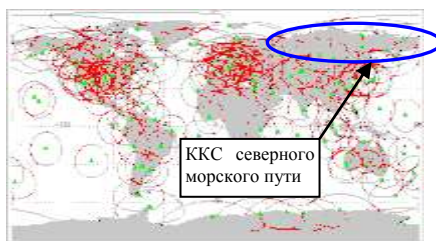
The role and prospects of development of the network of ionospheric stations

High accuracy of navigation definitions is achieved by making ionospheric corrections, which are formed on the basis of data from monitoring and correcting stations (MCS). Figures 1 and 2 show the northern sea route and the geography of the location of the MCS.

The basis for the formation of amendments is the information of global maps of the ionosphere. These maps are compiled to verify real-time indicators by overlaying the obtained data on a geographic map. This allows you to provide the required accuracy and calibration for ship navigation systems on the entire route, as well as used to monitor the state of the ionosphere, forecast ionospheric storms, which can lead to a decrease in information content or a complete shutdown of satellite navigation systems.



Picture 1 — Northern Sea Route.



Picture 2 — Map location control stations

The above problems pose the task of expanding the network of Roshydromet ionospheric stations and creating new measurement tools. This is determined both by the need to generate data for scientific studies of the ionosphere, and to display (analyze) its current state to provide consumers with high-quality navigation information.

The placement of domestic ionospheric stations of Russian and foreign production is based on the principle of creating longitudinal latitudinal chains covering the most important regions of the Russian Federation in terms of providing them with ionospheric information.

According to the current situation, a number of organizational and technical measures are currently planned. The number of observation points in the network will be increased in stages. The planned maximum number of points of only high-orbital radio tomography (HORT) should be 100 by 2025, low-orbit points (LOP) 20, combined points 20.

To obtain tomographic sections of the ionosphere, it is necessary to locate three or more hardware-software complexes (HSC) LOP along the preferential directions of low-orbit satellites, i.e. along 70° - 80° N

The distance between the points LOP should not exceed 500 km. In the general case, the minimum height at which the value of the electron concentration can be determined depends on the mutual distance of the distribution points.

The distance between the HORTpoints should be in the range from 200 to 400 km, which will allow monitoring of ionospheric parameters with a given spatial and temporal resolution in the mode close to real time. Depending on the applied problems in some regions, this distance should not exceed 200 km [4].

By 2020, in the Russian Federation it is planned to equip with modern equipment and restore about 16 stations. But this amount is unacceptably small for a region of 17 million square meters. km In order for the domestic network of VZ ionospheric stations to make a full-fledged contribution to global monitoring of near-Earth space, it must also be supplemented with at least 12 stations so that they cover the territory of the Russian Federation relatively evenly.

Based on the vastness and underdevelopment of the northern territories, the commissioning and operation of the stations themselves will require significant economic costs, determined by the difficulty of delivering equipment, fuel, maintenance and training of service personnel, etc. One of the ways to solve this problem is to maximize the automation of the processes of preparation and measurement, as well as the creation of identical for all means of control systems and data exchange, implemented on a modern element base.

The design of ionospheric stations

The ionospheric station, like any radar, consists of the following main parts: radio transmitter, transmitting antenna, receiving antenna, radio receiver, recorder.

For the ionospheric station, the main task is to measure the distribution of the number of free electrons with height, to obtain a vertical electron concentration profile.

The transmitting antenna of the station is designed so that in some stations the radiation goes straight to the zenith, vertically upwards in others obliquely. The transmitter sends up one after another short “queues” of radio waves, and the receiver connected to the antenna, during a pause, picks up the radio signals reflected from the ionosphere. Noting the time of the start and finish of the waves, you can calculate the height of the reflecting ionospheric layer. In more advanced and promising stations, the possibility of oblique sounding is realized, which makes it possible to monitor the “stratification” of the ionosphere, identify inhomogeneities and determine their characteristics.

Structure of a promising ionospheric station

Based on the target and constructive identity, the station's equipment can be divided into two groups. The first, unique for each station, includes: an antenna system, a receiving-transmitting complex equipment, a station technical condition monitoring complex. The second group includes hardware functionally and technically similar for most products. These are the systems: control, communication and data transmission - reception, the GLONASS and GPS receiving module.

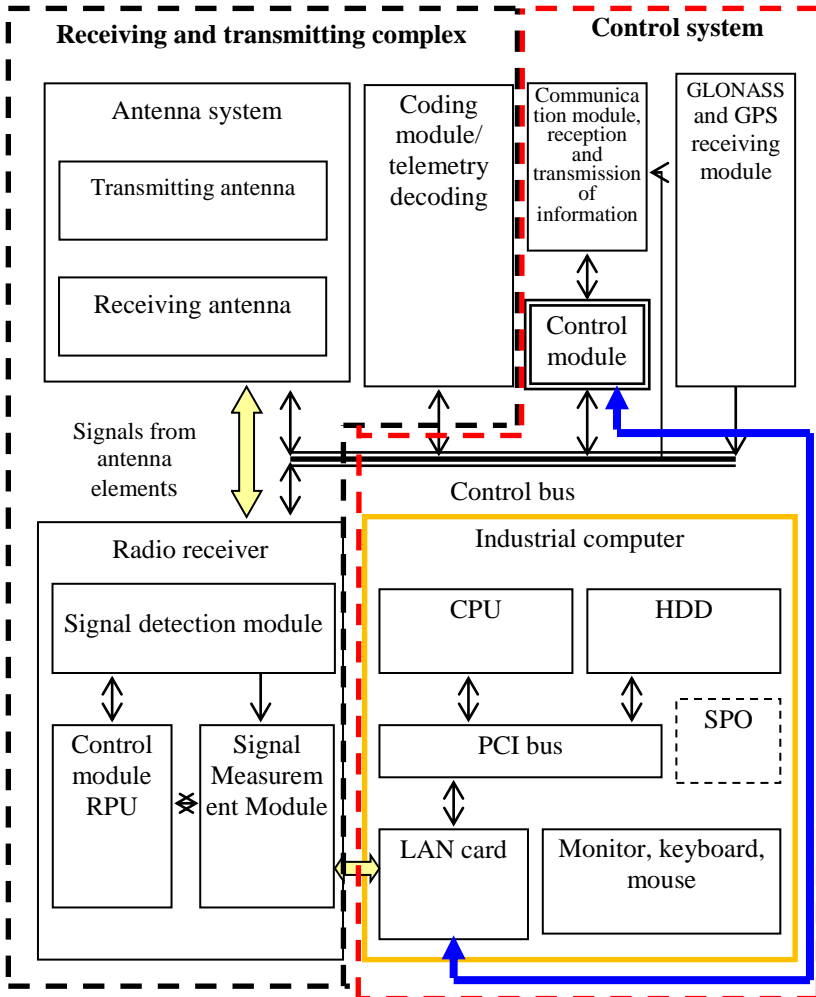
In this case, it makes sense to create a unified control system for all types of ionosondes. The structure of the station in this case takes the form of functionally and geographically separated complexes (see Figure 3):

- receiving and transmitting
- management, communication and data exchange.

Antenna system, radio receiver, telemetry information coding / decoding module and are standard equipment of ionosonde. The control system based on an industrial computer, the GLONASS / GPS reception module and the control module are located in separate rooms and are formed according to a single principle; the additional software expands the capabilities of the ionosonde.

The interaction of the main parts of the complex is as follows. Having received a control computer via a local network, telemetry channel or (and) from the operator, the list of tasks to be solved forms a time diagram of the operation of the complex in accordance with the specified priorities.

Ionosphere station



Picture 3 — Structural diagram of the ionospheric station

At the time of the event corresponding to the execution of the task, the control module issues commands to activate the corresponding mode of operation. Formed codograms of control, which are then issued to the electronic control module of the radio transmitting (RPU) and radio

receiving (PRRU) device. In RPU with the exact (no more than 1 μ s) coincidence of the tasks execution time, the corresponding operation mode is activated. Radiation is conducted by the radio control center and (or) reception of signals of the control switchgear.

The received signal information is received by the module for detecting and measuring the parameters of signals. If commands for measuring arrival angles within the detected signals are set, information about the amplitudes and phases of the signals from each of the active antenna elements is generated, which is necessary for estimating the arrival angles, which, together with the signal information, travels via the local network to the PC. The PC carries out procedures for the automatic processing of ionograms of vertical sensing and oblique sounding with the restoration of the vertical profile of the electron concentration (N (h) profile), if necessary, the angles of arrival of signals are measured.

The results of information processing of the ionosphere sounding through the local network are transmitted to the control PC.

The PC allows you to adaptively select modes of operation, and the control module to form commands for the operation of various radio systems adopted for maintenance.

Conclusion

So that way, domestic ionospheric observation sites can get a unique opportunity to reconfigure the target equipment without replacing the control complex. The proposed development will allow:

- reduce the cost of delivering equipment to remote areas,
- reduce the time of installation (replacement) of the ionospheric station,
- reduce the time and labor costs for commissioning equipment.

The proposed design of the development and manufacture of ionosonde allows the equipment to be equipped with additional computational tools and software.

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Аннотация. В настоящее время в Российской Федерации ведется активная работа по восстановлению сети ионосферных станций. Особое внимание уделяется отдаленным районам Крайнего Севера. Это в первую очередь связано с развитием арктического морского пути, где влияние ионосферных эффектов особенно заметно на качество спутниковой связи и навигационных систем. В настоящем докладе предлагается метод универсализации систем управления ионозондами с целью снижения затрат на ввод в эксплуатацию и обслуживание высокоширотных ионосферных станций.

Ключевые слова: системы управления ионозонда, север, спутниковой связи, навигационных систем.

Annotation. Currently, active work is underway in the Russian Federation to restore the network of ionospheric stations. Particular attention is paid to remote areas of the far north. This is primarily associated with the development of the Arctic sea route, where the influence of ionospheric effects is particularly noticeable on the quality of satellite communications and navigation systems. This report proposes a method for the universalization of ionosonde control systems in order to reduce the cost of commissioning and maintaining high-latitude ionospheric stations.

Keywords: ionosonde control systems, north, satellite communications, navigation systems.

UDC 62-5/520

TRACK OF A SPACE OBJECT BUILDING

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Introduction. The program of construction of routes of space object allows to make graphic display of a sub-satellite point of space object, to

analyze change of an orbit depending on change of parameters of an orbit. Simulation of the space object route is performed by predicting the position of the space object for a given period of time [1].

The program also allows to determine the time of entry and exit into the zone of radio visibility of ground vehicles. As an example, a list of 20 space objects with the ability to change any of the basic parameters of the orbit is given to display the route.

Main part. This program is implemented in C++ and Delphi. It has two Windows "Parameters" and "two-dimensional map".

In the "Parameters" window, you can select a spacecraft from the list and set it manually parameters:

- longitude,
- inclination,
- eccentricity,
- perigee argument,
- apogee height,
- perigee height.

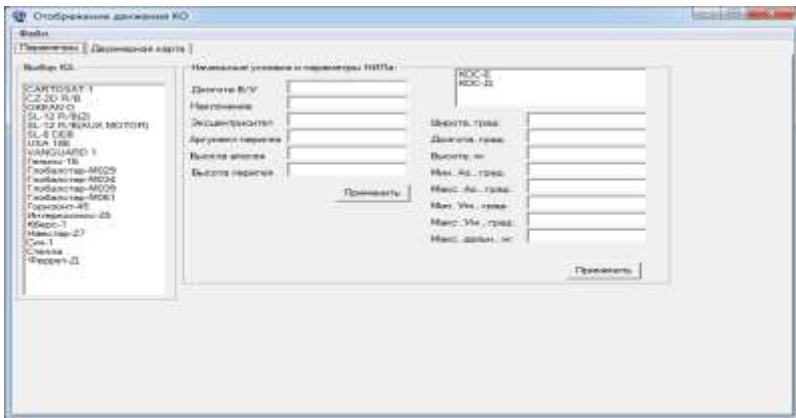


Figure 1 – Working window "Parameters".

In the "two-dimensional map" you can define the local time, as well as set the date and time manually, see the change in the trajectory of the spacecraft and select the active spacecraft, and is known to NIP (KOS-E, KOS-D).

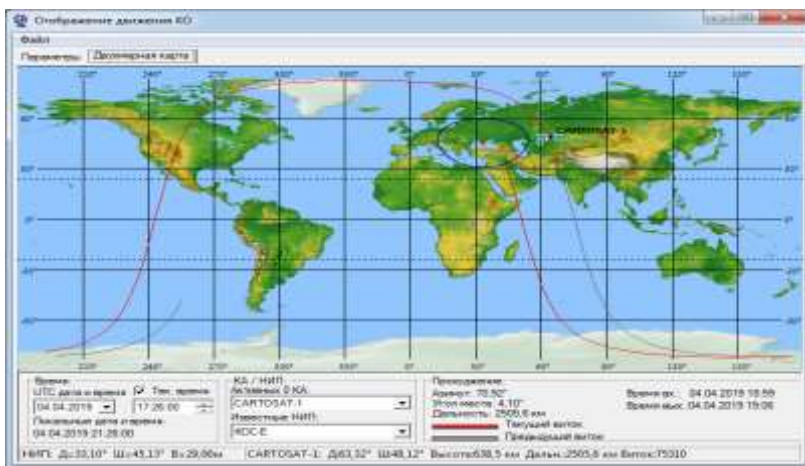


Figure 2 – Working window "two-Dimensional map".

Conclusion. You can see the movement of the spacecraft relative to the planet, by means of this program, clearly showing the trajectory of the spacecraft and ease of operation.

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Аннотация. Программа построения полосы обзора космического аппарата позволяет производить графическое отображение полосы обзора космического аппарата и проследить её изменение в зависимости от параметров бортовой аппаратуры аппарата.

Ключевые слова: Космический аппарат, C++, C, Delphi, траектория, космос, орбита, полоса обзора, визирование, угол, радиотехника, долгота, широта, эксцентриситет, программа, земная поверхность, аппарат, параметры, высота перигея, высота апогея.

Annotation. The program of building of the span of the spacecraft allows a graphical display of the span of the spacecraft and track its change depending on the parameters of the onboard equipment of the spacecraft.

Keywords: Spacecraft, C++, C, Delphi, trajectory, space, orbit, field of view, sight, angle, radio engineering, longitude, latitude, eccentricity, program, earth surface, vehicle, parameters, perigee height, apogee height.

DEVICE OF DESTRUCTION OF ICE ON SIDEWALKS

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Introduction.

For the companies on city improvement, to clean the icy sidewalk from ice is laborious process, on the average a covering of ice reaches 3 cm. Today there are no devices allowing to clean quickly, effectively and with the minimum efforts the sidewalk from ice.

The **problem** of our research is that one need a fairly significant expenditure of time and effort in order to clean the icy sidewalk with the help of current analogues,

Hypothesis: we assume that as a result of the creation of the device "Ice Destroyer", the cost of cleaning the sidewalk will be minimized, the processing time will be reduced.

The **purpose** of the research is to create a device for faster and more convenient cleaning of icy pavement based on sound wave.

Each method of removing ice from the surface of the pavement is not effective. Only one mentioned method minimizes the time resource of man - chemicals, but the price is high, as it needs to be updated constantly [1, 2]. From the existing analogues ritmix and Ausmelt are the most effective ones, in terms of price and quality.

The main components of our device are

1. Speaker.
2. The body which is made of plastic.
3. Battery for feeding the device with electricity.

Principles of work:

• Sound waves of a certain frequency come from the speaker located in the device.

- When sound waves and ice collide, the ice will break.
- It is necessary to drive the device on the surface of the pavement.
- After the ice has broken, you need to walk on the sidewalk with a broom.

This device (pict. 1), unlike analogues, will perform its task in about 2 minutes per square meter.



Picture 1 – 3D model of the instrument.

Ultrasound is sound wave having a frequency higher than perceived by the human ear, usually under ultrasound understand frequencies above 20 000 Hertz.

Although the existence of ultrasound has long been known, its practical use is quite young. Nowadays ultrasound is widely used in various physical and technological methods. Thus, the speed of sound propagation in the medium is judged on its physical characteristics. Speed measurements at ultrasonic frequencies allow with very small errors to determine, for example, adiabatic characteristics of fast processes, specific heat of gases, elastic constants of solids.

Most ultrasonic whistles can be adapted to work in a liquid environment. In comparison with electrical sources of ultrasound, liquid ultrasonic whistles are low-power, but sometimes, for example, for ultrasonic homogenization, they have a significant advantage. Since ultrasonic waves occur directly in a liquid medium, there is no loss of energy of ultrasonic waves when moving from one medium to another. Perhaps the most successful is the design of a liquid ultrasonic whistle, made by English scientists Cottel and Goodman in the early 50-ies of XX century. In it, the high-pressure fluid flow comes out of the El-liptic nozzle and is directed to the steel plate [3].

Piezoelectric element is an electromechanical transducer made of piezo-electric materials of a certain shape and orientation relative to the crystallographic axes, by which mechanical energy is converted into electrical (direct piezoelectric effect), and electrical to mechanical (reverse piezoelectric effect) (pict. 2).

Piezoelectric element fluctuations Diameter: 10 mm Thickness 1 mm Material: CTS -26 Voltage: 5V Excitation frequency: 1 MHz The scale of the fluctuations: 30000:1	A 3D model of a piezoelectric element, which is a circular disk with concentric rings of varying shades of orange and yellow, indicating fluctuations. The center has a small blue dot.
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Picture 2 – Piezoelectric element.

In order to increase the efficiency of ice destruction, a method is proposed, during the implementation of which repeated movements of the device on the field of destroyed ice are made. The number of movements is limited by a number, the excess of which does not lead to an increase in the strength of the electric current excited by the piezoelectric elements installed in the body of the device.

Experimental testing.

In the course of the work we had an experience with the sound generator. We wanted to see how the sound acts on the ice.

The experiment was conducted in the street because when cracks appeared on the ice.

The sound generator was used (Pict.3).

In the course of experience we stated that a frequency must be more than 20000 Hz (ultrasound).



Picture 3 – The sound generator

Purpose: intensification of processes in liquid and liquid-dispersed media (extraction, dissolution, purification, etc. processes), it can be installed in the processing line for processing in the flow mode. Based on the action of this device, we will make a more advanced machine for ice cleaning on sidewalks around the world

Conclusion. When modeling the device, we described the principle of operation, appearance, purpose and necessary components of the device. We also calculated that the device will complete the work within two minutes per square meter.

In the course of research and modeling, we confirmed the hypothesis that as a result of the creation of the device "Ice Destroyer ", it is possible to minimize the waste of energy for cleaning the pavement and reduce the processing time.

The technology of piezoelectric elements and the effect of ultrasound were studied, thus we confirmed the hypothesis that the ice can be destroyed by an ultrasonic wave.

During the research of piezoelectric elements apparatus series "wave-m" with a similar principle of action was found, which will be used as the basis of our device.

At the moment we are prototyping and we expect the degree of profitability device.

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Аннотация. В статье рассматривается проблема отсутствия более совершенной машины для уборки льда на тротуарах. Изучена технология изготовления пьезоэлементов и эффект ультразвука, подтверждена гипотеза о том, что лед может разрушаться ультразвуковой волной.

В ходе исследования пьезоэлементов был найден аппарат серии "волна-м" с аналогичным принципом действия, который будет использован в качестве основы авторского прибора.

Ключевые слова: очистка льда, разрушитель льда, ультразвуковая волна, жидко-дисперсные среды, пьезоэлектрические элементы.

Annotation. The paper deals with the problem of lack a more advanced machine for ice cleaning on sidewalks. The technology of piezoelectric elements and the effect of ultrasound were studied, thus the hypothesis was confirmed that the ice can be destroyed by an ultrasonic wave. During the research of piezoelectric elements apparatus series "wave-m" with a similar principle of action was found, which will be used as the basis of author's device.

Keywords: ice cleaning, Ice Destroyer, ultrasonic wave, liquid-dispersed media, piezoelectric elements.

SECTION 2 INFORMATION SYSTEMS



UDC 004.588

VISUAL DESIGN OF PROGRAMS IN MICROSOFT VISUAL STUDIO ENVIRONMENT

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1. Introduction

The profession of electronic engineering is quite versatile - it requires competences in traditional fields of training, such as circuit engineering, as well as in areas related to programming, application of automated complexes of designing and debugging of electronic circuits. The higher school should train specialists who are able to quickly understand modern information technologies, use them in their professional activities and are able to develop specialized utilities or more complex software products themselves.

Therefore, starting from the first year of study, the students get acquainted with programming technologies within the framework of

studying such disciplines as computer science, basics of information technologies and others. Primary programming skills are achieved by studying the concept of structural programming and basic algorithmic constructions. Tutorials are usually console applications implemented in such popular programming languages as C, C++, etc. At the same time, creating modern applications requires the implementation of familiar user interfaces, such as Windows interfaces.

2. The main part

The study of the object-oriented programming paradigm is usually based on the use of modern development tools such as Microsoft Visual Studio .NET and the study of C++, Java, Object Pascal, C# and other programming languages. At the same time, building user-friendly program interfaces is directly related to the use of the visual programming paradigm which is rather well implemented in Microsoft Visual Studio. However, the transition from console applications to object-oriented event programming is connected with difficulties caused by a fundamentally different approach to programming and, accordingly, requires additional time within the framework of independent preparation.

Proceeding from the abovementioned, the department of "electronic engineering" of SevSU within the framework of the disciplines chosen by the students was offered a new discipline "Visual design of programs in the Microsoft Visual Studio environment", where the main task was to gain practical skills of development of full-fledged interfaces of Windows applications, acquaintance with the basic elements of modern programming language C#, acquaintance with the concept of object-oriented programming, as well as programming of events of interface components.

A characteristic feature of Visual C# applications is that the programmer uses all the possibilities of object-oriented programming in them and all the program elements created in them are objects. GUI application forms are made in a Common Language Runtime (CLR) controlled environment and are Windows Forms Application. Windows Forms places standard Windows controls available through the Win32 API (Application Program Interface) into the managed code. The code created by the classes implementing API for Windows Forms does not depend on the development language.

Creating programs in modern programming environments implies a wide application of the principles of object-oriented programming (OOP), as well as the use of the event-based mechanism of program execution. In OOP, the main category of object model - class - combines at the elementary level both the data and the operations that are performed on

them. It is from this perspective that the changes associated with the transition from a structural approach to HHPs are most visible [3].

Applications developed in the visual environment are actually Windows applications and fundamentally different from console applications. The appendices, which are with the graphic interface using forms, are created in operated environment CLR and appendices Windows Forms Application - appendices under Windows. Windows Forms places standard Windows controls in the managed code. Windows Forms as when writing a program in programming languages: C, C++, C#, and on VB.NET, etc [1].

Microsoft Visual Studio development environment.NET (Figure 1) is a modern tool that can be used to create any applications, programs and software components for Microsoft Windows. As a result of object-oriented programming, the program text actually consists of a set of descriptions of the behavior of components when certain events occur. Using the hierarchical principle of component inheritance allows them to have a basic set of properties, methods and events. The concept of visual programming is implemented in Visual Studio environment with the help of Windows Forms constructor.

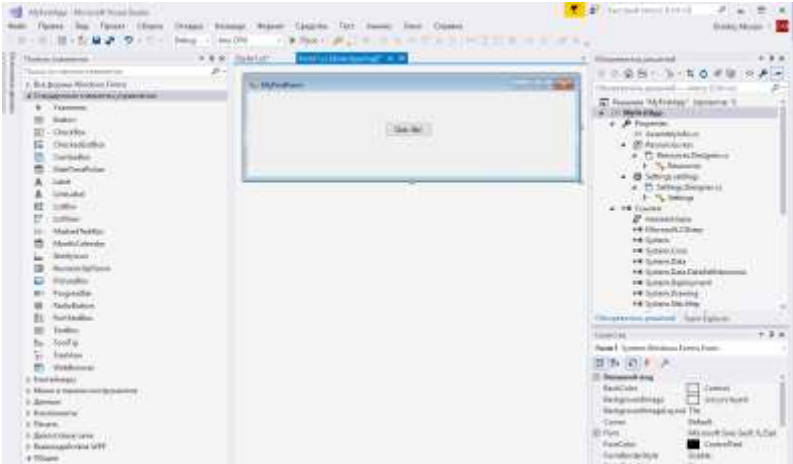


Figure 1 - Microsoft Visual Studio development environment

The process of creating a Windows application itself consists of two main steps:

1. Visual design, which consists in the selection and placement of various controls such as buttons, switches, icons, etc. on the window plane of the future application.

2. Define the application behavior by writing procedures for handling various events:

- by clicking on one button or another;
- when selecting a specific menu item;
- after a certain amount of time;
- or in the event of any other event.

The environment of fast development of the visual interface takes on routine work related to the preparation of the program for work, automatically generates the corresponding program code and allows you to focus on the logic of the future program.

Within the framework of practical work students become acquainted with such widely used controls of Windows Forms (Figure 2), as: Button, Label, TextBox, ListBox, ComboBox and many others.

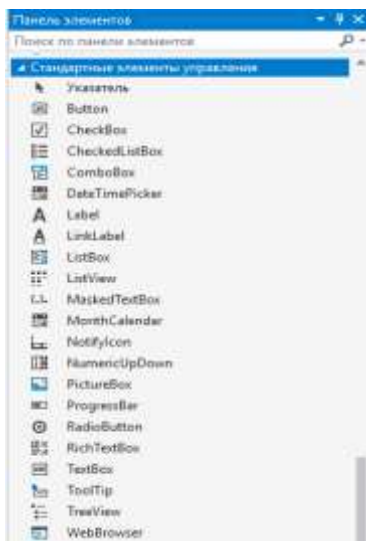


Figure 2 - Windows Forms Control Panel

The course also includes an introduction to WPF (Windows Presentation Foundation) programming technology. It is part of the .NET platform and a subsystem for building graphical interfaces using XAML (eXtensible Application Markup Language) - an extensible markup language for applications.

While traditional WinForms-based applications were based on Windows parts such as User32 and GDI+ to draw controls and graphics, WPF applications are based on DirectX.

The XAML language allows you to create a rich graphical interface using either a declarative interface declaration or a code in the managed languages C# and VB.NET, or to combine both. Significant advantages of WPF:

- use of traditional .NET-platform languages;
- new features that were difficult to achieve in WinForms, such as 3D modeling, data binding, use of elements such as styles, templates, themes, etc;
- good interaction with WinForms, so that, for example, traditional controls from WinForms can be used in WPF applications;
- rich possibilities for creating various applications: multimedia, 2D and 3D graphics, and a rich set of built-in controls, as well as the ability to create new elements, create animations, data binding, styles, templates, themes and much more.

Currently, the development of innovative technology in the Russian educational space - distance learning - is taking place. Opportunities and characteristics of e-learning technology provide the maximum possible efficiency of interaction between a trainee and a teacher within the framework of "e-learning" system. SevSU uses Moodle (Modular Object-Oriented Distance Learning Environment), which is distributed free of charge under the GNU GPL license [2].

In order to support the independent work of the student while studying the discipline, repeating the lecture material, testing the material assimilation, studying additional information (including with the help of video resources), an online course "Visual design of programs in Microsoft Visual Studio" was developed (Figure 3).

The course peculiarity is a large number of interactive elements allowing the student to learn the basic features of the C# language (data types, operations) and the interface of the Visual Studio system and the basic principles of event programming in a game form. Besides, in order to simplify understanding of practical work tasks and methods of their solution, there is an opportunity to become acquainted with the sources of the projects of examples of such practical work.

The use of the "Forum" and "Wiki" course elements allowed to effectively organize trainings in a team within the framework of problem discussion of the studied material, collective discussion of problems and mutual evaluation of answers by students. The result of mastering each lecture and section as a whole is passing the element of the course "Test", and using questions of different types.

For students wishing to implement the trajectory of self-development and consider the topics of the course in more depth, each section of the

online course has a subsection with additional links to the Internet resources with official documentation, interactive and video content for self-study.



Figure 3 – Online course for students

3. Conclusion

Thus in the work the basic problem questions connected with studying of technologies of programming for students of electronic engineers are considered. The article presents the peculiarities of developing an additional course on the choice of "Visual design of programs in Microsoft Visual Studio environment" using, among other things, remote learning technologies implemented on the Moodle platform. The main features of Windows Forms and WPF, which are considered as part of the practical work of the course, are given.

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Аннотация. В статье рассматриваются основные особенности визуального программирования в программе в среде Microsoft Visual Studio. Также представлены особенности разработки дополнительного курса для инженеров электронной техники.

Ключевые слова: визуальное программирование, объектно-ориентированное программирование, среда разработки, Microsoft Visual Studio, Windows Forms, Windows Presentation Foundation, дистанционное обучение.

Annotation. The main features of visual programming in Microsoft Visual Studio environment and development of an additional course for engineers of electronic equipment are presented and discussed in the article.

Keywords: visual programming, object-oriented programming, development environment, Microsoft Visual Studio, Windows Forms, Windows Presentation Foundation, distance learning.

UDC 621.396.6

RESEARCH AND DEVELOPMENT OF A RECEIVER WITH QUADRATURE MODULATION BASED ON FPGA

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Currently, no one person dispenses with devices and telecommunications systems. These systems evolve at an unimaginable speed, requiring ever more complex technical solutions. On the other hand, the number of users is increasing, which leads to an increase in the volume of transmitted information, hence, it requires an increase in the speed of the systems for receiving and transmitting information.

The solution to this problem is possible due to the use of various types of modulation, coding methods and signal processing. Therefore, there is a need to introduce a number of stringent requirements for modern systems: high performance, compactness, providing a high signal-to-noise ratio, maximizing the use of a dedicated frequency band, providing synchronization, ease of use,

QAM modulator essentially follows the idea that can be seen from the basic QAM theory where there are two carrier signals with a phase shift of 90° between them. These are then amplitude modulated with the two data streams known as the I or In-phase and the Q or quadrature data streams. These are generated in the baseband processing area [1, p. 373].

$$s(t) = I(t) \cos(2\pi f_0 t) + Q(t) \sin(2\pi f_0 t).$$

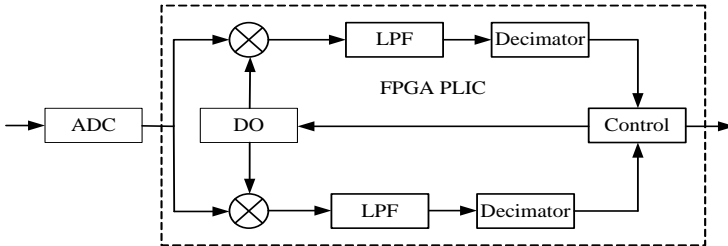


Figure 1 — The QAM demodulation functional diagram

Explanation of symbols:

ADC — Analog digital converter;

DO — Digital Generator;

LPF — Digital Low Pass Filter.

The system includes a parallel high speed ADC required for digitizing the input signal and the PLIC where processing occurs and the signal conversion. Used 256 QAM modulation. Implemented receiving and processing the signal with a spectral of 2 MHz and the possibility of adjustment of the carrier frequency through the computer.

As a test, this model performs enumeration of all possible values at the transmitter output with the subsequent transmission and reception at the receiver with a display on the signal constellation. This solution allows the analysis of the reception error for each point of the signal constellation with multiple repetitions of the entire transmission cycle, i.e. multiple iteration of all possible signal variants at the transmitter output.

The small signal-to-noise ratio of the received signal leads to the fact that the spread of the values of the received components increases and, as a result, the probability of erroneous decoding of the symbols increases.

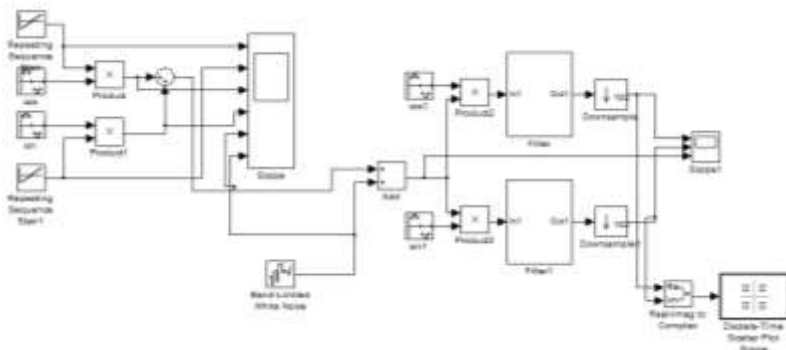


Figure 2 — Implementing a QAM receiver in Simulink

Figure 3 shows an example of this phenomenon with a signal-to-noise ratio of 18 dB, which corresponds to an error probability of 0.5%. The solution to this problem is to increase the signal-to-noise ratio by increasing the level of the transmitted signal.

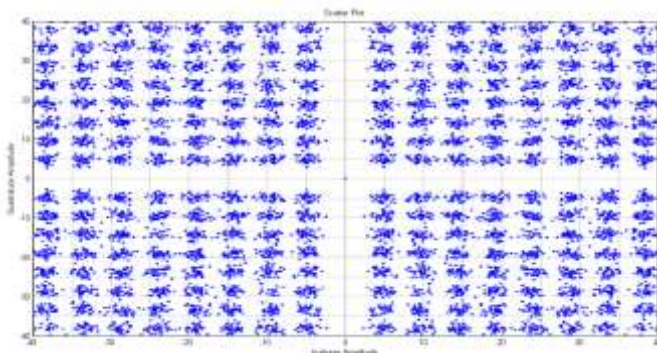


Figure 3 — Signal constellation for QAM-256

Also consider the effect of the phase mismatch of the received signal. Figure 4 shows the signal constellation for QAM-256 with a phase mismatch of $\pm 3^\circ$ relative to zero in the absence of noise.

From figure 4 it is seen that when the phase of the received signal is misaligned, there is a significant variation in the received values and the probability of errors increases. To solve this problem, it is necessary to introduce the synchronization systems discussed earlier.

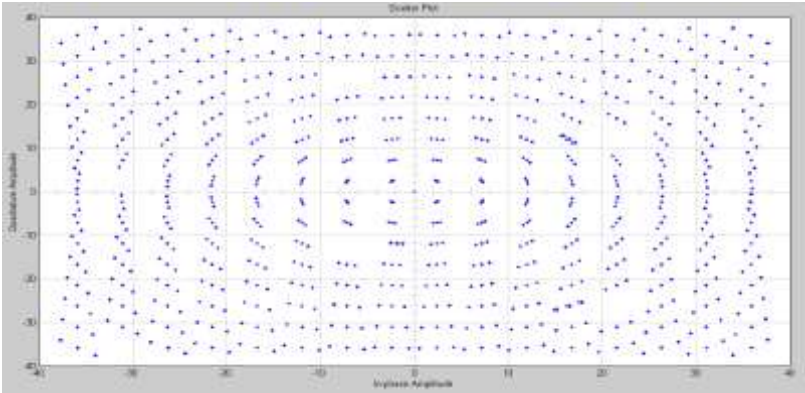


Figure 4 — Signal constellation at phase mismatch

For synchronization in the communication channel, it was decided to use a signal with a slower modulation, such as MSK or QPSK and using its parameters, to synchronize the faster QAM-256.

The synchronization circuit shown in Figure 5.

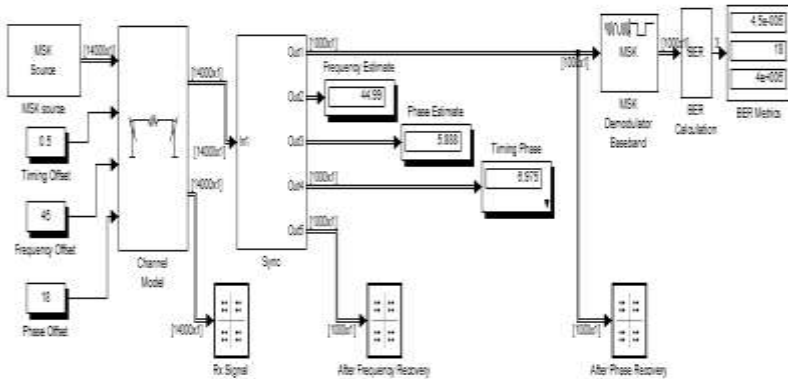


Figure 5 — Timing circuit diagram

In the course of research, a functional scheme of the quadrature demodulator was developed. A mathematical model for simulating the operation of the system has been created. The elements were calculated and matched and the system operation was simulated with the parameters specified earlier. The results of the simulation, as well as the parameters of the elements, are presented above.

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Аннотация. Данный доклад посвящён исследованию и разработке приемника с квадратурной модуляцией, на основе программируемой логической интегральной схемы. Устройство предназначено для обработки моделированного сигнала, с последующим преобразованием его в 8-ми битный двоичный код.

Система включает в себя параллельный быстродействующий АЦП, необходимый для оцифровки входного сигнала и саму ПЛИС, в которой происходит обработка и преобразование сигнала. Устройство применимо для демодуляции 256-ти позиционная КАМ. Диапазон частот входных сигналов от 1 до 100 МГц.

Ключевые слова: КАМ, ПЛИС, квадратурный демодулятор, цифровые фильтры, цифровые приемники.

Annotation. This report focuses on the research and development of a quadrature-modulated receiver based on a programmable logic integrated circuit. The device is designed to process a simulated signal, and then convert it into an 8-bit binary code.

The system includes a parallel high-speed ADC, necessary for digitizing the input signal and the very FPGA itself, in which the signal is processed and converted. The device is applicable for demodulation of a 256-position CAM. The frequency range of input signals is from 1 to 100 MHz.

Keywords: QAM, PLIC, quadrature demodulator, digital filter, digital receivers.

ENCRYPTION AS THE MOST BASIC METHOD OF CLOUD DATA ACCESS SECURITY CONTROL

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With the development of IT-technology computers, phones, smartphones and other gadgets have become firmly established in our lives. At the same time, the number of stored information is growing, as well as the number of problems associated with data storage. Cloud storage technology comes to our aid. Cloud computing turned into the most predominant innovation in recent years. This innovative technology provides services to the customers for software and hardware [5].

The difficulties in fulfilling of cloud computing environment regarding security hazard implementation strategies on cloud computing environment era considered by Ferretti L, Gorelik E., Colajanni M, Buyya R., Yeo C.S., Venugopal S., Broberg J., Brandic IDinh H.T., Hao Z., Zhong S., Yu NLee C., Niyato D., Wang P., Marchetti M., Tabassam S.

Höfer C.N. and Karagiannis G. state five fundamental attributes of the distributed computing which make the cloud driving more suitable innovation for information stockpiling and utilizing the assets over web:

- Self-service on demand;
- Pooling of resources;
- Broad network access;
- Rapid elasticity;
- Measured service [7].

So, Gorelik E. investigates three basic models introduced by cloud computing SAAS, IAAS, and PAAS, SAAS stands for software as a service:

- Software as a service;
- Platform as a service;
- Infrastructure as a service.

The cloud computing is determined as “a style of computing where massively scalable IT enabled capabilities are delivered ‘as a service’ to external customers using Internet technologies” [8, p. 299]. Cloud providers

currently enjoy a profound opportunity in the marketplace. The providers must ensure that they get the security aspects right, for they are the ones who will shoulder the responsibility if things go wrong.

Security issues in clouds such as data breaches, network security, data locality, DoS attacks, account hijacking, system vulnerabilities, Permanent data loss, Malicious insiders, shared technology, shared dangers, compromised credentials and broken authentication, hacked interfaces and APIs are described by Huang X., Liu J.K., Tang S., He D., Wang H., Zhang J., Wang L., Xiang Y, Hao Z., Zhong S., Yu N, Liang K.

The aim of our article is to analyze the most efficient solutions to security issues and determine the most basic method of cloud data access security control.

Cloud storage technology is an extension of cloud computing technology, which integrates various storage devices by using various technical means such as cluster application, grid technology, distributed file system, and so on, and realizes the cooperative work of storage devices with different architectures for data storage and business access.

It should be noted that the purpose of cloud storage is to allocate space in the network to store files of its customers. The principle of operation is downloading files from your computer to a dedicated server and storing them [1].

By uploading a file using the application to the server, it goes to the "cloud". Depending on your solution, files can be both in publicly or privately accessed: for certain individuals, files from the cloud can only be accessed over the Internet, making them available to you anywhere and from any device [4].

Each file is downloaded separately, and it is important to note that the transfer cannot be interrupted, otherwise it will not be possible to use it due to damage.

Some cloud storages allow you to edit files or folders. For example, you have changed on your PC a text file, if the file is in the cloud, the changes will occur there. The same is true-if the change in the file occurred in the cloud, then immediately on the computer the same file will be updated.

The operation of the servers is required to be round the clock, but it is certainly impossible to guarantee this. The technical side of the issue depends on many factors, so it is recommended not to panic if there is no connection [3].

Mobile cloud storage allows users to store and manage files, photos, music, and videos from their mobile devices (laptops, tablets and smartphones) [8]. Many new mobile phones come with preloaded and

configured cloud storage that can be used to back up the device's files. iOS devices use iCloud, Apple's mobile cloud storage service. Android-operating devices use Google Drive, while Samsung Galaxy has a partnership with Dropbox [2].

Cloud and virtualization gives you agility and efficiency to instantly roll out new services and expand your infrastructure. But the lack of physical control, or defined entrance and egress points, bring a whole host of cloud data security issues.

There are several of security problems for cloud computing, as it is surrounded by numerous technologies in addition of 'networks databases', 'working structures', 'virtualization resource booking', 'trade organization', 'stack changing', concurrence control, and memory organization [6].

The most efficient solutions to security issues are following:

- Written security policies plan;
- Multifactor authentication;
- Access to data;
- Appropriate cloud model for business;
- Encryption of backups and secure data destruction;
- Regulatory compliance;
- Formal change control process;
- Encryption scheme design and test.

Encryption is considered to be as the most basic method of cloud data access security control. Data encryption translates data into code, so that only people with access to a secret key (called a decryption key) or password can read it. "Encrypted data is referred to as ciphertext, while unencrypted data is called plaintext.

Currently, encryption is one of the most popular and effective data security methods used by organizations. Two main types of data encryption exist – asymmetric encryption, also known as public-key encryption, and symmetric encryption" [9, www].

Despite of many advantages there are lots of issues in cloud computing environment regarding the security of the clouds transactions and data storage over internet. As cloud users do not know where there data is going to secure and how much it is secured. As the information is stored in the cloud, it must be encrypted to avoid illegal data acquisition or data leakage.

The encryption of data in cloud storage exists in the process of data transmission and data storage. Common encryption includes linear search algorithm, security index algorithm, sorting search algorithm, keyword-based public key search algorithm, homomorphic encryption and retrieval algorithm (see table 1).

Table 1 – Common encryption features.

Main features	General description
Linear search algorithm	Searching for information with the following encrypted storage structure. The plaintext information is encrypted into ciphertext; a series of pseudo-random sequences are generated according to the ciphertext information corresponding to the Keywords: The pseudo-random sequence and the current ciphertext information are generated to encrypt the ciphertext information
Security index algorithm	It generates a set of sequences by means of encrypted secret key, and puts the index into the Bloom filter. The sequence is used to generate multiple trap gates for Bloom detection. The data obtained by decrypting the returned document is the required data
Keyword-based public key search algorithm	It uses the public key to encrypt the stored data and generates the ciphertext information used for searching. It is suitable for data storage and retrieval in mobile environment
The implementation of sorting search algorithm	It is to preserve the word frequency of keywords in data documents. The ciphertext containing the key words is retrieved , and the ciphertext information using the order preserving algorithm to recover the plaintext data is sorted
The full-homomorphic encryption retrieval algorithm	It uses vector space model to calculate the correlation between the stored information and the information to be checked. It uses the full-homomorphic encryption algorithm to encrypt the document, and it establishes an index. Indexing only requires plaintext encrypted by encryption algorithm. Data can be achieved without returning plaintext information

The most basic method is to encrypt the file key for the data owner, and the user accesses the server directly with the key. By means of hierarchical access control method users can derive the authorized data key through the user's private key and the public information table. This technology uses information to generate a proxy weight. Encryption key, which is used to encrypt the encrypted information twice, generates ciphertext data that can only be decrypted by a specified user.

Some security experts proposed the methodology to assure their employees, customers, and shareholders that they were able to provide adequate Confidentiality, Integrity, and Availability (see picture 1) for the sensitive data/intellectual property residing in physical data centers [10].

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Аннотация. Данная статья представляет описание структуры и функционирования технологии облачного хранения данных. Охарактеризованы основные характеристики, виды и способы работы с облаком. Анализируются технологии криптографического контроля доступа и другие технологии безопасности.

В заключение отмечается, что проблема безопасности данных становится все более серьезной. Эта статья будет полезна пользователям, которым требуется дополнительное файловое пространство, а также специалистам, которым требуется удаленная

связь со всеми файлами.

Ключевые слова: облачное хранилище, данные, хранение информации, дополнительное место хранения, удаленный доступ к данным.

Annotation. This article is a complete introduction to the structure and operation of cloud storage technology. The main characteristics, types and ways of working with the cloud are described. Cryptographic access control technology and other security technologies are analyzed.

In conclusion it is noted that the challenge of data security is becoming more serious. This article will be useful for users who need additional file space, as well as specialized workers who need remote communication with all files.

Keywords: cloud storage, data, information storage, additional storage, remote access to data.

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AI AND ROBOTS JOB OVERTAKE. IS IT REAL?

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Ever since Steven Spielberg's 2001 classic, Artificial Intelligence (A.I.), people have been concerned about the impact of the rise of machine intelligence. It seems to be a common theme in sci-fi movies (such as I, Robot) that one day, the machines are going to take over, but how true could that be? Will AI robots be taking over our jobs any time soon?

A decade ago, robots still seemed pretty limited. Now, not so much. And computers don't just win chess any more, they can win Jeopardy. They can win Go in which there are about 200 possible moves for the average position. They can drive cars for people, write poetry, music and this list goes on and on. So, the main question, that bothers minds of economists and futurists is : "Will we run out of jobs?". And here they split – futurists say "Yes" and the economists – answer "No". So who is right?



Picture 1 – Modern robots

Source: <https://www.therobotreport.com>

I should point out that everything that is written below is applicable for Russia but in 20-30 year gap caused by Soviet Union breakup. Russia, in terms of robotization rates, lags behind other countries and the “world average” indicators. We are forced to buy most industrial robots abroad, and this process is slow. The average annual sales of industrial robots in Russia are 600 pcs. on average in the world - 240,000. In Russia for 2017, there were 8,000 such robots; in the world - 1.6 million.

The density of robotization in Russia is 70 times less than the average in the world. But what does the density of robotization look like taking into account the spread across countries (data are shown by the number of robots per 10,000 enterprise employees):

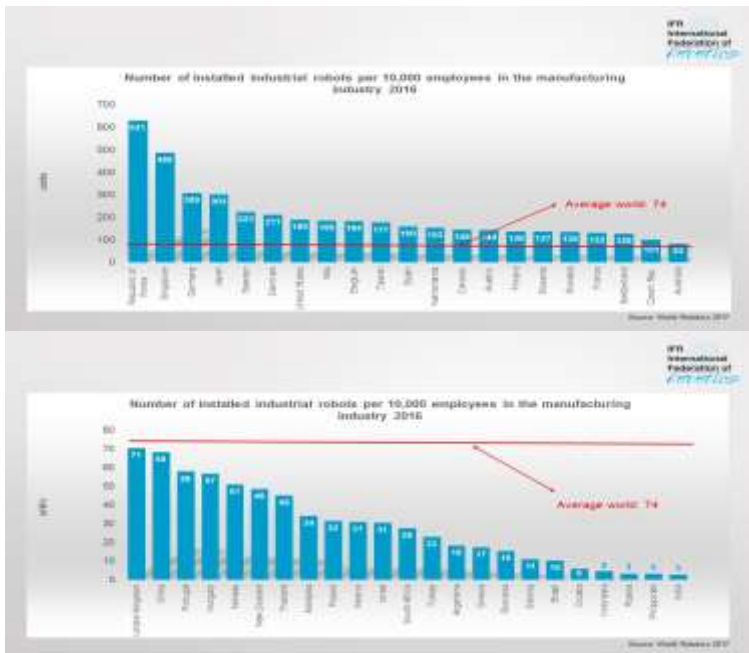
So let’s continue to our global problem keeping in mind that soon it will touch our country too.

One of the reasons a lot of economists are skeptical about robots taking all the jobs is that we’ve heard that before. There was a spike of automation anxiety in the late 20s, early 1930s when machines were starting to take over jobs on farms and also in factories. The article from 1928 points out that there used to be guards who opened and closed the doors on New York subway trains, and people who took tickets before there were turnstiles. Automation anxiety surged again in the late 1950s, early 1960s.

Another article from 1958 is about 17,000 longshoremen who were protesting automation on the piers. And if you don't know what longshoremen are, that’s because there aren’t many of them left. Technology destroyed a lot of those jobs.

And yet, we didn’t run out of work.

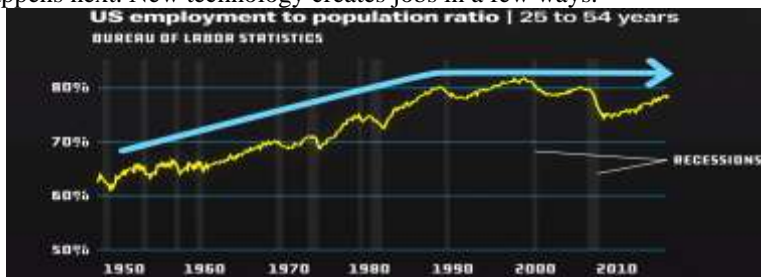
This chart (Pic. 3) shows the percentage of prime-age people with jobs in the US. Ever since women joined the workforce in big numbers, it’s stayed around 80%, outside of recessions. During this period, technology displaced some 8 million farmers in the US, 7 million factory workers, over a million railroad workers, hundreds of thousands of telephone operators.



Picture 2 – Robot density by country

Source: ifr.org

Gas-pumpers, elevator attendants, travel agents were lost. Tons of jobs have died but work persists. What you realize when you look through those old reports is that it's really easy for us to see the jobs being replaced by machines. It's a bit harder to visualize the jobs that come from what happens next. New technology creates jobs in a few ways.



Picture 3 – US employment to population ratio chart

Source: vox.com

There are the direct jobs for people who design and maintain the technology, and sometimes whole new industries built on the technology.

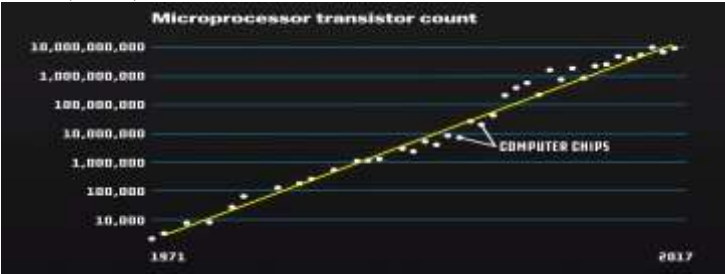
But the part we tend to forget is the indirect effect of labor-saving inventions. When companies can do more with less, they can expand, maybe add new products or open new locations, and they can lower prices to compete. And that means consumers can buy more of their product, or if we don't want any more of it, we can use the savings to buy other things. Maybe we go to more sports events or out to dinner more often. Maybe we get more haircuts or add more day-care for the kids. This process is how our standard of living has improved over time and it's always required workers. The key economic logic here is automation does indeed displace workers who are doing work that got automated, but it doesn't actually affect the total number of jobs in the economy because of these offsetting effects.

But people tend to look at bad side of things, like a widely cited Oxford University study from 2013 which says that 47% of current US jobs will be replaced by robots in 20 years. That study assessed the capabilities of automation technology. It didn't attempt to estimate the actual "extent or pace" of automation or the overall effect on employment: "The actual extent and pace of computerisation will depend on several additional factors which were left unaccounted for" says the Oxford research.

Now, all this doesn't mean that the new jobs will show up right away or that they'll be located in the same place or pay the same wage as the ones that were lost. All it means is that the overall need for human work hasn't gone away. Technologists and futurists don't deny that's been true historically, but they question whether history is a good guide of reality.

In a 2004 book, two economists assessed the future of automation and concluded that tasks like driving in traffic would be "enormously difficult" to teach to a computer. That same year, a review of 50 years of research concluded that "human level speech recognition has proved to be an elusive goal." And now? We have Tesla, Google Assistant, Siri, Alice.

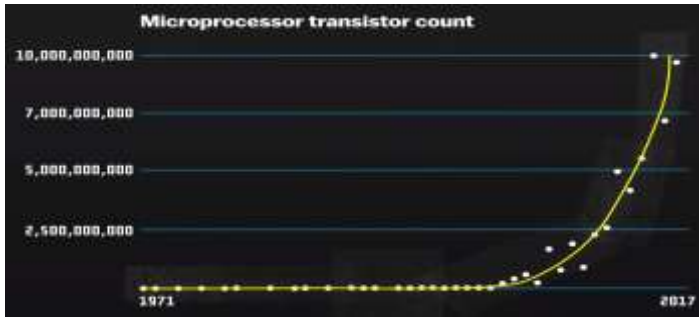
This is the textbook chart of advancement in computer hardware – it's the number of transistors that engineers have squeezed onto a computer chip over time (Pic. 4).



Picture 4 – Microprocessor transistor count (exponential scale)

Source: vox.com

Already pretty impressive, but notice that this isn't a typical scale: these numbers are increasing exponentially. On a typical linear scale it would look more like this (Pic. 5).



Picture 5 – Microprocessor transistor count (linear scale)

Source: vox.com

It really is hard to imagine this not being massively disruptive. And as the authors of *The Second Machine Age* point out, processors aren't the only dimension of computing that has seen exponential improvement. The idea of acceleration in your daily life when do you encounter that? Maybe in a car for a few seconds? In an airplane for seconds again? The idea that something can accelerate for decades literally just continuously is just not something that we deal with. We think in straight lines.

But even though there's been all this innovation, it's not showing up in the data. If we were seeing this big increase in automation we would see productivity growing much more rapidly now than it usually does, and we are instead seeing the opposite. Labor productivity is a measure of the goods and services we produce divided by the hours that we work. Over time it goes up - we do more with less labor. We're more efficient. If we were starting to see a ton of labor-saving innovation you'd expect this line to get steeper, but when you look at productivity growth, you can see that it has been slowing down since the early 2000s. It's possible that new technologies are changing our lives without fundamentally changing the economy.

So will this all change? Will today's robots and AI cause mass unemployment? There's reason to be skeptical, but nobody really knows. But one thing we do know is that the wealth that technology creates, it isn't necessarily shared with workers. When you account for inflation, the income of most families has stayed pretty flat as the economy has grown.

Thus, one of the problems we've seen over the last 40 years is that we have seen all of rising productivity growth but actually hasn't been broadly

shared, it's been captured by a thin slice of people at the top of the income distribution. Even if unemployment stays low, automation might worsen economic inequality, which is already more extreme in the US than it is in most other advanced countries. But technology isn't destiny. Governments decide how a society weathers disruptions, and that worries people on both sides of the debate about the future of work. We will probably always be fascinated by the prospect of robots taking our jobs. But if we focus on things we can't really control, we risk neglecting the things we can.

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Аннотация. В статье рассматривается проблема автоматизации большинства рабочих мест вследствие глобальной роботизации. Были проанализированы существующие точки зрения на эту проблему, рассмотрены возможные причины и последствия роботизации. В заключение был сделан собственный прогноз и рекомендация по эффективной профессиональной деятельности в эпоху автоматизации.

Ключевые слова: роботы, безработица, восстание машин, автоматизация производства

Annotation. The article addresses the problem of automating most workplaces due to global robotization. The existing points of view on this problem were analyzed, possible causes and consequences of robotization were considered. In conclusion, own forecasts and recommendations for effective professional activity in the era of automation were made.

Keywords: robots, unemployment, machine uprising, production automation.

RESEARCH OF CONSUMER USAGE AND PERCEPTION OF VOICE ASSISTANTS

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The trend of recent years is voice assistant on your computer or phone. The smartphone is an integral part of us. It is not only a device for audio or video communication with the interlocutor. The phone can accommodate an infinite number of functions, replacing the organizer, card, player, newspaper, computer, and has long been a necessity.

It is not only oriented in installed applications, but can support conversation, search for necessary information, record and save files, send messages and calls. To enhance the effect of interactive communication, many companies offer game interaction with the user. "Consumer awareness of voice devices and assistants, in terms of all the technology that exists and the capabilities that are already in place, is nascent. Yet, there's no denying that voice is the future" [5, www].

The purpose of our article is to determine the main voice assistant usages and identify perspectives of its development.

Methodology: During February 2019, we surveyed 50 students of Information System Department between the ages of 18-69 who have used a voice assistant. We used a survey as a method. The method of survey in research has a special position and it is the most authoritative. The survey is a set of questions offered to the Respondent, the answers to which provide the necessary information [6].

We take into consideration that the most well-known assistants are Google, Siri (Apple), Alice (Yandex).

Siri is a cloud-based personal assistant and question-and-answer system whose software client is part of Apple's iOS, watchOS, macOS, and tvOS. This application uses natural speech processing to answer questions and give recommendations. Siri adapts to each user individually, learning their preferences over time [3].

Google Assistant is a virtual voice assistant from Google. This is an evolution of the Android feature known as Google Now, which provided

information on a voice request without the need to print text. But, unlike Google Now, Google Assistant to conduct a dialogue with the user, understanding the meaning of the conversation [4].

Alice is a voice assistant from Yandex. Unlike other similar programs, "Alice "is designed in such a way that it is a program of "artificial intelligence", in which the data entered by voice are processed in a certain way and issued in the form of a meaningful response [2].

All assistants have the ability to voice control without manually turning on the program. They respond to a specific word that serves as a signal to launch.

Of course, the benefits of such an assistant can be enormous. In fact, this is the mobile assistant. By learning how to correctly formulate queries and knowing its capabilities, you will significantly reduce the time to perform many routine tasks.

Applications allow you to maximize the use of the least involved groups of citizens: pensioners, young children, people with motor disabilities, or visually impaired [1].

During February 2019, we surveyed 50 students of Information System Department of Sevastopol State University who have used a voice assistant. 100% of surveyed respondents were familiar with voice-enabled products and devices. The majority have used a voice assistant (72%). Despite being accessible everywhere, two out of every four students (50%) are using their mobile voice assistants at home. The majority of focus group participants were quick to say that they prefer privacy when speaking to their voice assistant.

For now, many respondents have yet to graduate to more advanced activities like shopping or controlling other smart devices in the home. Males are more likely to experiment with more advanced features, but it's at a minimum.

We asked surveyed respondents to give answers on the question:

In what situations do you most frequently use Voice Control?

We analyzed the results and created a chart 1:

- ask a quick question – 50%
- check weather – 12%
- play music – 6%
- set a timer – 6%
- check traffic – 0%
- do shopping – 0%
- control smart devices – 6%
- other –20%.

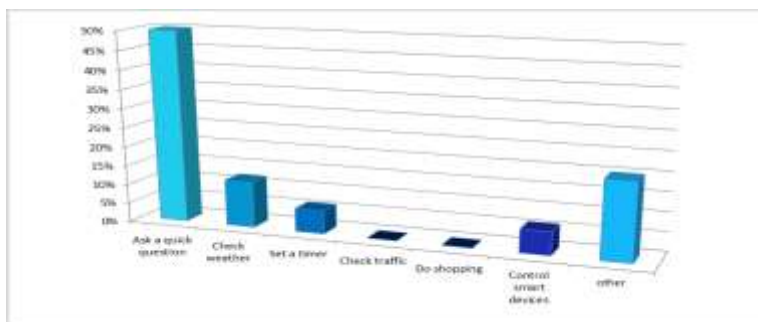


Figure 1 – Voice Control Application

Source: compiled by the authors

Respondents see voice assistants as the smarter, faster, and easier way to perform everyday activities. For more serious situations involving money (shopping, etc.), they prefer what they already know and trust.

The experiment showed that 95% of students are satisfied with their voice assistants; 20%, very satisfied. Voice assistants help people feel: organized (40% agree), informed (60%), happy (17%), smart (20%), confident (35%) and free (10%).

As voice assistants become more pervasive, they should aim to meet certain criteria with every task. At bare minimum, respondents expect their voice assistants to:

- Be correct / accurate / consistent – 60% agree
- Understand the accent/diction every time someone speaks– 46%
- Save time – 88%
- Tell the difference between multiple voices– 45%
- Help make life easier – 23%.

Thus, we can say that the voice assistant is very relevant and convenient thing. Each of these assistants has its own differences and advantages.

Voice-controlled digital assistants are being incorporated into a wide range of products, and 100% of respondents say they now use these applications to interact with smartphones and other devices, according to our research survey conducted in Sevastopol State University. With a number of presented reasons (why they might use voice assistants), 50% of users say “a major reason” they use the assistants is that these applications allow them to interact with their devices without using their hands.

Smaller shares say that they use voice assistants because they are fun (23% cite this as a “major reason”), because speaking to the assistant feels more natural than typing (22%), or because these programs are easier for children to use (14%).

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Аннотация. Цель статьи – определить основные функции голосового помощника и определить перспективы его развития. Некоторые респонденты еще не перешли на более продвинутые виды деятельности. Они используют voice assistant как возможность дистанционного взаимодействия со своими устройствами.

Ключевые слова: голосовой помощник, smart, Google, Siri (Apple), Алиса (Яндекс), голосовое управление.

Annotation. The aim of this article is to determine the main voice assistant usages and identify perspectives of its development. Some respondents have yet to graduate to more advanced activities like shopping or controlling other smart devices in the home.

Keywords: voice assistant, smart, are Google, Siri (Apple), Alice (Yandex), voice-controlled.

CORRECT QUESTIONS AS A KEY FACTOR IN THE ORGANIZATION OF A DIALOGUE BETWEEN THE USER AND THE INTELLIGENT SEARCH SYSTEM

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Introduction

Any person, engaging in various activities (scientific, industrial, cognitive, etc.), is often simply not able to see the decisions that lie outside his area of knowledge. The easiest way to see these solutions is to replenish your knowledge, and the fastest way to increase your level of knowledge is to get answers to your questions through the search system (SS).

However, the time spent on obtaining the requested information depends not only on the level of the question, its depth and complexity, but also on the user's ability to concentrate on the question and the selection / processing of the answers received from the SS. Artificial Intelligence (AI), developed for an intelligent search system (ISS), allows through dialogue with the user to maintain his concentration, using, for example, search algorithms similar to those used in SS.

Main part

Let us consider in general terms the work of the SS, which, based on certain rules for selecting keywords from a user request, provides quick and, as a rule, free access to resources sorted by user attendance rate relative to the request [1].

From the point of view of the organization of the search in the SS, the user enters his request, the system generates the user request in machine language, highlighting the user request words as key. Next, the system sends a request packet to its information repository, if the user has previously entered his request, otherwise - to the browser server

(information repository), in order to get the address of the target resource with detected information, which context contains the user query Keywords:

Having received the request packet from the SS, the server searches for the address of the target resource. In case the address is found, the server issues the address of the end resource SS, otherwise it updates the request packet through the domain name system and receives the address of the end resource.

By accepting the address of the end resource from the server, SS provides this resource as a response to the user. The user either accepts the response or rejects it, specifying a new SS request. The process continues until the user is satisfied with the answer, presented in the form of a set of necessary knowledge, which he personally structures.

Thus, the principle of information searching by SS is to match the information from the end resource with a set of keywords in the user's request and, in the case of a successful match, the issue of the address list to the resource as a response.

Since such a search principle is of a generalized nature, the system quite often, accepting a specific, deep and complex user's request, either cannot understand it and gives a list of unnecessary sources of information, or it gives out too much information without highlighting what the user needs.

Therefore, the user personally has to turn on the information search mode on the web page of interest to him, and then structure the received information.

It is important to note that on the user's requests of the generalized nature the SS gives access to huge amounts of information in a matter of fractions of a second, which often forms a mistaken idea in user's mind of the unlimited possibilities of SS. The solution to the problem of increasing the efficiency of the targeted search algorithm is connected with the question of representing the knowledge by AI.

Traditionally, AI is defined as the direction of computer science, the purpose of which is to develop computer systems capable of performing functions that are traditionally considered to be intellectual: understanding the language, inference, using accumulated knowledge, training, planning actions, etc. Knowledge in AI systems is understood as formalized information, data that are referenced in the process of logical inference. It is clear that in AI systems, knowledge cannot be represented directly in the form in which they are used by man. Therefore, it is necessary to search for such forms of knowledge display that would be suitable for storage in the computer's memory. These forms of knowledge, which are also called models of knowledge representation, should have sufficient expressiveness,

ease of use and efficiency of manipulation [2].

The most interesting are heuristic search methods, the main idea of which is to use additional information to manage the search process. This additional information is formed on the basis of empirical experience, guesswork and intuition of the user SS, i.e. heuristics. Heuristics make it possible to reduce the number of viewed options in a searching process for a problem solution, which leads to a more rapid achievement of the goal.

Note that among the heuristic rules and theoretical-analytical methods that have shown their effectiveness in practice, distinguished expert knowledge, which are used to build the so-called expert systems (ES). These include software systems that accumulate the knowledge of an expert in a particular area and are able to develop solutions and recommendations at the expert level. The fundamental difference in ES from other systems is that the knowledge stored in them is acquired in the process of communication with an expert.

A typical ES architecture usually contains a shell and a kernel. The shell forms the interface of interaction with the user and the object, the knowledge acquisition subsystem and the explanation subsystem. The ES kernel is formed by a database, a knowledge base, and an output machine.

Thus, AI, using the capabilities of the expert system, will improve or change the approach to the targeted search algorithm for SS. However, user interaction at the binary level, implying answers to the “how?” and “why?” questions, reduces the quality of the information retrieval algorithm. Therefore, the urgent task is to increase the number of issues understood by ES. This approach is supported by studies of those analysts who argue that the way of thinking determines a person’s view of the world. It also depends on what restrictions a person imposes on himself and what possibilities he sees. From this point of view, users who ask questions ES, are characterized by two types of thinking: cognitive and evaluative [3].

A person with a cognitive type of thinking is susceptible to life circumstances. He tends to view the past as the path that leads him to the future. Despite the fact that the cognitive approach requires great effort, its application brings many benefits. A person who thinks this way seeks to look at things objectively, to solve problems creatively and constructively.

Evaluative thinking is, on the contrary, responsive. A person with an estimated type of thinking is often not looking for ways to solve a problem, but its causes.

For comparison, we give examples of questions characteristic of the cognitive / evaluative types of thinking.

- What is good or useful about it? / Why is it a failure?
- What possibilities does this open up? / Who is to blame?

— What can we do about it? / Why can't you fix the situation?

Note that in the practice of interpersonal communication of people, not only relationships, type of thinking, rate of speech, choice of the right moment, environment and situation, but also the design of the question are important. It is often useful to present the question as a gift. Similarly, the question can be expressed in the form of a request for a favor, and not in the form of a claim.

From this point of view, it is desirable for ES to issue questions to the user in a timely and positive manner. If the ES asks a suggestive question too early, then the user may not have enough experience to collect data for an adequate answer. In this case, it is likely that ES will not be understood. If ES asks a leading question too late, then it misses the opportunity to use it as a learning tool and disappoints its users, who have to search for a solution for too long without any help and support.

Asking questions is often very simple. However, if the user is dealing with a serious problem, then in order to properly plan the order of its discussion, ES should follow a certain sequence of actions. First of all, to start a dialogue with some simple quite ordinary question on the merits, in order to create a calm atmosphere and induce interlocutor "talking". Secondly, to arrange the next leading question, defining the context and creating prerequisites for further communication. Thirdly, to answer the user's question so that he does not lose interest in the "search" approach. And, finally, ask clarifying questions to the user about the usefulness of the answer to his question [3].

Conclusion

The studies to which this article is devoted continue the development of scientific ideas about modern methods of applying mathematical algorithms for targeted information search in the network and their active implementation through information technologies.

An essential role in the development of ES is played by the end user, who defines many design constraints. During the design process, it is necessary to consider constantly the issues associated with the end user:

- level of explanation required by the user;
- ensuring user input of correct data;
- user's satisfaction with the results obtained by his request;
- specific useful information that the user received from the search results for his query [2].

Although the article does not cover all the sets of strategies and techniques for effectively addressing questions, the art of asking questions is not limited to the use of tips and techniques. The main thing is to sincerely strive to learn, and not to look for the guilty; openly and

impartially receive answers and, finally, translate the knowledge gained into concrete actions.

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Аннотация. В статье обсуждается роль вопросов в организации диалога между пользователем и интеллектуальной поисковой системой (ПС). Анализируются механизмы поиска и получения ответов в ПС. Рассматривается роль искусственного интеллекта с точки зрения экспертной системы для ПС.

Ключевые слова: правильные вопросы, поисковая система, искусственный интеллект, база знаний, экспертная система.

Annotation. The role of issues in organizing the dialogue between the user and the intelligent search system (SS) is discussed in the article. The mechanisms for finding and receiving responses in SS are analyzed. The role of artificial intelligence from the point of view of an expert system for SS is considered.

Keywords: correct questions, search engine, artificial intelligence, knowledge base, expert system.

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DESIGN IMPACT ON BUSINESS SUCCESS

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Both science and technology have a fundamental relationship with design. Technology preceded science, but now most technological developments are based on scientific understanding.

Innovation is driven by hope and fear. Emerging technologies are maintaining scale and deflation, accelerating the pace of change, having a profound impact on how societies, institutions, businesses and individuals interact. The emergence of new identities, facilitated by technologies and enabled by new values, is the new revolution [4]. In the current fast-changing world, the idea that innovation and technologies control economic growth is undeniable. It is widely known that innovation is creating values by introducing something creative and new. In different contexts and industries, the definitions of innovation might be slightly different.

In my article, I will assess the relationship between innovation, and web designing technology. “Hard to believe, but 2019 means we’re heading into the final chapter of the decade. The internet has grown and changed a lot in the past ten years: we’ve seen the reign of mobile, the introduction of AR, VR, AI, AMP and many other acronyms. As exciting as all of this new technology has been, where we really see and feel these changes is in web design trends” [1, www].

In some years, design trends have pushed towards rampant creativity and technological advancements have led to websites becoming smarter. 2019 web design trends will see these two sides of the coin – aesthetics and technology – come together like never before. Because if there’s one thing we can say for certain about 2019, it is the last call for web designers to make their mark on the decade.

“10 web design trends that will be huge in 2019:

1. Serifs on screen
2. Black-and-white palettes
3. Natural, organic shapes
4. Glitch art
5. Micro-interactions
6. Chatbots evolve
7. Even more video content
8. Minimalism
9. Thumb-friendly navigation
10. Diversity” [1, www].

Chatbots evolve, minimalism and thumb-friendly navigation web design trends are considered to be the most essential for a successful project in business.

Design has a strong influence on business success. This is stated by both designers and businessmen, and their customers. Each consumer first of all, getting acquainted with any product, service or company, pays attention to the logo, website design or commercial offer and packaging. It is the design that is more memorable to all customers, and they decide on

further cooperation with this company based on these memories. But does every promising business really need a great design? It's worth to sort out.

It is known all over the world that successful design is one of the most important factors in the economic growth of any company. In Russia, the concept of the positive impact of design on the success and development of the company drew attention recently, or rather, in February 2006, the first state research began and gave impetus to the development of this sphere in the Russian Federation. Now more entrepreneurs hire experienced designers and develop their logos and packaging with them, because the competition is growing every day.

Creating a design requires creative skills [3]. Everyone seeks to create a design that would be convenient and pleasant to the client, while acting on the psyche of the person so that he immediately wanted to buy a product, order a service or just take contacts for further treatment.

The purpose of this article is to study the subject of design as a factor in the economic growth of any company. *Research objectives* are to study the specifics of modern design to determine the impact of the economy on the production of design products; the role of the designer in the success of the company.

Due to the rapid growth in demand for a good design project, the list of requirements for the designers is growing. Now every employee of this industry should know not only the theory of design and be able to competently and effectively execute the work. Now entrepreneurs expect from a good designer both analytical skills and knowledge from the spheres of marketing and Economics. Therefore, yesterday's graduate of the faculty of design without additional knowledge will be difficult to resist the huge competition in the market.

The design is distinguished by the focus on innovation, the development of new trends, modern technologies and unusual materials, the quality of the consumed product and the technical properties of the created range produced for customers with different welfare and interests [2].

In the early 20th century design as a new profession, was able to prove itself only as a wealthy customer. The whole history of design development has shown its role as an effective tool to improve the competitiveness of industrial products [5]. Is it necessary to design business for effective growth and development?

St. Petersburg Art and Industry Academy conducted research on the role of design in business and published the results. Having studied this issue, they came to several conclusions and provided them for general information. Growing companies were investigated in most cases.

One of the main conclusions of this study was that companies that play a significant role in design in their concept have increased revenue in the last 3 years in 50% of cases (Fig. 1). However, in the business where design was given a limited role, it was not particularly dealt with, there was no growth in sales or other efficiency in 71% of cases (Fig. 2).

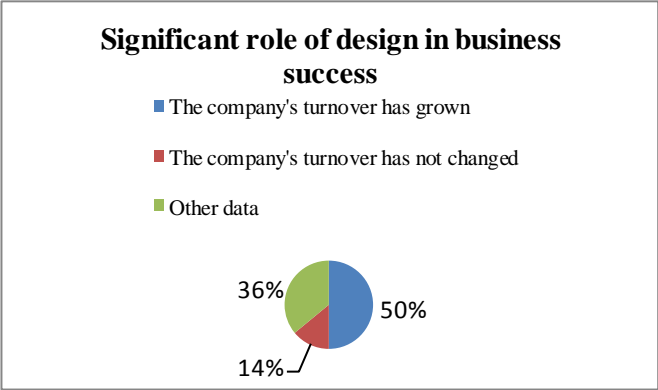


Figure 1 – Significant role of design in business success

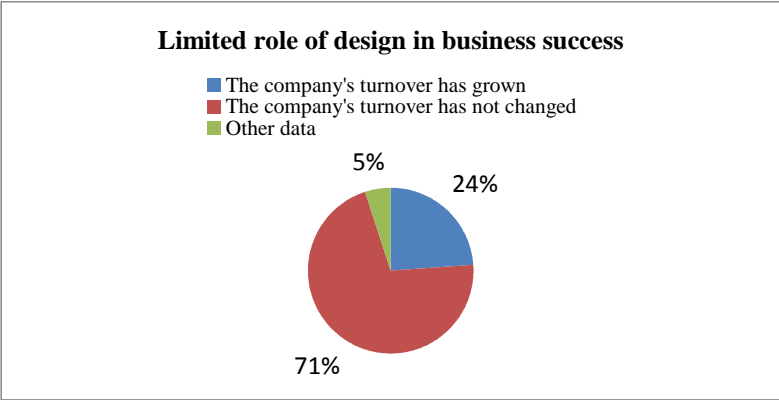


Figure 2 – Limited role of design in business success

Based on the presented data, we can conclude that design still plays a role in the success of the company. It turns out that business simply can not do without a good design project, if its founders and owners want to grow and develop [5].

This study shows another interesting results. Companies involved in data collection were asked to answer the question of what the role of design is specifically in their business. A significant role can be seen in 45% of companies, while a limited role in 28.7%, and no role of design in business – 6.5% of companies. More information can be found in figure 3.

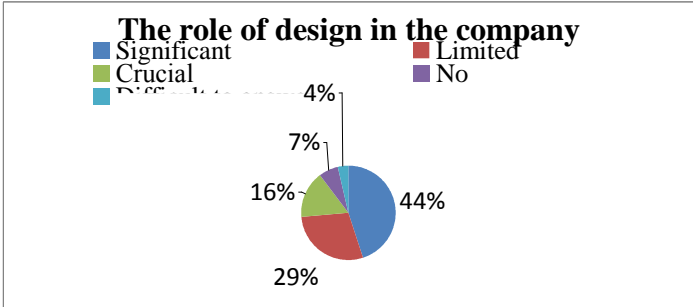


Figure 3 – Role of design in the company

Based on all the above results, we conclude that design really affects success, and entrepreneurs often use it to achieve high results in sales and other indicators.

Analyzing the causes of such conclusions, we turn to the psychology of the consumer. Experienced businessmen know that customers make a decision to buy or trust a company in the first 0.1 seconds. It happens subconsciously. Most often wins this battle is a product or website with a memorable and attractive design. In a sense, this may mean that creating a great product is not an indicator of good results. And for achievement of high indicators it is necessary to add to the product excellent giving [4].

The most essential web design trends for a successful project in business are chatbots evolve, Minimalism and Thumb-friendly navigation.

Chatbots evolve will finally move into the spotlight in 2019. “The new chatbots will be showing up more and more on web pages with higher levels of customization than we’ve seen in past iterations. Bright colors will make them not only more prominent on the page but more inviting. We can also predict an influx of friendly mascots to represent brands and give these bots a personable face” [1, www].

One of the most classic and timeless web design trends, minimalism is often the go-to aesthetic of choice. The fewer elements and content on a website, the less your audience will have to think. If a website is designed in the right way, it will show the user exactly what he/she is searching. Minimalism dominates the digital market in 2019.

“With mobile browsing having firmly overtaken desktop, design overall is becoming increasingly thumb-friendly. Users will encounter navigation tailored to the thumb, such as the hamburger menu moved to the bottom of mobile screens” [1, www].

What other reasons can help consumers to choose a particular product, thereby exaggerating the success of the company?

First of all, it must be said that excellent design leads to high recognition. We all know and at any time remember the logos of CocaCola or McDonalds, even if you do not buy their products. Why? Because to remember the logo of any brand, it is enough for our brain to see it 7-10 times, even without paying special attention. This is how the psychology of advertising works.

Secondly, a good website design helps a potential client to find any necessary information. After all, if the client does not find the necessary data as soon as possible, he will close the site tab and never return. Entrepreneurs, who understand this fact, make the search process as easy as possible, while raising performance indicators.

In conclusion it is should be noted that all the facts presented in this article, unconditionally confirm the fact that design really strongly affects the level of business success. It is simply impossible. Therefore, people who already have a small project or just planning to start a business, it will be useful to begin to study the field of design and think about a good project to become more successful and effective tomorrow.

Design activity achieves a high level of design literacy by enabling persons to develop critical-thinking and design skills, which they can apply in a practical context. While designing may take various forms, it involves the selective application of knowledge within an ethical framework.

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Аннотация. Рассматривается дизайн как один из важнейших факторов в экономическом росте любой компании. Проанализированы преимущества дизайн-проекта в достижении успеха и узнаваемости компании. В статье рассматриваются 10 трендов веб-дизайна, которые будут ведущими в 2019 году. В заключении отмечено, что для старта любого бизнеса необходимо изучать сферу дизайна и разрабатывать проект для достижения эффективности.

Ключевые слова: дизайн-проект, успех, компания, бизнес, психология потребителя.

Annotation. A design is considered as one of the most important factors in the economic growth of any company. The advantages of the design project in achieving success and recognition of the company are analyzed. 10 web design trends that will be huge in 2019 are considered in the article. In conclusion, it is noted that to start any business, it is necessary to study the sphere of design and develop a project to achieve efficiency.

Keywords: design project, success, company, business, consumer psychology.

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ANALYSIS OF BUILDING METHODS WIRELESS SECURITY ALARM

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1. Introduction

Currently, wireless security alarms are becoming popular and affordable means of protecting property. New generation systems are quite easy to use, simple to install and do not require wiring. They integrated remote monitoring and home automation system. Ambient temperature, water leakage, carbon monoxide, video cameras, interior and exterior lighting, thermostats, garage doors and door locks - all this can be monitored and controlled from a single gateway, using a Smartphone, tablet or computer [3].

2. Main part

The main advantage of wireless alarm systems is versatility. Such systems can be mounted on various types of buildings and objects, regardless of the architectural complexity of buildings and the configuration of protected areas. Systems can be installed within the gsm-network coverage by the operator. In terms of reliability, the operation of sensors and devices is protected from intentional external interference. The absence of stationary cables eliminates the risk of mechanical or deliberate damage. Another advantage of wireless systems is non-volatility. Sensors and other devices contain batteries or rechargeable batteries; their work does not depend on the availability of power in the network. Another advantage is saving. In the total estimated cost of installation work, the laying of fixed cables occupies a significant place. Also important is the ease of installation and configuration. The entire system can be installed independently in just 2-3 hours without the involvement of specialists. No wiring and connection of radial loops.

The choice of frequency range indirectly affects the one and reliability of communication between the sensor and the base unit. Figure 1 shows the maximum wall thickness in the design of wireless security systems, depending on the frequency range and wall material.

433 MHz is one of the most common ranges, used not only in the field of security, but also in the automation and control of various equipment, car alarms, barriers, radio stations, radio-controlled toys and more.

868 MHz - the range is less "littered", compared to 433 MHz. Therefore, in some cases, its use is justified. Some manufacturers produce their devices that operate both at 433 MHz and at 868 MHz. Antenna for devices in this range may be with controlled polarized as described in [2] it may increase the range [1] of alarm system.

2.4 GHz is the least common band in security systems, but having a place to be. Such popular communication standards as Wi-Fi, Bluetooth, ZigBee work on it.

Penetration of radio signals is largely dependent on the obstacles encountered in the propagation path of radio waves. Different types of

material differently reduce the signal level and, as a consequence, the quality of communication.

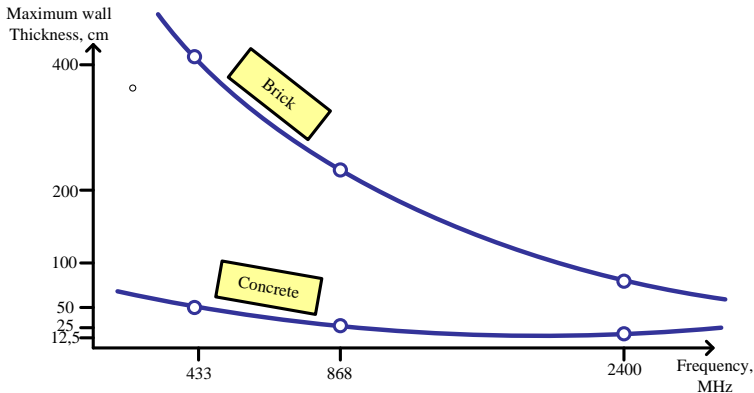


Figure 1 — Penetration of radio signals vs Frequency and wall material

Therefore, it is impossible to perceive the communication range specified by the manufacturer as an absolute value. It will strongly depend on the architectural features of the object, the type of wall materials and their thickness. In cases where the communication range is insufficient, repeaters can be used. They will help increase radio coverage and avoid the problems of "missing" sensors.

The basic composition of wireless systems of fire alarm equipment includes: a central panel, sensors, a keyboard, additional control devices, for example, keyfobs or contactless cards, a siren, a backup battery, and executive modules for controlling any devices.

3. Conclusions

To date, modern methods of building fire alarm systems are unsatisfactory and require a significant amount of wires and interfacing devices, which in itself does not satisfy the current pace of development, when equipment is updated as a rule every 3-5 years, therefore the development and implementation of IIoT allows greatly simplify the installation and, if necessary, the dismantling of existing or newly developed (installed) complexes. Considering that the development of technologies, signal processing algorithms, miniaturization, an increase in the noise immunity of communication channels will lead to the prevailing spread of wireless systems.

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Аннотация. В статье рассматриваются особенности построения беспроводных охранных сигнализаций. Анализируются достоинства и недостатки проводных и беспроводных охранных систем.

Ключевые слова: беспроводная сигнализация, проводная сигнализация, IIoT.

Annotation. The article discusses the features of the construction of wireless security alarms. The advantages and disadvantages of wired and wireless security systems are analyzed.

Keywords: wireless alarm, wired alarm, IIoT, processing algorithm.

UDC 004.8

RECENT ACHIEVEMENTS IN MACHINE LEARNING

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"The last 10 years have been about building a world that is mobile-first. In the next 10 years, we will shift to a world that is AI-first."

Sundar Pichai, CEO of Google, October 2016

A definitive factor for success will be artificial intelligence (AI). It is a study in which computers could learn without decidedly being programmed. AI deals with the formation and design of algorithms that work by gathering Intel from inputs and building a collection of data. AI now presents one of the most exciting and potentially transformative opportunities for the mankind. In fact, it is being heralded as the next industrial revolution.

Ramnath Sagar considered the benefits of using AI to control space-exploring robots which are already being realized by missions. "While humanity has made great strides in exploring the observable universe, we need to rely on intelligent robots to explore where we cannot humanly go. This is because our galaxy, the Milky Way, is one messy place, filled with cosmic dust from stars, comets, and more; concealing the very things scientists want to study" [4, www]. The next giant leap for mankind will come from the small step of a robot, powered by AI and Mellanox.

In this research, we present a general information about artificial intelligence: origins of AI and history; goals of AI; use in computer science and Artificial Intelligence directions.

"Foundations of ideas revolving around the creation of artificial intelligence can be traced back to automatons built by Egyptian and Chinese civilizations as well as to ancient Greek mythology. Implementing human properties to objects and abstract ideas is one of the ways people have been reasoning with their existence from the moment they acquired consciousness" [6]. The idea was proposed in the 16th century. It is Thomas Hobbes, who is considered 'Grandfather of AI'. The first computer – Analytical Engine, was designed in the 19th century by Babbage Charles.

In 1950 Alan Turing proposed the machine model through which he discussed the theoretical possibilities of human intelligence. Based on philosophical, logical, mathematical, cybernetic, neuroscience and information technology advancements, artificial intelligence field of study was born in 1956 at a conference at Dartmouth College. Experts John McCarthy and Marvin Minsky became prominent names in the wide-spanning effort to create intelligent machines for the next fifty years.

Coined in by Dartmouth Assistant Professor John McCarthy, 'Artificial Intelligence' (AI) is a general term that refers to hardware or software that exhibits behaviour which appears intelligent. In the words of Professor McCarthy, it is "the science and engineering of making intelligent machines, especially intelligent computer programs." Machine learning (ML) is a sub-set of AI. All machine learning is AI, but not all AI is machine learning. Artificial Intelligence has certain directions (table 1).

"Machine learning concentrates on the design of such computer programs and algorithms that are self taught to grow and adapt when given new data. In data mining applications data is extracted for human comprehension while machine learning algorithms use that data to find patterns in the data and change the program's actions accordingly" [2, www]. It is closely linked with computational statistics and as a scientific effort, machine learning arose from the purpose for artificial intelligence. There three types of machine learning algorithms (table 2).

Table 1. Artificial Intelligence directions.

Directions	Description
Proof of Theorems	Artificial intelligence is developed by means of evidence theorems
Image recognition	The application of artificial intelligence for pattern recognition gives possibility to create practically working systems for determining graphic objects on the basis of similar features
Machine translation and understanding of human speech	The task of analyzing sentences of human speech with the help of a dictionary is a typical one of artificial intelligence systems. To solve this problem, an intermediary language was developed to facilitate the matching of phrases from various languages

Applications of machine learning may be in optical character recognition, spam filtering and in search engines. Data scientists and data analysts use machine learning to determine which algorithm is the best for producing [2].

Table 2. Three Types of machine learning algorithms

Supervised learning	the purpose is to learn a main rule on the basis of given sample inputs that maps inputs toward outputs
Unsupervised learning	labels/tags or explanations are not given to the learning algorithm regarding input. These algorithms can extract their own inferences or conclusions from given datasets
Reinforcement learning	a software interacts with a changing media in which it must do a certain task without being told about its destination

The figure 1 shows growing popularity of machine learning. But machine learning has both advantages and disadvantages (table 3).

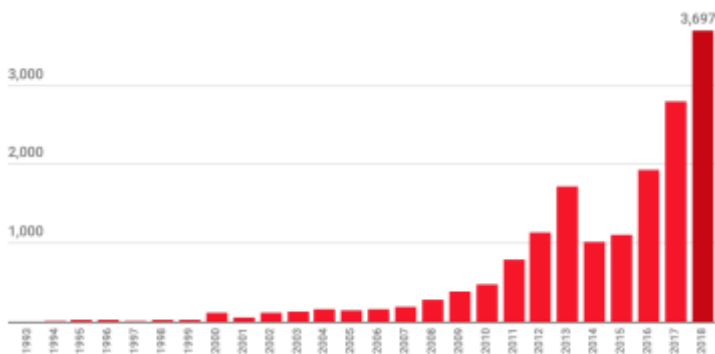


Figure 1 – Growing popularity of machine learning

Conclusion.

Machine learning is quickly becoming a very important part of our daily life. AI gives possibility to plan, solve problems, think abstractly, comprehend complex ideas, learn quickly and learn from experience (which is an agreed definition of human intelligence).

“In practice, this artificially emulated intelligence is to reflect a broad and deep ability to comprehend its surroundings so as to figure out what to do in infinite possible situations” [6, www].

Recent achievements in Artificial Intelligence, especially Deep Learning, are set to make an impact in the sphere of astronomy and astrophysics. “From navigating the unknown terrain of Mars, to analyzing petabytes of data generated from Square Kilometer Array, to finding Earth-like planets in our messy galaxy, AI is already reforming our lives by building smarter and more autonomous cars, helping us find solutions to climate change, revolutionizing healthcare and much more” [4].

Table 3. – Advantages and disadvantages of machine learning

Advantages	Disadvantages
Machine can work continuously	Failures: shifting a multitude of complex tasks to artificial intelligence, one should not forget that any machine can fail
It can handle a large amount of resources. Parameter optimization is similar to feature learning. Machine learning mostly uses a range or spectrum based method of optimizing a large number of parameters	Standoff: continuous improvement of logical processes can isolate artificial intelligence from humanity that can cause dangerous and unpredictable consequences
It has a high processing speed	Cost of maintenance and repairs is high. Software must be constantly updated to meet changing requirements
"Human factor" is excluded. Regardless of the complexity, volume, monotony of the work, the algorithms remain unchanged for a specified time of action	The limitation is the production capacity of the equipment

President of the Russian Federation stated that artificial intelligence was one of the most important areas in computer science. Global competition is increasingly directing to science, technology and education. In order to achieve high growth rates, it is also necessary to solve systemic problems to strengthen the potential of science, to form unique technological reserves. Now one should implement new ambitious scientific and technological programs – artificial intelligence.

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Аннотация. В исследовании представлена информация о достижениях искусственного интеллекта. Изложены направления применения в информатике и искусственном интеллекте. Проанализированы преимущества и недостатки машинного обучения. В заключение автор подчеркивает, что достижения в области искусственного интеллекта, имеют большое значение в области астрономии и астрофизики.

Ключевые слова: машинное обучение, искусственный интеллект, алгоритмы, распознавание символов, человеческий интеллект, космические роботы.

Annotation. The research presents information about artificial intelligence achievements. The origins of AI and history are considered. The application in computer science and Artificial Intelligence directions are stated. The advantages and disadvantages of machine learning are analyzed. In conclusion the author amphasizes that recent achievements in Artificial Intelligence, especially Deep Learning, are of great importance in the sphere of astronomy and astrophysics.

Keywords: machine learning, Artificial Intelligence, algorithms, character recognition, human intelligence, space-exploring robots.

VIRTUAL REALITY TECHNOLOGY AND ITS PROSPECTS

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Virtual reality is a world created by technical means, transmitted to a person through his/her sensations: vision, hearing, touch and others. VR blocks the real world and immerses the user into a digital universe. Virtual reality simulates both impact and response to impact. To create a convincing complex of sensations of reality computer synthesis of properties and reactions of virtual reality is made in real time.

Objects of virtual reality usually behave close to the one of similar objects of material reality. The user can affect these objects in accordance with the real laws of physics (gravity, water properties, collision with objects, reflection, etc.). However, often for entertainment purposes, users of virtual worlds are allowed more than possible in real life (for example, to fly, create any objects, etc.) [2-5].

The main purpose of this article is to show a wide range of people the possibility of progression of virtual reality devices not only for entertainment purposes, but to a greater extent the opportunity to focus them on medicine, education and everyday life.

The concept of artificial reality was first introduced by Myron Kruger in the late 1960s. The first virtual reality system appeared in 1962, when Morton Hailig introduced the first prototype of a multi-touch simulator, which he called "Sensorama". The sensor immersed the viewer into virtual reality with the help of short films, which were accompanied by smells, wind (with a hair dryer) and the noise of the metropolis from the audio recording. In 1967, I. Sutherland described and designed the first helmet, the image of which was generated by a computer. Sutherland's helmet allowed the images to change according to the movements of the head (visual feedback).

The first implementation of virtual reality is considered to be "Aspen film", created at the Massachusetts Institute of Technology in 1977. This computer program simulated a walk around the city of aspen, allowing you to choose between different ways to display the area. Summer and winter options were based on real photos.

In the 80s the company VPL Research and developed more modern equipment for virtual reality. These equipment include -goggles and gloves EyePhone, and DataGlove. One of the company's employee, Jaron Lanier – a talented inventor coined the term “virtual reality” [1].

Regardless of the implementation of virtual reality, it can distinguish the following properties:

- generation (virtual reality is other, foreign to its reality);
- relevance (there is actually, at the time of observation;
- autonomy (has its own laws of being, time and space);
- interactivity (can interact with other realities, however, having independence).

In 2000, the Quake game was introduced. By means of the AR technology The VR/AR boom began only in 2012. August 1, 2012, a company Oculus launched on their platform a campaign to raise funds for the head-mounted display with a resolution of 640 by 800 pixels for each eye.

On the 6th of January 2015, started pre-sales of the first production of consumer head-mounted display Oculus Rift CV1. The entire first batch of helmets has been sold out in 14 minutes [1].

This was the symbolic beginning of a boom VR-technology and the increase of investment in this field. It was in 2015 that virtual reality technology became a truly new technological phenomenon.

VR can now be used not only in military affairs but also in other areas [7]. “VR is also applied for the treatment of mental disorders for the treatment of mental illness, and especially – anxiety disorder and phobias” [9, p. 128]. A group of scientists from the UK and Spain developed a method for the depression treatment by means of virtual reality and demonstrated its effectiveness.

Virtual reality has more opportunities available to mainstream consumers as some companies engaged in the full development of innovative technologies [8]. Many companies of this sphere were established at the end of 2016 at the Global the Virtual Reality Association (GVRA). This association will be connected with the development and promotion of VR. The association consists of Facebook (Oculus Rift), Acer (Starbreeze), HTC (Vive), Samsung (Gear VR), Google (Cardboard , Daydream), and Sony (PlayStation VR) and others.

Dexmo Gloves can transmit physical sensations of human interaction with the virtual objects (pict.1). They monitor 11 degrees of freedom of movement of the user's hand and act on every single finger when touching the hand to the virtual object [10].



Picture 1 – Gloves Dexmo F2

According to IDC, global headset shipments grew 25.5 percent (year-over-year) in the second quarter, reaching 2.1 million units (fig.1). Despite growing interest in augmented reality – Apple and Google both released an AR development kit for their mobile platforms this year – virtual reality still accounts for 98 percent of shipments in the AR/VR market [11].

HTC announced that it will officially launch Vibe Pro on March 20 in Korea at the end of April. Vibe Pro supports a maximum resolution of 2880×1600 , and a dual display enhances visual immersion. The resolution is 78% better than the existing Vibe product. In addition, noise cancellation function is applied, so that we can concentrate on VR audibly. Integrated high-performance headphones with built-in amplifiers are also included. It is an enhancement of audiovisual VR experience [10]

In conclusion it should be noted that according to a new report from Tractica, VR head-mounted display (HMD) shipments will be 130 million units annually by 2021, up from just 17 million in 2016. Mobile VR headsets will dominate the market, accounting for approximately 75% of all units sold [12]. The market intelligence firm forecasts that annual worldwide revenue from VR HMDs, accessories, and content will reach \$35 billion by 2021 (fig.1).

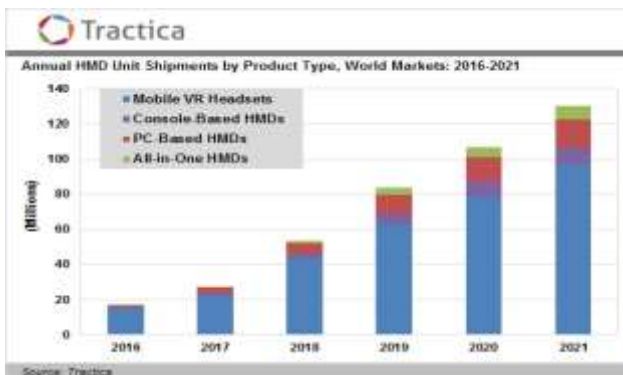


Figure 1 – Annual Unit Shipments by VR products.

The report features global market forecasts for annual unit shipments and associated revenue by 2021. “HMDs are segmented into four product types: PC-based devices, console-based devices, all-in-one devices, and mobile VR headsets” [12, www]. VR accessories, such as gamepads and other VR-specific controllers, hand tracking devices, and 360 cameras will be on the market as well. The content market is segmented into gaming and media.

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Аннотация. Основная цель исследования – показать возможность прогрессирования устройств виртуальной реальности не только для развлекательных целей, но в большей степени возможность сосредоточиться на медицине, образовании и повседневной жизни. В заключение анализируются годовые отгрузки продукции VR.

Ключевые слова: виртуальная реальность, виртуальные объекты, дополненная реальность, наушники, усилители.

Annotation. The main purpose of the research is to show a wide range of people the possibility of progression of virtual reality devices not only for entertainment purposes, but to a greater extent the opportunity to focus them on medicine, education and everyday life. In conclusion annual unit shipments by VR products are analyzed.

Keywords: Virtual Reality, virtual objects, augmented reality, headphones, amplifiers.

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COMMUNICATION CHANNEL ORGANIZATION METHODS ANALYSIS FOR THE INDUSTRIAL INTERNET OF THINGS

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1. Introduction

Industrial Internet of Things (or IIoT) is a key aspect of Industry 4.0 – the fourth wave of innovation in the history of technology. See figure 1. As the trend towards smart plants grows, it is important to understand many of the terms used, to understand how intelligent technologies are already being introduced at production facilities, and to prepare the business for the future [1]. One way or another, wireless systems are beginning to gradually penetrate into industrial applications. A variety of technology options are available. Therefore, the analysis of communication channel organization methods for IIoT is an urgent task.

2. Main part

When developing IIoT elements, a radio channel is usually used when organizing communications between system elements. The most commonly used Wi-Fi.

The obvious advantage of Wi-Fi is not attachment to the position of the device (you just need to provide power connection). Advantages: ease of connection; wide use; large selection of equipment; a set of encryption protocols to ensure data security; possibility of standard connection to the network.

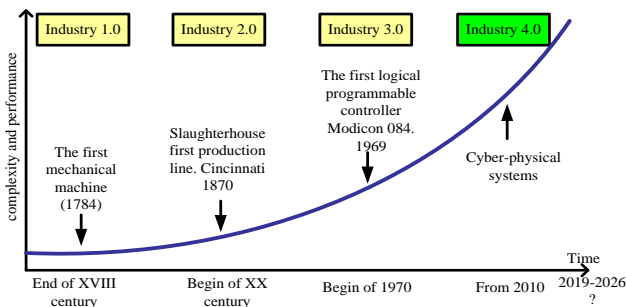


Figure 1 — The development of industry from the end of the XVIII century to the present day

Disadvantages: poor stability in conditions of strong electromagnetic fields; limited bandwidth; high power consumption; the need to connect to an external power supply; short range, which becomes even smaller in the "dirty" radio-technical environment. To improve the quality of communication, you can use polarization separation of signals in order to release the frequency spectrum using special antennas [2].

Bluetooth and Bluetooth Low Energy (BLE). Modern devices often operate with different stacks of Bluetooth protocols, which gradually conquer the world of industry solutions. The implementation of BLE was particularly successful: ultra-low power consumption allows for the

implementation of autonomous monitoring systems that remain autonomous for several years. Their weak point is the lack of direct interaction with high-level networks. Although there have recently been references to attempts to implement hubs such as BLE - Wi-Fi or BLE - Wired Internet, no ready solutions are visible on the market yet, and interaction with BLE devices is performed through an intermediary in the form of programmable logic controllers (PLC). Advantages of BLE: low power consumption and high autonomy; significant data transfer rate; built-in encryption protocols. Disadvantages: a small range of data transmission; unstable work in a contaminated radio environment; the inability to directly transfer data to the Internet.

GSM-GPRS is the most common data transmission method for sparse systems located over a large area. Practically not used to build complex systems, but is widely used where data exchange points operate in the "fields": for barriers, in security systems, autonomous or mobile devices. Advantages: a wide coverage of public access networks with a ready data transmission infrastructure; low price; availability; High speed data transfer in 4G networks. Disadvantages: poor protection against unauthorized connections; poor signal permeability.

Long range networks (LoRa). This method of data transfer in machine-to-machine communication is gaining popularity precisely for industrial applications - data exchange systems operate at frequencies allocated for industrial use. Although a consortium of manufacturers has not yet been created and there is no well-established standard for such networks, the equipment is already on the market as commercial products of different price groups. Advantages of LoRa: good immunity to interference; high signal permeability; low power consumption; long distance during data exchange (up to 20 km) especially when using antennas with optimized radiation characteristics [3]; built-in encryption algorithms; availability of own gateways for data transmission to high-level networks. Disadvantages: lack of industry standard and low data transfer rate.

3. Conclusions

The technology of industrial Internet of Things allow to access data from enterprises (systems) and use them in more significant ways compared to digital technologies. Since the systems are heterogeneous and their specific needs are unpredictable, when connecting to the Internet of things, lower-level software may have to either be deeply adapted or rewritten for each PLC system to fit the equipment and tasks. In addition, you must take into account the distance of data transmission and on the basis of this, choose a wireless data transmission system.

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Аннотация. В статье проводится анализ методов организации каналов связи для промышленного интернета. Сформулированы критерии выбора систем связи при построении таких систем в зависимости от их особенностей организации.

Ключевые слова: ПоТ, система связи, LoRa, Wi-Fi, Bluetooth Low Energy.

Annotation. The article analyzes the organization of communication channels for the industrial Internet. The criteria for selecting communication systems when building such systems are formulated, depending on their organization features.

Keywords: ПоТ, communication system, LoRa, Wi-Fi, Bluetooth Low Energy.

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MULTICHANNEL STOPWATCH TO MONITOR RELAY PROTECTION SYSTEMS

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1. Introduction

Ensuring the uninterrupted power supply of settlements is an important task that is intended to solve the staff of electrical substations. The most important node of an electrical substation is relay protection, which protects equipment, both the main substation nodes and the power lines [1].

To reduce the time of relay protection control, it is necessary to use multi-channel stopwatches that allow you to simultaneously monitor several channels of relay protection. Therefore, the development of a multi-channel device for monitoring the response time of the relay protection is an important task.

2. Main part

Reliability of protection is the ability to perform the functions assigned to it in full under certain operating conditions. To ensure the required reliability, high-quality installation of protection from high-quality relays and devices, proper operation and timely repair of equipment are necessary. Diagnostics are used to detect damages and violations in the protection operation, allowing to detect faults that can lead to failure or false activation of the relay protection.

Relay protection consists of a number of independent elements, called relays, interconnected according to a certain scheme.

A relay is an automatic device that reacts to a change in the value it controls and switches when its deviation exceeds a certain predetermined value (the setting of the response). The relay has perceiving and executive bodies. A controlled quantity is fed to the receiving organ. In electromechanical relays, a coil of an electromagnet serves as a sensing organ, to which a transformed controlled quantity is supplied. As an executive body in electromechanical relays, contacts are used, in electronic ones - transistors and thyristors, which change the output signal abruptly.

The main characteristic of protection is its response time. To control the response time, a device has been developed whose structural diagram is shown in Figure 1.

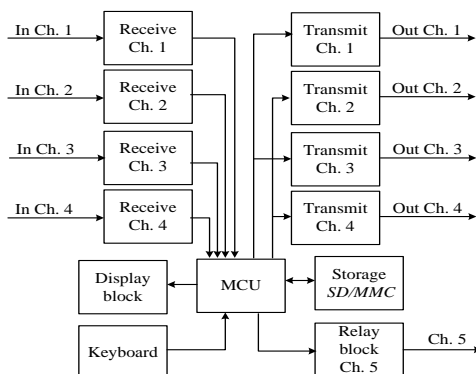


Figure 1 — Block diagram of the multi-channel stopwatch

The device being developed must remain operable when connecting its measuring channels to points whose potential lies within (0 ... 380) V. Therefore, galvanic isolation is required at the device input. In this case, it is necessary to use a transformer isolation, and as a probing signal it is necessary to use a harmonic signal with a frequency of up to 200 kHz produced by DDS like in [2].

The choice of natural frequencies for each of the channels due to the possibility of connecting relay protection circuits that are tested. In order, for example, the detector of channel 2 from the signal of the channel 1,3,4 signal does not need to be spread these channels in frequency. The use of a notch filter in the receive circuit is necessary to ensure the required selectivity for the adjacent channel. When transmitting, the microcontroller will generate two signals in a form close to the meander with a frequency of 40 kHz and 60 kHz. In the spectrum of these signals there will be no second harmonic, therefore, it is possible to apply filters of a smaller order. This is important, since filters of a high order introduce a sufficient delay. In the transmitting path, the filters are tuned in pairs to the first and third harmonics of the original signals.

The delay of relay protection is measured by the method of sequential counting of pulses as described in [3]. The device includes four transceivers that form four measuring channels, the fifth channel, the active one, is formed by a relay unit. To display and enter information using the display unit and keyboard. To save the data is a block SD / MMC.

3. Conclusions

As a result of the development of the structural scheme of the multi-channel stopwatch, the following has been established. The method of sequential counting of pulses was chosen to measure the time intervals of

the relay, since this method is quite simple to implement, and on the other hand provides a satisfactory measurement accuracy. A frequency plan has been developed for four measuring channels.

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Аннотация. В работе рассматриваются вопросы разработки многоканального миллисекундомера для контроля времени срабатывания релейной защиты. Выполняется обзор устройств контроля релейной защиты. Производится выбор, и обоснование структурной схемы измерительной части прибора.

Ключевые слова: измерение временных интервалов, формирование зондирующих последовательностей, миллисекундомер.

Annotation. The paper deals with the development of a multi-channel stopwatch to control the response time of relay protection. A review of the relay protection control devices is performed. The selection and justification of the block diagram of the measuring part of the device.

Keywords: measurement of time intervals, formation of probing sequences, stopwatch.

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THE WEB-APPLICATIONS DEVELOPMENT FEATURES FOR IOT USING THE MQTT PROTOCOL

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1. Introduction

In modern society, information technologies play an increasingly important role. The most modern and promising is the technology of the Internet of things. The relevance of products from the IoT sphere is not in technology or in the Internet connection as such [1]. Relevance is the information that “smart” devices collect, turning data into information and a guide to action for individual owners or groups of people. It is not the sensor and the parking application that is important - information about where you can quickly and conveniently park your car at the rush hour is important. That is why in the “Internet of Things” the interface and usability of the finished gadget or software product is important [2]. After all, all these smart things have to interact not only with a person, but also with each other. Therefore, the analysis of the features of the development of WEB-applications is an important task.

2. Main part

The MQTT broker interacts with the MySQL database using a script written in the Python programming language. This script serves as a service that provides bidirectional communication between MQTT and MySQL servers. The script contains data for connecting to the broker MQTT and the server database MySQL, a description of the establishment of the interaction of servers.

The data for connecting to the MQTT broker are: server address, username and password, client's MQTT identification number and a list of topics from which information for the database should be extracted.

The data for connecting to the MySQL database are: the address of the database server, the user name and password, the name of the database.

This script serves only to transfer data from the broker to the database, since the database is a “reader” and cannot transfer data to the broker according to the rules of the MQTT protocol. The structural diagram of the interaction of the script with the broker and the database is presented in Figure 1.

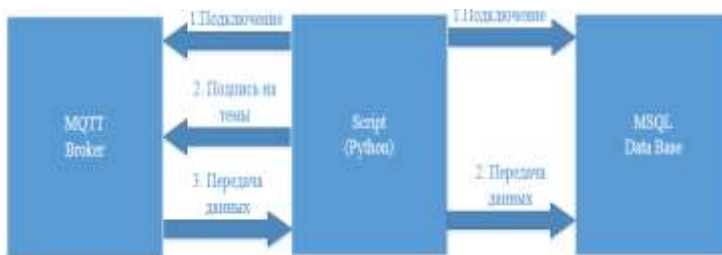


Figure 1 — The structure of the interaction of the script with the broker and the database.

The database has a function for processing incoming data on the server and entering data into the appropriate fields of the database. The table fields are often: md5, message time, subject and value.

This script is executed via the command line, after the script is launched, it displays information about its execution, delay of the response between servers and the data transferred, which allows you to track the correctness of its execution and data transfer.

WEB-application is developed in the development environment of Visual Studio 2017 in the C # programming language. The Entity Framework was used to create the WEB application. Entity Framework is a special object-oriented technology based on the .NET framework for working with data. If traditional ADO.NET tools allow you to create connections, commands and other objects for interacting with databases, then the Entity Framework is a higher level of abstraction that allows you to abstract from the database itself and work with data regardless of the type of storage. If at the physical level we operate with tables, indexes, primary and foreign keys, but at the conceptual level that the Entity Framework offers us, we already work with objects.

Entity Framework suggests three possible ways to interact with the database:

- Database first: Entity Framework creates a set of classes that reflect the model of a particular database.

- Model first: first, the developer creates a database model, on which the Entity Framework then creates a real database on the server.

- Code first: the developer creates a data model class that will be stored in the database, and then the Entity Framework for this model generates a database and its tables

Using the Entity Framework technology allows you to reduce the entry threshold for the development of WEB applications for IoT, which in turn allows you to expand the scope of the Internet of things. For example, this

technology can be applied for research tasks when developing an RFID reader [3].

3. Conclusions

Thus, today the use of the Internet of Things technology is hampered not by the complexity of developing devices supporting this technology or by the complexity of adapting existing systems to this technology, but by creating an end-user interface that would initially support IoT technology and be platform-independent. Most fully these requirements are met by WEB-applications that can be run on virtually any device, from smart watches to personal computers. However, when developing such applications along with an understanding of web technologies, it is necessary to take into account the peculiarities of IoT technology.

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Аннотация. В статье рассматриваются особенности взаимодействия протокола MQTT (Message Queue Telemetry Transport) и WEB-приложений. Особенности работы с базой данных, передачи сообщений и вывода их конечному пользователю. Показана структурная схема взаимодействия MQTT сервера с MYSQL базой данных, описан принцип работы взаимодействия с базой данных, обменом сообщениями.

Ключевые слова: MQTT, MYSQL, брокер, скрипт, база данных, данные, WEB-приложение.

Annotation. The article discusses the features of the interaction of the Message Queue Telemetry Transport (MQTT) protocol and WEB applications. Features of working with the database, sending messages and outputting them to the end user. The block diagram of the interaction of the MQTT server with the MYSQL database is shown, the principle of the interaction with the database, message exchange is described.

Keywords: MQTT, MYSQL, broker, script, database, data, WEB application.

COMPARISON OF CURRENT BIOMETRIC METHODS OF IDENTIFICATION

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The modern level of development of information technologies, as well as higher requirements for information security have led to the fact that traditional means of identification - logins, codes, keys, access cards - are no longer effective, which entails not only material damage to the company due to the actions of intruders, but also does not provide the required security of the individual in the information space. Personalization requirements and active introduction of smart technologies in technical systems, and even at the household level (for example, Smart Home, IoT - Internet of Things), have led to the need to use more advanced and reliable identification mechanisms. Authentication technologies move to a new level of development – complex methods of subject verification based on a combination of different identifiers, algorithms and protocols are used. On the first place among requirements of maintenance of safe access to object accuracy of identification and efficiency leave. Comparison of biometric methods of identification by these indicators is the main task of the research.

On the basis of analysis of modern biometric methods of identification of personality we can identify the most promising technologies that meet the requirements of accuracy and efficiency.

The accuracy of identification is determined by two indicators: the probability of refusal of access to the person having admission (I kind of errors), and the probability of false coincidence of biometric characteristics of two people (II kind of errors). In addition, the characteristics of biometric identification systems include: stability to the moulage (imitation of biometrics), speed of operation, ease of use, the cost of the system. Efficiency is the ratio between the achieved result (correct identification) and the resources of the system used to identify a subject [1].

The peculiarity of biometric systems is that the procedure of receiving, storing and using for the identification of biometric data is complex, which leads to the high cost of technical devices implementing it. Biometric data

are unique, they do not need to be remembered as a password, and they are always with the subject. Let's consider the peculiarities of implementation of various methods of biometric identification [2, 4].

Biometric data are divided into two groups: physiological and behavioral. The first group includes the following: physiological and behavioral data: DNA; fingerprint (fingerprint data); digital image of the face in 2D or 3D projection; iris pattern; retinal pattern; vein pattern of the hand, voice; hand geometry; shape of the ear, etc. Behavioral are: signature dynamics; keyboard handwriting; gait; voice.

The most common method of biometric identification is fingerprint examination. To take a fingerprint, both traditional and modern methods of obtaining an electronic fingerprint with the help of a scanner are used. Special sensors make a high quality digital image of the papillary pattern of the finger, which is then converted into a code stored in the database. This method is inexpensive, fast and accurate, and there are a large number of printers and specialized programs on the market. Modern scanners have advanced functionality; for example, can take into account the relief of lines, pressure and temperature, these additional parameters are used to exclude the possibility of counterfeiting biometric data. The disadvantage of the method is that cuts and scratches often occur on the fingers, which can make identification difficult or unsuitable. In addition, the specifics of individual activities (e.g., chemical production) make fingerprinting impossible and the method unsuitable for subject identification.

The second most popular method is facial geometry identification. The popularity of the method is due to the fact that it is often used in forensics to determine the location of the offender and identify terrorists. The method is based on the recognition of persons caught in the frame using video surveillance systems. Such systems are widely used in crowded areas, such as train stations, subways and airports.

However, this method of biometric identification has poor statistical indicators, its effectiveness depends on the parameters of the video camera, lighting, speed of movement and remoteness of the object of observation, it is sensitive to mimicry. The emergence of modern methods of pattern recognition and 3D-image creation has led to an improvement in the quality of this method, but, at the same time, the cost of equipment.

Iris identification is recognized by many experts as the most accurate way to establish identity. The iris pattern is virtually unchanged throughout a person's life, and physical contact with the device is not required for the identification procedure, as it is read at a comfortable distance from the eyes. Scanners capture the image, digitize it and transfer it to a comparison device that compares the image with the database and reveals compliance.

These systems are highly reliable, fast and accurate. The downside is that the accuracy of the method depends on the resolution of the camera as well as the cost of the equipment. However, due to the high accuracy of the method, such systems are used by organizations whose activities include working with classified documents.

The method of scanning the retina is the best in terms of recognition accuracy. These systems have the lowest failure rate, so they are most often used on highly sensitive sites for the implementation of access control systems and employee identification. The method is based on obtaining an image of blood vessels on the back wall of the eye. Disadvantages of the method: the complicated procedure of obtaining the image of blood vessels by the optical system requires a long enough immobility of the subject, which causes discomfort. The cost of the systems is quite high. It takes a long time to get and process the image.

The method of recognition by hand vein pattern is quite accurate and has high reliability. In addition, this characteristic is difficult to forge, because to get an image, you need to use a special infrared camera, and a program that converts the image into a code. This technology is one of the newest. Disadvantages of the method: some diseases can lead to changes in the vein pattern; scanners are sensitive to sunlight and halogen lamps.

The main indicators of the reliability of the biometric system are errors of the I and II kind, FAR and FRR coefficients: False Acceptance Rate (FAR) - wrong confirmation (decision making "alien = alien", the probability of unauthorized access) and False Rejection Rate (FRR) - wrong refusal (decision making "alien = alien", the probability of false detention) [1]. A comparison of the accuracy of different biometric identification methods can be made using FRR and FAR indicators.

It is important to take into account that the probability of erroneous failure and erroneous confirmation are related to each other, and the quality of the recognition procedure is determined by their ratio: the more accurate the identification is, the less the value of FRR at the same FAR values. To assess accuracy, an EER (equal level of error) is entered, which is a factor at which confirmation and failure errors become equivalent. This means that the accuracy of the biometric system is higher the lower the EER. To determine the accuracy of the identification method as a numerical parameter, the permissible value of FAR is fixed (that is, set the "threshold" of matching biometrics of two subjects, see Fig. 1), and the value of FRR becomes an integral criterion of accuracy.

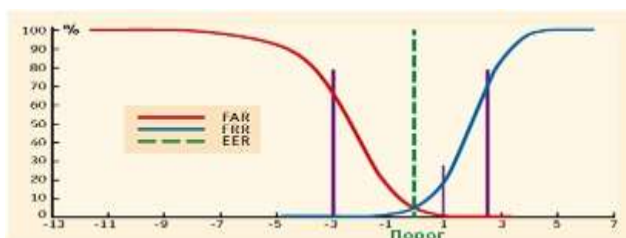


Figure 1 – FAR and FRR charts
Source: <https://algorithm.org/arch/arch.php>

Based on the results of statistical studies, the characteristic curves - ROC-curves (Receiver Operating Characteristic), or performance curves of PX, which show the dependence between VLNS - false non-match rate (FNMR) and VLS - false match rate (FMR). ROC is a parameter-driven decision threshold function that takes into account an attacker's attempts (probability of a false positive decision, x-axis) and a legitimate user's attempts (probability of a true positive decision, y-axis), as shown in Figure 2.

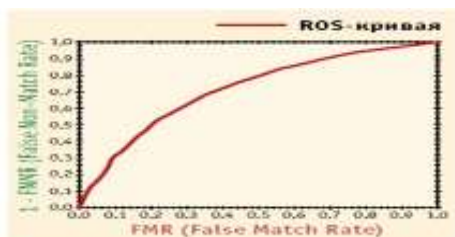


Figure 2 – Example of a ROC curve (PX performance curve)
Source: <https://algorithm.org/arch/arch.php>

Thus, the choice of the required ratio between the FAR and FRR indicators is a compromise solution, the adoption of which depends on many factors, such as the number of staff of the company, and, accordingly, the size of databases, methods of restricting access used by the company, the purposes of identification of subjects. To solve this problem, the CCH curves are used – the compromise error definition. CCH curves are a modification of the performance curve. The x-axis of the compromise error determination curves is the value of the probability of false positive errors, and the y-axis is the value of false negative errors. Thus, using the curve of CCH it is possible to construct graphs of probability of errors of comparison (FNMR) depending on FLNS (FMR), probability of errors of decision-making (FRR) depending on FAR (FAR) and probabilities of identification

on the open set (FLONI depending on FLONI) [1]. An example of compromise error determination curves is presented in Fig. 3.

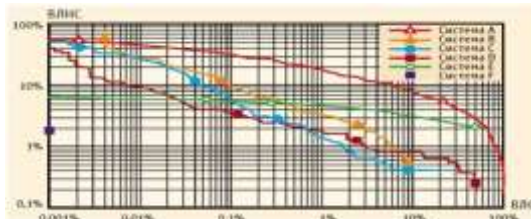


Figure 3 – Example of CCS curves of some set of A-F systems
Source: ГОСТ Р ИСО/МЭК19795-1-2007

Methods of teaching ROC curves are different. The choice of testing methods depends on the circumstances of testing, the algorithm and conditions of tests, the scenario of the system used, the number of factors to be tested and other factors. In turn, the type of testing is determined by the applied methodology. There are technological, scenario and operational tests. Therefore, the results of the analysis of the same identification system, obtained by different testing methods, may differ significantly. Thus, the efficiency of a biometric identification system is an integrated indicator that depends on the percentage of correct identification and the resource error minimization.

The probability of false positives depends on the number of subjects. In large databases of biometric matching error is higher, for example, with the number of subjects 2000 and above, none of the biometric methods is satisfied with accuracy. Therefore, it is recommended to use multi-criteria systems for identification (double, triple verification), such as multiple fingerprints, voice-face combinations, etc.

Traditional identifiers are gradually being replaced by more reliable and accurate systems based on biometric identification. Analysis has shown that the most accurate systems are biometric identification systems using DNA, iris and retina patterns as biometrics. The next stage in the development of biometric identification technologies is the introduction of intelligent tools that work in conditions of incomplete reliability and uncertainty of information, and are able to use the mechanisms of fuzzy logic and neural network technologies for the implementation of identification/verification procedures of subjects.

Biometric systems of identification of the person are widely applied at the enterprises for protection against unapproved access, the control of a presence of the employee on work, the account of working hours. In addition to civil systems, biometrics is widely used by intelligence agencies

to search for criminals and identify terrorists. Since July 2018, it has been decided to use biometric passports in the banking sector to protect banking secrecy, control access, identify customers when obtaining loans and making financial transactions at ATMs.

Introduction of biometric identification systems in educational and medical institutions, transport (as part of the payment system) and electronic voting systems has begun. Application of these technologies contributes to ensuring both personal security in the information space and security of business, science, and the state as a whole.

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Аннотация. Биометрические методы являются эффективным инструментом идентификации личности и применяются для верификации субъекта, защиты от несанкционированного доступа, контроля явки сотрудника на работу, поиска преступников, выявления террористов. В статье приведен обзор современных биометрических методов идентификации, личности, показаны их преимущества и недостатки, а также примеры использования в различных сферах деятельности. Показаны особенности использования физиологических

и поведенческих биометрик. Приведены основные характеристики биометрических методов идентификации. Проведен анализ статистических данных и сделано сравнение точности разных методов биометрической идентификации по показателям FRR и FAR, характеризующим надежность идентификации. Даны рекомендации по применению методов верификации субъекта на основе комбинации различных идентификаторов.

Ключевые слова: информационная безопасность, биометрия, идентификация, биометрические технологии, распознавание образов.

Annotation. Biometric methods are an effective tool for identification and they are apply to verify the object, protect against unauthorized access, control the appearance of the employee to work, search for criminals, identify terrorists. The article provides an overview of modern biometric methods of identification, where are shown advantages and disadvantages, and also examples of using them in various sphere of activity. Features of use of physiological and behavioral biometrics are shown. The main characteristics of biometric identification methods are given. The analysis of statistical data and a comparison of the accuracy of different methods of biometric identification indicators FRR and FAR, characterizing the reliability of identification. Recommendations on the use of methods of verification of the subject based on a combination of different identifiers are given.

Keywords: information security, biometrics, identification, biometric technologies, pattern recognition.

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BASIC PRINCIPLES OF BUILDING AUTOMATED SYSTEMS

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Automated control system (ACS) is a combination of mathematical methods, technical means (computers, communication devices, information display devices, etc.) and organizational complexes ensuring rational management of a complex object (process) in accordance with a given goal.

The accumulated experience in the development and operation of NPPs allows formulating a number of principles for their construction, the observance of which is a necessary condition for the creation of efficient systems. Consider these principles in relation to production management systems, but they are fully applicable to systems of other classes.

1. The principle of a systematic approach.

This is a fundamental principle. Its essence lies in the fact that the projected object must be considered from the position of a higher level. Thus, for example, a projected task should be considered from the standpoint of the functional subsystem into which it belongs; design subsystem - from the point of view of the system, etc.

The design of an automated system should begin with a thorough system analysis of the control object, the control part and the external environment. It is necessary to find out all the many factors under the influence of which the system is located, as well as all the many factors that are influenced by the system itself. In parallel with this, it is necessary to clarify the entire set of goals facing the designed system. For each goal, it is necessary to develop one or more performance criteria, which are a numerical measure of the degree of achievement of goals. It is necessary to reveal the full range of issues that need to be resolved in order for the designed system to best meet the goals and performance criteria. In relation to AS for organizational management of production processes, this set of issues should include not only technical issues, but also economic and organizational issues. The implementation of the NPP should be accompanied by the improvement of economic indicators and methods of economic incentives, as well as changes in existing and legal forms of documents, changes in the routes of their movement, changes in the functional responsibilities of management personnel, etc.

2. The principle of new tasks.

Its essence lies in the fact that it is not enough to limit ourselves to shifting to computer and other technical means the existing forms, methods and tasks of management. The main attention should be paid to the enormous opportunities offered by the use of modern computing equipment and software. Particular attention should be paid to those tasks that in the existing control system due to large volume or computational difficulties are not solved or are solved in an incomplete degree.

3. The principle of the first head.

Successful implementation of the two first principles is possible only if the development and implementation of the AU are under the direct responsibility of the first persons of the customer's organization (director or chief engineer). In this case, systems engineering is assigned the task of a clear distribution of functions between the organization of the customer and the organization of the developer. Customer functions are:

- formulation of system objectives, performance criteria, general system concept (together with the manager of the organization of the developer),

- determination of priorities and sequence of input of various management tasks (together with system developers),
- participation in the development of the information base of the system,
- implementation of organizational measures (changes in the structure and functions of the management apparatus), the allocation of appropriate space for the technical means of the system, the organization of financing development, the allocation of appropriate staff units for the personnel servicing the developed system.

Developer functions (besides listed above):

- development of technical specifications for the designed system (together with the management of the customer's organization),
- development of a technical project (development of the structure of the system, algorithms for solving problems, the information base of each task, the choice of a complex of technical means),
- development of a working draft (development of document forms, work programs, operating instructions),
- introduction of the developed system into operation (together with the personnel operating the system).

4. The principle of continuous development of the system.

It provides for the possibility of introducing new tasks and perfecting the already implemented tasks without compromising the quality of solving operational tasks and moreover, without excluding the possibility of solving at least one operational task. Systems with these qualities are called open systems.

5. The principle of reasonable typing project.

By developing such expensive products as an automated system, the system engineer naturally strives to ensure that the solutions offered to them are suitable for the widest possible range of customers. However, typing, naturally, leads to deterioration of the proposed solutions, since it does not allow to take into account all the specifics of the control object. At the first stages of NP development, there was an attempt to develop a universal program for the logistics subsystem. This program has been very slow because of its versatility. Applied to this example, the principle of "reasonable typing" consists in a reasonable increase in the speed of implementation of a specific program compared to a universal one.

6. The principle of workflow automation.

In automated systems, it is not enough to limit the performance of calculations on a computer for certain models, it is necessary to automate all stages of information processing, namely the collection of primary

information, its transmission, processing, storage and communication of the results to specific users of this as.

7. The principle of a single information base.

Its essence lies in the fact that the magnetic media accumulates and constantly updated information necessary to solve not individual, but all management tasks.

8. The principle of single entry and multiple use of information.

It follows directly from the previous principle. Information about any document, object or event must be entered into the system only once. Non-compliance with this principle leads to the fact that, for example, about the same event, there may be several conflicting opinions, which clogs the memory of the system and inevitably disables it. Repeated use means that at any level of management, from the Minister to the head of the site, information should come from a single information base. In this case, the form of representation of this information, the degree of detail, etc. for each level should be different.

9. The principle of complexity of tasks and work programs.

Most of the problems solved in the systems under consideration are closely related, for example, the problems of subsystems of technical and economic planning and logistics. There is a constant exchange of information between these sub-systems, and the separate solution of these problems significantly reduces the efficiency of the entire system.

10. The principle of consistency of throughput of different elements of the system.

In the simplest case, for successive sections of the system, the starting capacity of each subsequent element should not be less than that of the previous one.

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Аннотация. В настоящее время широкое распространение получили автоматизированные системы. Представить современный мир без компьютерных технологий невозможно. Автоматизированные системы управления информацией представляют собой сложные человеко-машинные комплексы. Это совокупность крупных подсистем, симбиоз данных и знаний, экономико-математических моделей, инструментальных и технических средств, средств связи и

оргтехники, а также специалистов, предназначенных для обработки информации и принятия решений.

Современные информационные технологии внедряются в автоматизированные информационные системы, составляющие их основную часть - содержательную часть.

Ключевые слова: автоматизированные информационные системы управления, принципы построения АСУ, технические средства, информационная база.

Annotation. Currently, automated systems have become widespread. Imagine the modern world without computer technology is impossible. Automated information management systems are complex man-machine complexes. This is a set of large subsystems, a symbiosis of data and knowledge, economics and mathematical models, instrumental and technical means, communications and office equipment, as well as specialists intended for processing information and making decisions.

Modern information technologies are implemented in automated information systems, making up their main part - the content part.

Keywords: Automated information management systems, principles of building ACS, technical means, information base.

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METHODS OF SECURITY OF COMMUNICATION CHANNELS IN INFOCOMMUNICATION NETWORKS

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I. Introduction

Protection of wireless networks is one of the most acute problems for IT-specialists. New technologies that allow to transfer data quickly and easily between several subscribers are becoming more and more widely

used every year. Unfortunately, the vulnerability of such communication channels is also constantly growing. The principle of Wi-Fi says that it is quite easy to intercept a particular information or carry out an attack with the necessary equipment. The main reason for the vulnerability of wireless networks lies in the exchange of data packets via radio waves. This technology allows attackers to work at any point where the signal remains physically available.

Networks that use incorrectly configured authentication methods are particularly vulnerable. Imagine that the signal of an organization's access point extends for quite a long distance, and as a password it uses a set of letters from the name of the company. Anyone who is near the office will be able to easily pick up the code and access the corporate network. This is what is called a Wi-Fi vulnerability.

At present, robots equipped with various sensors, monitoring, navigation and communication tools are increasingly being used to solve problems of protecting territories and objects, solving special tasks, as well as dealing with emergency situations. In the special-purpose ground-based robotics, one of the most sought-after areas is the construction of autonomous robots and the remote control of a robot (group of robots) by means of an operator or using programmed commands from the control server. Building autonomous robots is quite a challenge. Remote control is carried out by a wireless communication system, which is one of the most vulnerable elements of the robotic complex, subject to various threats. Such threats include viewing, substitution, interception and interference suppression of transmitted control information.

Wireless communication channel is one of the most vulnerable elements of the robotic complex. Unauthorized access (viewing, substitution, interception and suppression of interference), aimed at disrupting the operation of the robot, can lead to critical consequences. For this reason, the analysis of methods of protection against threats of information exchange in the wireless control channel of special-purpose robotic systems is an important task.

The embedded information security systems (cryptography, broadband signals) used in the most common wireless standards IEEE 802.15.1, IEEE 802.15.4, IEEE 802.11, IEEE 802.16, GSM, 3G that are well described and researched. However, the existing modern arsenal of means for electronic suppression of these wireless communication systems makes it possible to effectively destabilize their work. The use of cryptographic methods of protection provides protection against viewing and substitution of information, but is not effective against the interception of information and suppression of the information signal by interference [1].

II. Main definitions

A communication channel is a complex of technical means, as well as a signal transmission medium, which allow information to be transmitted from the sender to the receiver and vice versa. Digital communication channels allow you to transmit any type of information, including: digital data, video, as well as organize voice communication.

Since wireless networks use air and space to transmit and receive information (the signals are open to any person in range), the security of data transmission is a very important aspect of the security of the entire system. Without ensuring proper protection of confidentiality and integrity of information during its transmission between workstations and access points, one cannot be sure that information will not be intercepted by an attacker, and that workstations and access points will not be replaced by an outsider.

First of all it should be noted that wireless networks differ from cable networks only at the first two — physical and partly channel — levels of the seven-level model of open systems interconnection. Higher levels are implemented in accordance with the same principles as in wired networks, and the real security of networks is ensured precisely at these lower levels.

The security of wireless networks can be threaten with:

- violation of the physical integrity of the network;
- traffic interception;
- network intrusion.

At present, methods for protecting wireless communication channels of special-purpose robotic systems should be divided into the following groups:

- cryptographic;
- VPN (virtual private networks);
- broadband signals;
- change the parameters of the radio signal (frequency, power);
- mixed methods.

Nowadays one of the most effective methods of protecting information are cryptographic methods of protecting information. If we are talking about wireless networks, two algorithms are widely used for wireless networks protection - initially WEP, based on RC4, and AES later.

Initially, WEP was widely used in various systems providing wireless access to digital networks, by means of which traffic is encrypted, making it difficult to analyze the latest scanning equipment. For data encryption, the standard provides encryption capabilities using the RC4 algorithm with a 40-bit shared key [2].

Wireless networks cannot provide high availability. Various natural, man-made and anthropogenic factors can effectively disrupt the normal functioning of the radio channel. This fact should be considered when designing a network, and wireless networks should not be used to organize channels with high availability requirements [3].

A common drawback to the use of cryptographic protection methods is the complexity of the hardware implementation with increasing key dimension, as well as a significant time delay arising from the implementation of the encryption-decryption procedure for messages.

The most protected types of networks, both wired and wireless, are where, along with the cryptographic protection of the transmitted data, cryptographic protection of user data used to gain access to network resources is also implemented. For wireless networks this possibility was expressed through the use, and subsequently consolidation, of digital certificates in the 802.11i standard. Their presence or absence while building a network significantly affects its ultimate security. Thus, the use of digital certificates when accessing a wireless network should be included in the authentication criteria as the last criterion.

Based on the recommendations of 802.11i, Cisco Systems implemented the Temporal Integrity Protocol (TKIP), which provides for changing the RPC encryption key (Per Packet Keying) in each packet and monitoring Message Integrity Check message integrity.

The RPC procedure involves changing the initialization vector IV in each packet. Moreover, the encryption is performed by the value of the hash function from the IV and the WEP key itself. Considering the fact that the WEP keys change dynamically, the encryption reliability is rather high.

Ensuring integrity is entrusted to the MIC. In the emerging frame, the MIC and SEQUENCE number fields are added, the sequence number of the packet is indicated in the SEQ field, which allows you to protect yourself from attacks based on repetitions and sequence violations. A packet with incorrect sequence numbers is simply ignored. In the 32-bit MIC field, the value of the xsm function is calculated, calculated from the values of the 802.11 packet header itself, the SEQ field, and user data.

Another promising encryption and integrity protocol, already proven in wired solutions, is AES (Advanced Encryption Standard). It has better cryptographic strength compared to DES and GOST 28147-89. The AES key length is 128, 192 or 256 bits. As already noted, it provides both encryption and integrity.

Note that the used algorithm (Rijndael) does not require large resources either in implementation or in operation, which is very important for reducing the data latency and processor load [4].

Virtual Private Network (VPN) technology was proposed by Intel to provide secure connection of client systems to servers through public Internet channels. VPN is probably one of the most reliable in terms of encryption and authentication security.

VPN uses several encryption technologies, the most popular of which are described by PPTP, L2TP and IPSec protocols with DES, Triple DES, AES and MD5 encryption algorithms. IP Security (IPSec) is used in about 65-70% of cases. With its help almost the maximum security of the communication line is ensured.

VPN technology was not designed specifically for Wi-Fi - it can be used for any type of network, but protecting it with wireless networks is the most correct solution.

The main disadvantage of using a VPN is its high cost. In addition, VPN has disadvantages similar to cryptographic protection methods [5].

III. Known methods of security

To ensure server resiliency, mechanisms such as replicated servers and quorum systems are usually used, but they increase the likelihood of secret disclosures due to the compromise of one of the servers. The scheme of sharing the secret between servers is struggling with this problem in such a way that the secret can be restored only if enough shares of the secret are received from the servers. For these purposes, you can use a distributed cryptosystem.

Probabilistic Secure Routing Scheme: This scheme is that for each destination the node supports a probabilistic distribution across all neighbors. This distribution is based on the relative likelihood that a given neighbor will transmit and ultimately deliver the message to the addressee. On each hop, the message is transmitted to a particular neighbor with some probability, based on the probability distribution of the reachability of the node.

Thus various paths are supported. Also, the transmission of messages in itself provides a response to adjust the probability distribution. For example, a signed confirmation of the delivery of the message will be a positive response to reachability by the way it was sent. Thus the scheme is called self-correcting.

Maintain different paths: To maintain reachability, you must find and maintain different paths between two nodes, that a small number of compromised nodes could not undermine all paths.

Discovery of routes by sending messages: Even a secure protocol for finding routes that prevents attempts to cheat by compromised nodes cannot do anything if the compromised nodes cooperate during the detection of

routes, but when sending messages, it will be easy to calculate them by their incorrect operation [6].

IV. Conclusion

IEEE 802.15.1, IEEE 802.15.4, IEEE 802.11, IEEE 802.16, GSM, 3G standards of information transmission are widely used as channels of wireless communication for ground-based special-purpose robots. The built-in information security systems (cryptography, broadband signals) used in the aforementioned standards are well described and researched, but for special purposes their use is ineffective because it is associated with the appearance of significant shortcomings.

The use of cryptography as a method of protection provides protection against traffic viewing and spoofing; however, this method is ineffective at intercepting information and suppressing the information channel by intentional interference.

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Аннотация. В данной статье рассматриваются и анализируются основные способы защиты информации в каналах связи инфокоммуникационных сетей. Беспроводной канал связи является одним из наиболее уязвимых элементов робототехнического комплекса.

Несанкционированный доступ (просмотр, подмена, перехват и подавление помехами), направленный на нарушение работы робота, может привести к критическим последствиям. По этой причине анализ методов защиты от угроз информационного обмена в беспроводном канале управления робототехнических систем специального назначения является актуальной задачей.

Ключевые слова: беспроводная сеть, канал передачи, алгоритмы шифрования, протоколы, защита информации.

Annotation. This article discusses and analyzes the main ways to protect information in communication channels of information and communication networks. Wireless communication channel is one of the most vulnerable elements of the robotic complex.

Unauthorized access (viewing, substitution, interception and interference suppression) aimed at disrupting the operation of a robot can lead to critical consequences. For this reason, the analysis of methods of protection against threats of information exchange in the wireless control channel of special-purpose robotic systems is an important task.

Keywords: wireless network, transmission channel, encryption algorithms, protocols, information security.

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MOBILE TRENDS IN 2019

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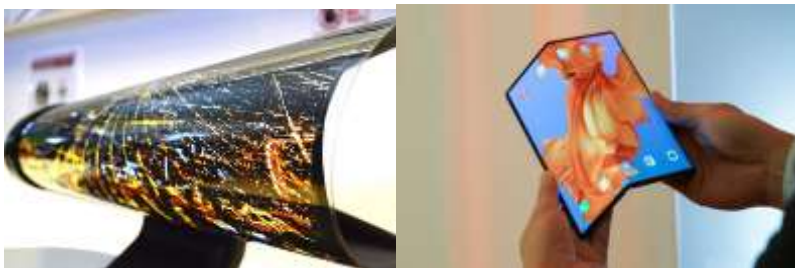
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Introduction. Smartphones producers try to surprise us with innovations every year. Everybody wants to create something new, which is not present at all. However, the innovations are "infectiousness" and everyone can buy a new product. The trend of developing accelerated mobile pages is now more obvious than before. The turning point for this trend was that Google presented the AMP project to the public: What should you be looking to integrate in the coming year. When it comes to mobile technology it is important to be ahead of the curve when adopting trends. These tech updates are often beneficial for marketers.

The **aim** of our article is to consider the most popular innovations in mobile realm in 2019 year.

An unambiguous standard a frameless design will become - a screen will occupy all frontal surface. This year a screen will be 88-89% at average smartphones. The producers of smartphones use different ways to reach the aim. For example, the producers of Apple gave up the scintiscanner of finger-prints and retained a person recognition. Huawei, Vivo, Oppo and Honor disposed the scintiscanner of imprints straight on the screen. For other smartphones of middle price category scintiscanners for fingerprints were placed on the backplane of a telephone.

There is another method that can help to attain maximal index of screen - to - body-ratio. It is a transferring of frontal chamber from a facial panel. Similarly, some designers plan to create openings instead of cuts. Another interesting trend is a flexible display. Developers invented absolutely NT and now they think of the most inconceivable devices, in fact besides flexible smartphones they created the first smart-watch with a flexible display (pict. 1). The flexible screens can be any size, and are easy to read in direct sunlight. They can be black and white or colour and are very thin and light. They use very little power, so there is no need for large batteries, and this makes them easy to carry around. This technology could be used for heart monitoring, smart-watches, second screens for mobile phones [1].



Picture 1 – Flexible display

Source: <https://www.printedelectronics.ru/ru/oblast-primeneniya.html>

Samsung on the first day of Samsung Developer Conference 2018 showed the long-awaited folding smartphone with a flexible screen. The ready solution will be this year

The novelty is equipped with Infinity Flex Display and can be deployed as a book. The main screen with a diagonal of 7.3 inches works in this mode. When folded, a small display on the front side of the device is used [2].

Similarly producers do not stop to surprise us more quality photos. Wide focus module, standard one, long-focus module for optical zoom,

module for creation of effect of side, module for a survey at night are all the already existent variants of mobile cameras. In spite of the fact that there is only one touch-control for the clever algorithms for a staggering photo, many producers continue to set a few cameras on the gadgets.

Maybe this year the first smartphone will go out with a five module back camera. A process and filming result will resemble computer graphics by means of it when programmatic algorithms and powerful processors "draw" an image on the fly. Photo on a smartphone is about 50 % of real computer graphics. Photo became similar one created by a professional mirror camera.

If 2018 was the year of the triple camera, 2019 will be the year of the quad or even quintuple camera monster. Or so Android Authority's Joe Hindy and Williams Pelegrin predict.

The introduction of telephoto, wide-angle, monochrome, and depth sensor camera combinations pushed smartphone photography capabilities up another notch this year. "It certainly wouldn't be a surprise to see manufacturers throw everything they can at both front and rear camera setups in 2019" [2, www]. Samsung already has a quad-camera phone with its Galaxy A9 2018 edition, and flagship models could go even further (pict. 2).



Picture 2 – Quad-camera phone

Source: 10 tech predictions from the staff of Android Authority <https://www.androidauthority.com/10-tech-predictions-2019-935988/>

Let's consider network 5G. This is a name of 5G mobile communication. 5G will unite smartphones and internet of things from one side, and artificial intelligence, large data and cloud computing with other. These networks will be able to provide not only the reliable and rapid transmission of large volumes of data on speeds in hundreds of one times of exceeding speeds modern networks but also minimize a delay to the signal. During testing the achievement of indexes of spades was fixed at the level of a 25,3 Gbps. It means that it will be possible to load films in permission of full HD for seconds. And the reduction of delay of a signal will allow using mobile connection even in those situations, when critically an

important value has a time of response. For example, for remote-control agricultural machinery, industrial robots or pilotless cars.

Distribution of networks of 5G fifth will result in the death of Wi-Fi, in fact our gadgets always and everywhere will have unlimited access to the internet. But a smartphone that supports them may need for the use of these networks.

At last let's consider scanners. Now producers try considerably to extend the range of "sensible" part. Already some companies worked out the concept of the smartphone, that will support technology of fullscreen fingerprint, that allows to unlock a smartphone by means of an imprint, attaching a finger to any place on the screen.

In conclusion it should be noted that mobile technology will continue to extend its functionality into applications. Developers have understood the need to deliver more immersive, innovative, 360° experiences to final users – and as such, they are trying to incorporate AR modules in their apps, to drive up engagement levels.

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Аннотация. В статье представлен перечень инновационных мобильных трендов. Целью исследования является рассмотрение наиболее популярных инноваций в мобильном мире в 2019 году. Прочитав статью, можно понять, что производители стараются значительно расширить ассортимент "разумной" части устройств.

Ключевые слова: смартфон, четырехъядерный камера, гибкий дисплей, монохромный, сканер.

Annotation. The article presents the list of innovative mobile trends. The subject of the research is to consider the most popular innovations in mobile realm in 2019 year. Upon reading the article one can realize that producers try considerably to extend the range of "sensible" part of the devices.

Keywords: smartphone, Quad-camera, Flexible display, monochrome, scanner.

ARTIFICIAL INTELLIGENCE IN CONTROLLING WILDFIRES

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Introduction. Artificial intelligence refers to the simulation of human intelligence in machines that are programmed to think like humans and mimic their actions. The term may also be applied to any machine that exhibits traits associated with a human mind such as learning and problem solving [1].

The ideal characteristic of artificial intelligence is its ability to rationalize and take actions that have the best chance of achieving a specific goal. The **purpose** of the article is to consider ways of modeling human intelligence in machines and to study some facts from the history of artificial intelligence.

Main part. The first theoretical development and refers to the 40s of twentieth century, which could be implemented using existing computers. In 1943, Warren McCulloch and Walter Pitts proposed a model of an artificial neuron. They published their works under the title "A Logical Calculus of the Ideas Immanent in Nervous Activity" which laid the foundations for artificial neural networks.

In 1950 Alan Turing published a fundamental article "Computer engineering and intelligence" about artificial intelligence. It describes the well-known test, which is considered the gold standard for assessing the abilities of artificial intelligence. All test participants do not see each other. If the judge can't say which of the interlocutors is person, it is considered that the machine has passed the test. For the test the intelligence of the machine, the conversation is conducted in text mode. Correspondence should be conducted at controlled intervals so that the judge cannot draw conclusions based on the speed of responses.

At the same time, the concept was born, called Baby Machine. It involved the creation of machines in which thought processes are first formed at the level of the child and then gradually improved.

The term "artificial intelligence" originated in 1956 at the Dartmouth conference. The active development of machines with artificial intelligence capabilities began after that meeting.

There are more complex tasks for researchers in modern life. Today the development of AI is conducted in completely different conditions, if we compare what happened during the birth of artificial intelligence. The processes of globalization, the actions of cybercriminals in the digital sphere, the development of the Internet and other problems – all this poses complex challenges for scientists, the solution of which lies in the field of AI.

Controlling the spread of forest fires requires a detailed understanding of the forests and how to manage them – something that is beyond all but a handful of specialised experts [2].

Earthquakes, tsunamis, flooding and wildfires are nature at their most fierce and uncontrollable. But predicting when and where they might strike could help save lives.

For example, SilviaTerra (San Francisco) is a company using artificial intelligence to map forests, providing resources to help planners reduce the risk of fires. Satellite data along with aerial photographs and laser scanning techniques are used to measure the spread of vegetation.

Once the maps are complete, machine learning algorithms help to identify the areas most at risk of fire. Machine learning technology could not just help to coordinate the response to disasters, but also help in the rescue efforts themselves. Robots would use AI-powered machine vision to help them interpret what they are seeing and make their own decisions.

In **conclusion** it should be said that Artificial intelligence is continuously evolving to benefit many different industries. Machines are interconnected using a cross-disciplinary approach based in mathematics, computer science, linguistics, psychology, and more [3].

The development of AI is at the level of the child today. Artificial intelligence has no mission, and the tasks are set for it in order to automate processes and reduce resources. Some researchers believe that artificial intelligence could help provide an early warning of natural disasters themselves.

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Аннотация. Рассматривается моделирование человеческого интеллекта в машинах, запрограммированных думать как люди и имитировать их действия. Изучены некоторые факты из истории развития искусственного интеллекта. Отмечается, что контролировать распространение лесных пожаров можно с помощью ИИ.

Ключевые слова: искусственный интеллект, лесные пожары, технология машинного обучения.

Annotation. Simulation of human intelligence in machines that are programmed to think like humans and mimic their actions are considered. Some facts from the history of Artificial Intelligence development are stated. It is noted that controlling of forest fires spread is possible by means of AI.

Keywords: artificial Intelligence, machine learning technology, natural disasters, risk of fire, rescue efforts.

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INTERNET OF THINGS

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The Internet of things is a concept of space which combine both the analog and digital worlds. IoT devices include not only computers, laptops and smartphones, but also objects that have been equipped with chips to gather and communicate data over a network. “What do wearable tech, smart homes, smart cities, and intelligent transportation systems all have in common? They are current applications of a widespread, worldwide technological development known as the Internet of Things (IoT)”[1, www]. This will redefine our relationship with objects, as well as the properties and essence of the objects themselves. Internet of things is a

single network connecting the surrounding real world objects and virtual objects.

Moreover, wireless connectivity is now becoming standard in a rapidly growing subset of new products across the globe. Some experts predict that by 2025, there will be a total of 1 trillion networked devices worldwide in the consumer and industrial sectors. Internet of Things is not just the latest buzzword: it is where our world is heading [1]. The article deals with the following issues:

- Internet of things features
- Relevance of the Internet of things
- Internet of things application

As an example, a fitness watch that in the morning can fix your waking up and send a signal to the kettle, which warm up the water while you brush your teeth or doing something else.

In the Internet of things we are not talking about the usual process automation, because it involves the presence of a person in the system, we are talking about the complete absence of a person from the system. The devices of the smart world will need only the initial setup, then on the basis of experience they will be improved to the needs of the person.

For example, a person who looks at the sensor readings at the machine, will no longer be needed in the system, and a gadget will perform instead of man. It will send this data to the computer, the computer in turn will analyze whether the maintenance of this machine is necessary, if so it will send another signal to another gadget. The classical scheme "Man→Machine" will change to "Machine→Machine". This will reduce the presence of a person, and thus reduce the negative consequences that could be during the stay of a person in this system.

The future of artificial intelligence, is not a fantasy, it's reality, right now. The Union of all smart devices creates the same network of "smart home" in which things work together to make a person comfortable at home. The most widespread Internet of things is in the field of agriculture and the name of it - SmartFarming. Farmers of civilized countries use the Internet of things to run their farms. For example, cows, pigs, horses are connected to a special device equipped with special sensors that accurately assess the condition of the animal. If the cow is hungry it is given food without human participation. Bundles of things that monitor the fields are used in agriculture. For example, it is easy to irrigate the territory by means of drones, previously helicopters with water tanks were used. Special drone rises and analyzes arid areas. If it sees somewhere in the arid zone it gives signal to the processor which waters the territory. Gadgets in the

SmartFarming system are able participation to solve problems on farms without human intervention.

Smart home, smart field, all these contain millions of sensors that constantly monitor us, analyze our activities, learn our preferences and in the future it is possible that someone will be able to use it and our data will be used.

Smart home hubs, thermostats, lighting systems, and even coffee makers collect data on your habits and patterns of usage. When you set up voice-controlled devices, you allow them to record what you say to them and store those recordings in the cloud. In most cases, the data is collected to help facilitate what is called machine learning [2].

Most often, copies of block chains are stored on a variety of different computers independently of each other, there was a unique cryptocurrency IOTA, its developers took up the creation of a secure Internet of things, developing a unique own Block Chain called Tangle, its advantages include the fact that it has no problems with scaling like a conventional Block Chain. In the classic Block Chain, the more participants are present in the system, the worse it works.

The Internet of things is already transferred to industrial production, for example in Japan a transport infrastructure will be developed by means of the Internet of things, based on the technology of the Block Chain.

Future applications of IoT might include:

- Smart wristwatches that provide directions to the nearest fire extinguisher in case of a fire;
- Pens that “remember” and store a consumer’s hand motions, thus recording what it has written;
- Implanted organs that can notify hospitals when they begin to fail;
- Homes that “learn” and “adapt” to their owner’s needs by activating or deactivating residential devices based on its predictions of the owner’s behavior;
- Cars that automatically reduce energy as they “sense” approaching gas stations; or
- Water conservation systems that automatically conserve water based on weather predictions.

In conclusion it should be stated The future of the Internet of things is inevitable, technology is increasingly integrated into our lives and the moment will come when people will depend on them. Daily manipulations will be performed by artificial intelligence cooking, maintaining health, cleaning, climate control, everything will be in the hands of smart devices. This is all our future, because the greatest costs for the Internet of things were summed up at the end of 2018, and they were connected with

production operations, management of production assets, smart home systems and monitoring of transportation.

By 2022, the highest growth rates of IoT investments are expected in the following areas:

- automation of facilities at the airport;
- charging electric vehicles;
- monitoring of processes in agriculture;
- medical telemetry;
- contextual marketing in the store.

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Аннотация. В статье рассматриваются особенности интернета вещей, его актуальность и применение. К устройствам IoT относятся не только компьютеры, ноутбуки и смартфоны, но и объекты, оснащенные чипами для сбора и передачи данных по сети. Будущее Интернета вещей неизбежно, технологии все больше интегрируются в нашу жизнь.

Ключевые слова: Интернет вещей, блокчейн, SmartFarming.

Annotation. The article deals with the Internet of things feature, relevance of it and its application. IoT devices include not only computers, laptops and smartphones, but also objects that have been equipped with chips to gather and communicate data over a network. The future of the Internet of things is inevitable, technology is increasingly integrated into our lives.

Keywords: Internet of things, Block Chain, gadgets, SmartFarming.

UDC 004.35

WEB-DESIGNER VS WEB-DEVELOPER

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Introduction. The terms web-designer and web-developer are used interchangeably in advertising and mass media but they are not synonyms. Almost every person is familiar with the Internet whereby he/she visits different websites to find some information. Web-design is responsible for a visual perception of these websites and web-development is responsible for its functionality.

The aim of this article is to consider the differences between these occupations, their skills and the basics of their job.

“At present, the boundaries between web designers and web developers are getting blurred. More and more designers began to learn to code, and developers are beginning to pay close attention to design theory” [1, www].

Main part.

It should be noted that there are differences in web-design and web-designer skills. To begin with, the meaning of these terms is the same as both create the outer shell of sites.

Web-designers use graphic design tools (Photoshop or InDesign). Most of them need to know HTML to better understand the work and be able to carry out their projects and various websites by themselves. The web-designer is responsible for using animation and knowing a web content layout to be able to change or rewrite the website ‘stuffing’, if necessary.

What is web-development and what is this job?

Web-development is a process of qualified site programming related to the regulation of HTML-code creation stages, the addition of various scripts and functional components. The task of developer is to create the infrastructure for optimized functionality of website. Web-developers use encoding technologies, JavaScript programming language and various text editing programs in their work. What the skills and tools they should master as follows:

Source code management tools: SVN, CVS, Git, etc;

IDE: VS Code, WebStorm, Sublime etc. All these are excellent IDE, you can choose and master any one of them;

Front-end development technology: JavaScript, HTML, CSS and so on.

Front-end framework: jQuery, React, Bootstrap and so on [1].

Differences between Web-design and Web-development.

Firstly, they have different goals. Designer performs a web-design and can define its set of functions using various graphical applications while developer creates this website. Web-developer can spend considerable time upgrading the code for old applications and try to add new functions to

them, instead of abandoning the product altogether to create something new. When it comes to design, customer is more likely ask to create a new website than to improve the existing.

Secondly, the difference is in the implementing. Both web-design and web-development require a certain level of programming skill. However, this level is much higher and better for development, since not all designers will need to immerse in developers' job. The designer controls the process of site navigation, while the developer focuses more on how a website visitor will be able to take certain actions.

Web-design or web-development?

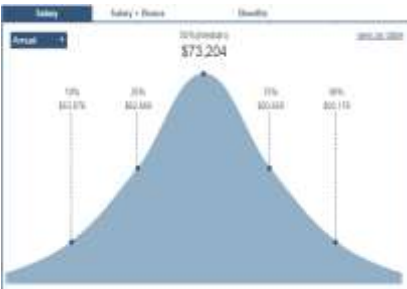
Most of you certainly wondered what to choose after all: web-design or web-development. Since the world of programming may look very complicated for uninitiated people, we will further try to give a detailed answer to this question.

The services of developers and designers who are equally good both with graphic work and with website programming are popular in this field.

Complex website development allows one person to fully develop a project from a visual layout to functionality and external promotion. Nowadays some specialists started to study at once several fields of a website development process therefore the distinction between web-design and web-development has gradually become to blur.

There are differences between web-designer and web-developer jobs. The salary for web designer differs from one of web-developer.

Usually designers earn less than developers (pict. 1, 2). For the first ones, a portfolio is important and for the seconds – a code. Web-designers are creative and artistic personalities while web-developers differ by an analytical mind.



Picture 1 – The salary for web designer



Picture 2 – The salary for web developer

Source: <https://www.mockplus.com/blog/post/web-designer-vs-web-developer>

The figure 1 is the expected percentage of American web designer salary, which is lower than the annual salary. For example, the average

annual salary of a web designer in the US is \$ 73,204. The chart 2 depicts the percentage of people working for network software developers in the US, which is less than the annual salary. For example, the median annual salary of a typical U.S. network software developer is \$ 77,458 [1].

In conclusion, we can say that many specialists of both occupations understand the vision of each other's work. However, most companies and organizations prefer to have both specialists.

Conclusion. Web-designers perform a difficult work to create an enabling environment for a user, making a convenient design and attractive interface for the pleasant and comfortable using of website.

They have to know the web-basics, master the related instruments, understand how to write scripts and in which languages, etc.

Both specialists should work together to create a successful website for a customer and live up to his/her expectations. Only in some very exceptional cases, one person can properly combine the skills of both activities. Thus the beautiful web interface is originally created by web designers, and the developer is responsible for turning the nice image into a page that really shows to the visitors. Web design and web development both require some level of programming knowledge.

There are many students with such skills at Sevastopol State University who can work in two structures simultaneously.

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Аннотация. Авторы анализируют различия между веб-дизайном и веб-разработкой. Указаны различия между работой веб-дизайнера и разработчика. В заключение представлены основные сходства между рассматриваемыми специальностями.

Ключевые слова: веб-дизайнер, Веб-разработчик, навыки программирования, внешнее продвижение, портфолио, код.

Annotation. The authors try to analyze the differences between web-design and web-development. The differences between web-designer and web-developer jobs are stated. In conclusion the main similarities between considered jobs are presented.

Keywords: web-designer, web-developer, programming skill., external promotion, portfolio, the code.

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COULD GOOGLE CHANGE THE FUTURE OF GAMING?

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Google intends to change the future of gaming. Could you image that you can play your favorite games wherever you are? Google Stadia can do it. In March 2019 Google announced new game-streaming platform “Google Stadia” and world gaming industry had changed. Stadia's cloud based gaming infrastructure delivers beautiful HDR graphics and smooth frame rates. Devices on Google Play moved to the new Google Store.

There were many Google improvements in 2018.

- It launched an ad filter to keep you safe from malicious and annoying ads;
- It helped move the web to HTTPS to keep you secure online;
- It launched site isolation which provides deeper defense against many types of attacks including Spectre;
- It brought VR and AR browsing to Chrome.

And Google is now rolling out a set of new experiments to improve Chrome's startup time, latency, usage of memory, and usability. “As someone that who has used PlayStation Now on multiple devices, the ease of transferring from one platform to the other was a true delight as there weren't any 15-second loads or initialization processes to go through” [2, www].

What's Google Stadia? It is cloud service available on a number of devices, and if you have good internet connection you can play in any supported region of the world. You don't need high-performance hardware to run games only Google Chrome browser, it is all what you need.

How does service work? The service uses Google's own servers run games, which you can then connect to and play whenever you would like on any screen in your house like desktop, laptop, TV, phone etc. Games on the service are already downloaded, that means you don't have to waiting for updating and installing game before you can start playing. At the initial

stage two games will be available. These are Doom: Eternal and Assassins Creed: Odyssey (pict.1).



Picture 1 – Google's Odyssey

The graphics chip is to deliver 10.7 teraflops of power compared to the PlayStation 4 Pro's 4.2 teraflops and the Xbox One X's six teraflops of power. All of that will be complemented by a custom-made 2.7GHz x86 CPU with 16GB of RAM.

The main problem is that no matter how fast Google servers, system performance depends on your internet speed and quality. If you have internet connection less than fifty megabits probably you will have a heap of problem.

Google Stadia's technology is probably going to work. We haven't used it, but we thought that was good enough. Now we don't know how much the service costs, the full library of games it will have on it and how it will work. If Google can create a service that works good for everyone and have nice pricing model that makes sense and

But will Google's game-streaming service change the world of gaming?

Streaming might be the future of gaming, but there's a reason why so much of the world has been resistant to this change.

We tried to analyze some experts' opinions and came to conclusion:

1. This isn't an issue that impacts those in rural areas. According to Internet World Stats, as of December 2018, only 55.6 percent of the world has internet access at all, let alone high-speed access. Considering Google wants to expand gaming beyond its current base, there is still a lot of work to be done in just making Stadia available to all.

2. Another issue is that simply building a great platform isn't enough to get people to change their gaming habits and switch to it. One only has to take a look at the Xbox One X to know that. Systems live or die by what exclusive titles they have. Players won't make a leap and change their gaming habits until they are given a good reason to, and Google will have to deliver the goods first as these current words are just empty promises without anything to back them up.

3. Another worrying part of Stadia is how often Google will launch a service and then abandon it a few years down the line. Google Hangouts, Google Reader, Google Plus are all services that had plenty of promise and delivered innovation, but Google never fully invested in them. Will the tech giant give up on gaming the same way?

In conclusion it should be said that despite these three reasons Google Stadia is a great idea that is built for where society is heading. Many people use multiple electronic devices every day and everywhere. There is no options shortage and with technology constantly improving, this type of jumping between devices will only become more common [2].

This is why Stadia's design, and being able to switch devices is a huge advantage to it and can go anywhere or any sort of device with the significant caveat of their being high-speed internet access.

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Аннотация. Как следует из названия, статья описывает новые игровые сервисы Google. Текст дает ценную информацию о Google Stadia. Подробно говорится об этой новой услуге. Автор попытался объяснить: будет ли Google раскрывать будущее игр? Статья представляет интерес для людей, которые любят играть в игры.

Ключевые слова: Google Stadia, game-streaming сервис, Chrome, графический чип, игра.

Annotation. As the title implies the article describes new Google game services. The text gives valuable information about Google Stadia. It is spoken in detail about this new service. The author tried to explain: would Google reveal the future of gaming? Streaming might be the future of gaming, but there's a reason why so much of the world has been resistant to this change. The article is of interest to people who like to play games.

Keywords: Google Stadia, innovation, game-streaming service, high-speed internet access, Chrome, graphics chip, game.

ARE ROBOTS REPLACING JOBS?

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Introduction. Robotics is an applied science that develops automated technical systems and is the most important technical basis for the development of production. Some scientists predict that robotics and artificial intelligence will destroy 5 million jobs by 2020 80 to 90 percent of jobs will be eliminated in the next 10 to 15 years, 47 percent of jobs are “at risk” of being automated in the next 20 years, about half the activities people are paid almost \$15 trillion in wages to do have the potential to be automated, and about 60 percent of all occupations have at least 30 percent of constituent activities that could be automated [3]. “The most transformative aspect of automation is that it gives us the opportunity to create a thriving civilization which serves humanity and the planet by changing the definition of a job from something that people have to do to survive, to what they want to do for personal satisfaction” [3, www].

The **purpose** of the article is to consider the origin of the term, some facts of the development of robots and to answer the question whether the robot will replace jobs in the future.

Main part. The word "robotics" was first used in print by Isaac Asimov in the science fiction story "The Liar", published in 1941. Three laws of robotics in science fiction are the obligatory rules of behavior for robots, first formulated by Isaac Asimov in the story "Round dance" (1942). Laws say:

- 1) A robot can not harm a person or by its inaction allow to be harmed.
- 2) A robot must obey all orders that a person gives, except when these orders contradict the First Law.
- 3) A robot must take care of its security to the extent that it does not contradict the First or Second Laws.

Let's consider the history of the development of robotics. The robot should be distinguished from simple mechanisms and automata. This device has the ability to interact more closely with the operator and the external environment. The robot is able to perceive external signals and adapt its actions in accordance with them. Thus, its interaction with the

external environment becomes more flexible, accurate and versatile. Even the very first robots in the world had primitive analogs of the sense organs, without which this fundamental difference would be impossible.

The history of the creation of robots is closely intertwined with the development of mechanics and logically stems from it. Ancient Greek mathematician and inventor Archi Tarentsi invented the wooden pigeon in the 5th century BC, which was launched into the sky with the help of a steam catapult.

Ancient Greece can be considered the birthplace of robotics, because many automatic devices were not just built here, but the principles of their creation and functioning were theorized.

"Robots" of the Middle Ages

The Middle Ages were not an era of general decline and technological regress. Science, including mechanics, continued its development. Surprisingly, many complex devices came into being thanks to the Church. In those days, Catholic monasteries were one of the centers of scientific and engineering thought. In particular, the legends attribute to the most prominent scientist and theologian Albert the Great the creation of a "mechanical handmaid" who could move independently and even reproduce speech.

Leonardo da Vinci, being a genius of engineering, proposed schemes of various mechanisms, one of which is the figure of a knight chained in armor. The collected sample was demonstrated by the inventor at the court of Louis Sforza in 1495. In the 20th century, an exact and functional copy of this device, now stored in the Museum of Milan, was reproduced from preserved drawings.

New time: the golden age of automatons

The automatic mechanisms gained real popularity and rapid development from the beginning of the Renaissance. The science, having escaped from the monopoly of the Church, received an additional impetus to development, including by rethinking the achievements of ancient scholars.

Swiss Pierre Jaquet Droz, who lived in the same 18th century, founded the famous watch company Jaquet Droz. At that time, he became popular not only for his chronometers, but also for his complex devices, among which three of his works are especially known:

"The Scribe" is an automatic figure of a boy, containing about 4,000 details, was able to write any text of 40 characters, independently dipping a feather in the ink-pot;

"Artist" is a similar automaton, but instead of text, he applied various drawings on paper, such as portraits of people, images of animals, etc;

“Girl-musician” is an automaton in the form of an organist who could play 5 different melodies on a small organ, while moving her head and body, and at the end of the performance she was gracefully bowing.

A distinctive feature of these automatons was the ability to program them, for which drums or discs with notches were used, in which the sequence of actions was coded. By changing their location, the master could force his devices to write various texts, play another melody, etc.

The present stage of development of robotics

The development of electricity technology gave humanity a new source of energy that could power the device for a much longer time. At the same time, the first attempts to make complex mechanisms work for a person begin, replacing his labor in production.

The man who created the first operating robot is an American engineer Roy Wensley from the Westinghouse Electric Company. The mechanism called “Herbert Televox”, developed by him in 1928, was a humanoid machine capable of opening doors and windows, turning off the oven, electric motors, etc. The most important difference of this invention was the ability to respond and respond to commands sent to it by telephone .

In 1948, in the United States, General Electric created the first industrial robot to operate in a nuclear reactor. In the mid-50s, American George Devol founded the company Unimation, which was engaged in the release of the first serial industrial robots, programmed using punched cards. By the mid-60s in developed countries, there were several dozen companies that have established the production of such machines. Japan has particularly succeeded in this - having bought the first robots from “Unimation” in 1968, already 10 years later this country became the world leader in producing its own analogues and equipping them with production facilities.

The first tragedies involving robots

We must not forget that nothing and never passes the way we would like with you. So, as a result of possible failures, mistakes, or simply negligence, people may suffer because of robots. And such cases occurred and will occur in our history with you.

January 25, 1979, Robert Williams died due to a wound to the head, which he received from a robotic arm at the Ford plant in Flat Rock, Michigan, USA. Accumulated errors in the software of the robot led to its incorrect operation, and Williams, violating safety regulations, climbed the stairs to the rack behind the desired part, where he received a fatal blow to the head.

Kenji Urada became the second, but by no means the last, victim of automatic devices in production. A robotic arm pushed an engineer into an

automatic crusher, in which the employee died in 1981 at the Kawazaki plant in Akashi, Japan.

Nowadays. Millions of robots are used in the world today. Robots control airplanes and trains, descend into volcano vents and to the ocean floor, assist in building a space station, assembling cars and producing microchips, guard buildings, are used by military for reconnaissance and demining, help rescuers find people under the rubble.

Diagram below shows a number of installed industrial robots per 10,000 employees in the manufacturing industry 2016.

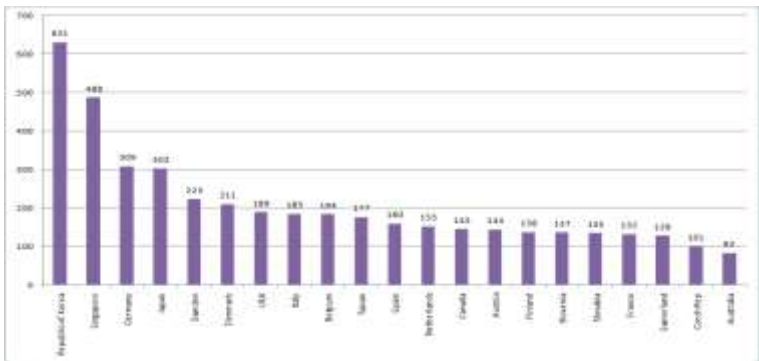


Figure 1 – A number of installed industrial robots per 10,000 employees in the manufacturing industry 2016

In the early 2000s, robots entered the household: lawn mowers, robot vacuum cleaners and floor washers. iRobot has already sold several million Roomba rob-vac. Wiser and motionless cars: washing, dishwashing, etc. Home robots quickly enter our life.

Robots in the near future

Today's cars will become much wiser: at first, they will only help drivers to perform certain operations (difficult parking, control over safety, driving on the highway), but then they will take over the whole process of driving.

Robots will be increasingly used in medicine. By 2020, a significant part of the operations will be performed by robots, and the first microrobots will begin to monitor the health of people inside their bodies.

Impact on the economy and society

The emergence of robots will have a huge impact on the economy. Human physical labor will become unnecessary in many areas. The attitude of people towards the spread of robots will depend on the political and economic system. Super cheap robot work will make it possible to increase

the cost of waste recycling, environmental protection and safety. Diagram below shows how much money is spent on the production of robotics.

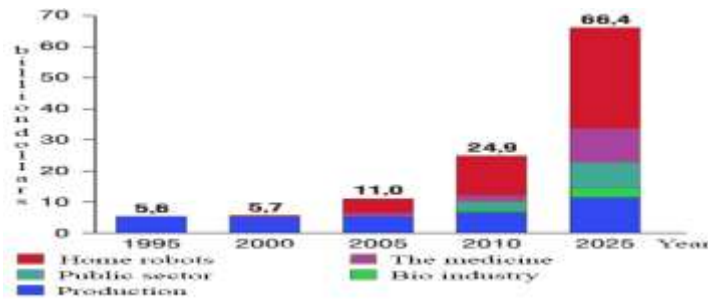


Figure 2 – The production of robotics

Nanobots. In the near future microrobots will be actively used, measuring in centimeters and millimeters. They will be used in medicine, in agriculture (as smart sensors) and in many other areas. Nanorobots will be able to carry out the construction of the necessary structures of molecules and atoms, which will allow to do without the special preparation of raw materials. This means that even individual nanorobots will be fairly independent. A nanorobot is a machine that can build and manipulate things precisely at an atomic level. It is essentially machines programmed with a function like “read messenger RNA to create a specific protein” [1].

Nanomachines can not only produce, but also repair, including the cells of the human body. It is medical nanobots that will make a person not just ageless and not diseased, but also practically invulnerable. A set of invisible nanorobots in the form of "constructive fog" will fill the space at the surface of the earth, ready to instantly transform into any object on the first mental command of a person. The applications of these nano and micro-machines are nearly endless (tabl.1).

The most innovative companies in the field of robotics are:

- IRobot (for maximizing doctor-patient face-time);
- Recon robotics (for building an army of throwable spybots);
- GOOGLE (for taking robot cars to Vegas);
- Mazor robotics (for turning robots into brain surgeons);
- SpaceX (for getting to the space station, and back, with a robot spacecraft. Dragon capsule docked with the International Space Station, a milestone for the burgeoning commercial space industry);
- Lockheed Martin (for flying robot pilots. Like other defense contractors, Lockheed Martin develops its share of death-dealing hardware);

- PV-Kraftwerker (for harnessing machines to harness the power of the sun. With the upfront costs of solar power slowing its widespread adoption, this robot is a glimpse of brighter days ahead);
- Boston dynamics (for making humanoid robots with a purpose);
- EKSO BIONICS (for bringing wearable robots to market. The Ekso Bionics exoskeleton is life-changing technology);
- Seegrid (for proving that forklifts are not as scary as they sound) [2].

Table 1. Nano and micro-machines application.

Application	Description
Cancer Treatment	Identifying and destroying cancer cells more accurately and effectively.
Drug Delivery Mechanisms	Targeted drug delivery mechanisms for disease control and prevention.
Medical Imaging	Creating nanoparticles that gather in certain tissues and then scanning the body with a magnetic resonance imaging (MRI) could help highlight problems such as diabetes.
New Sensing Devices	Nanorobotics would unlock new sensing capabilities we can integrate into our systems to monitor and measure the world
Information Storage Devices	5.5 petabits of data — around 700 terabytes — are stored in a single gram of DNA, smashing the previous DNA data density record by a thousand times.
New Energy System	Nanorobotics might play a role in developing more efficient renewable energy system.
Super-strong Metamaterials	New type of material, made up of nanoscale struts crisscrossed like the struts of a tiny Eiffel Tower, that is one of the strongest and lightest substances ever made
Smart Windows and Walls	Electrochromic devices, which dynamically change color under applied potential, are widely studied for use in energy-efficient smart windows — these can control the internal temperature of a room, clean themselves, and more.
Ocean-cleaning Microsponges	A carbon nanotube sponge capable of soaking up water contaminants such as fertilizers, pesticides
Replicators	Also known as a “Molecular Assembler,” this is a proposed device able to guide chemical reactions by positioning reactive molecules with atomic precision.
Health Sensors	These sensors monitor our blood chemistry, notify us when something is out of whack, detect spoiled food or inflammation in the body, and more.
Connecting Brains to the Internet	Nanorobots will allow us to connect our biological nervous system to the cloud by 2030.

In **conclusion** it should be said that any technology system is programmed, it doesn't think on its own. Even if you have an AI system, it still doesn't match the complexity of the human brain, at least right now.

It is clear that autonomous robotic operation equipment is banned after failed operations. So do robots cannot be replace at something and mostly human can perform logical decisions.

Humans are the ones using, creating as well as adjusting the technology to suit their needs. Humans are also the one to bring in all the necessary solutions that make the process simpler and increase performance in the first place [4]. In the future, we cannot guarantee that technology won't be able to think and create with the complexity level of the human's brain. Technology is still a productive assistant to human [3].

Research finds that only specific tasks within jobs, rather than entire occupations themselves, will be replaced by automation in the near future, with some jobs more heavily impacted than others. there will always be jobs to be done, but not in the form as we know it today.

There will always be transformation and augmentation of tasks within jobs, not the jobs themselves.

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Аннотация. Автор рассматривает происхождение термина, некоторые факты развития роботов, первые трагедии с участием роботов. Автор приходит к выводу, что только конкретные задачи в рамках рабочих мест, а не целые профессии, будут заменены автоматизацией в ближайшем будущем.

Ключевые слова: робот, человек, наноробот, робототехника.

Annotation. The author considers the origin of the term, some facts about robots development. The first tragedies involving robots is stated. The author comes to conclusion that mostly human can perform logical decisions. Only specific tasks within jobs, rather than entire occupations themselves, will be replaced by automation in the near future.

Keywords: robot, humans, jobs, innovative, nanorobot, nanobot, robotics, logical decisions.

UDC 004.912:577.21

PROGRAM FOR THE PREDICTION OF PCR PRODUCTS AND THE SEARCH FOR DNA TRANSPOSONS

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Relevance process automation consequence development of bio-information technologies. From year to year, number of genomes which primary nucleotide sequence has been deciphered is rapidly increasing, and therefore, there is growing need for developing software products that will allow you to process data sets quickly and efficiently. And there is a need for both programs that require large resources, and for light applications that can be used on ordinary office computers. The number of applications for software products is also steadily increasing as data is processed and new research tasks and strategies emerge. For example, prediction products polymerase chain reaction (PCR) is necessary as this analysis is expensive and time-consuming.

That is why is essential to create such program which will allow you to know in advance outcome analysis. Another area is search for DNA transposons, one classes mobile genetic elements. This software allows you to search for them, thereby expanding area that studies spread of MGE in genome organisms. Below you can find a program model presentation of PCR products and search DNA transposons in figure 1.

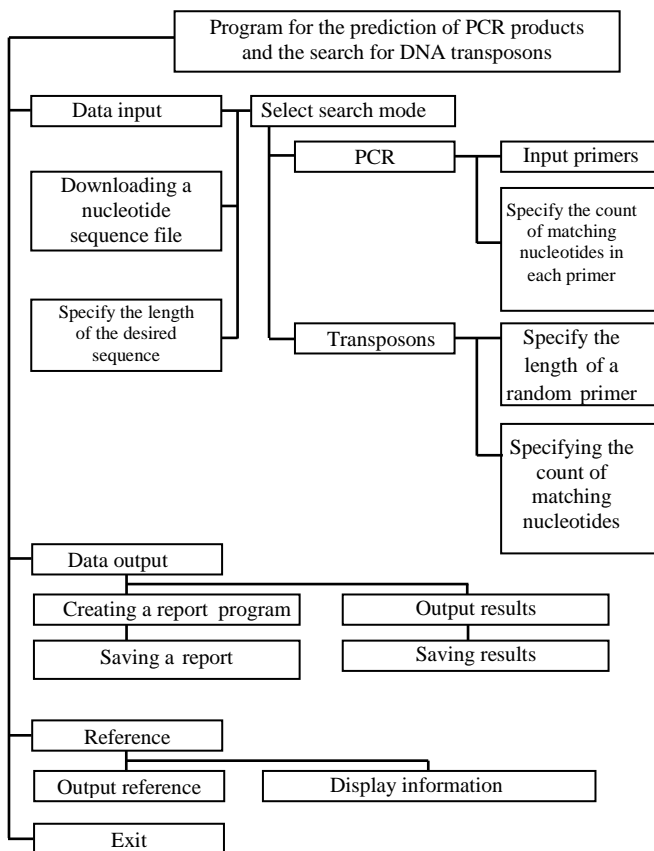


Figure 1. – A program model presentation of PCR products and search DNA transposons.

We cannot but introduce program description. The window of program is a workspace in which user can perform all basic actions.

Program is sure to provide main menu, it allows access to following actions:

- download nucleotide sequence file;
- reversal of data field for manual analysis of results;
- transition to additional subprogram “Actions with primers”;
- help output;
- display information about program;
- exit from program.

Program has a field for loading a sequence of nucleotides, which is static for each type of search.

Depending on type of search selected, interface of main window changes. Interface for “PCR” search type is presented in figure 2.



Fig. 2 – The PCR form interface

For each primer, a separate input field is provided - "Primer 1" and "Primer 2". Number of matching nucleotides is indicated independently for each primer. Length of desired results is entered in appropriate fields "Result Length: from ___ to ___".

It is possible to search for undefined parts of sequence for which “N” flag is responsible. To search for individual primers, “Include” checkbox is provided; length of “tail” taken with a separate primer is indicated in “Length” field.

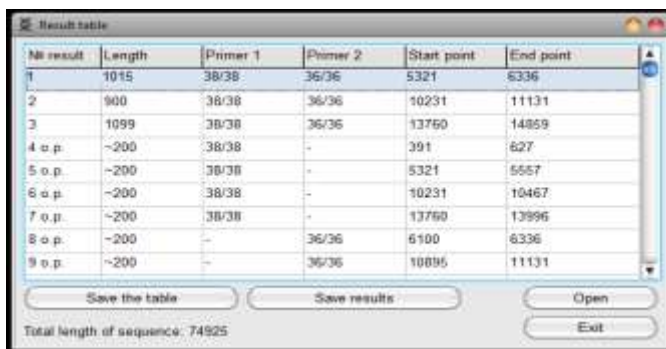
Search mode “Transposons” – when this search type is selected, primer input panel is replaced with two fields – length of primer and number of matching nucleotides. Controls, form of up and down arrows, are left to change value of these fields. The “N” flag, and “Separate primers” function are blocked, since this type of search does not need them. File download occurs as when searching for "PCR."

After end of program (excluding “PCR (files)” type of search, since results are saved automatically), user has two options for viewing results, namely: directly entering its number or using results table.

The “results table” is an improved version of viewing the results, it provides minimal additional information:

- result length;
- number of nucleotides in primers
- number of matched nucleotides for each primer;
- starting point is place from which result was collected in relation to entire sequence;
- end point;
- total length of sequence.

The results table is shown in figure 3.



No result	Length	Primer 1	Primer 2	Start point	End point
1	1015	38/38	36/36	5321	6336
2	900	38/38	36/36	10231	11131
3	1099	38/38	36/36	13760	14859
4 o.p.	~200	38/38	-	391	627
5 o.p.	~200	38/38	-	5321	5557
6 o.p.	~200	38/38	-	10231	10467
7 o.p.	~200	38/38	-	13760	13996
8 o.p.	~200	-	36/36	6100	6336
9 o.p.	~200	-	36/36	10895	11131

Save the table Save results Open Exit

Total length of sequence: 74925

Fig. 3 – Results Table

When viewing results table, you can save it, save all results, view individual results and save them.

When displaying a separate result, both from main working form and from table, it is possible to save it separately in .fasta format, or in .txt format. There is a button on form to display additional information about a particular result. Along way, with output of result, more detailed additional information is created for it, which stores full entered primers and found ones.

Additional subroutine for actions with primers can be accessed from “Menu”, “Advanced”, then “Actions with primers”. Main action of subroutine is translation of primers and comparison. When translating a primer, user can choose which chain at output he needs to obtain: complementary or inverted (these functions can be combined). Same functions can be used when comparing. When comparing primers, nucleotides that are not matched are highlighted in red.

To sum everything up it can conclude that, today, this software is relevant. It allows you to pre-determine products of polymerase chain reaction, which reduces cost of this analysis, as well as provides ability to search for DNA transposons, thereby expanding field of studying distribution of mobile genetic elements in genome of organisms.

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Аннотация. Данная статья посвящена автоматизации процесса поиска ДНК-транспозонов, а также продуктов ПЦР (метод полимеразной цепной реакции). Статья представляет собой описание необходимости реализации программного обеспечения для этих целей. Описываются модели программы.

Перечисляются возможности, которые предоставляет данное программное обеспечение. Анализируется реализация интерфейса и даются методы работы с программой. Приводится список ссылок, которые использовались для создания и тестирования программы.

Ключевые слова: Биология, генетика, ДНК, ПЦР, транспозоны, биоинформационные технологии, программирование.

Annotation. This article focuses on automating the process of searching for DNA transposons as well as predicting PCR products (Polymerase chain reaction). The given paper is a description of the need to implement software for these purposes. Program models are described.

The capabilities that this software provides are enumerated. The implementation of the interface is analyzed and the methods of working with the program are presented. A list of links that were used to create and test the program is given.

Keywords: Biology, genetics, DNA, PCR, transposons, bioinformatics technologies, programming.

UDC 621.39

READER OF RADIO FREQUENCY IDENTIFICATION NFC

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Introduction. In the modern world near field switching technology NFC is widespread. This technology operates at a frequency of 13.56 MHz, usually has a small radius of action, about 20 cm.

This technology allows to establish a connection between devices, so it is widely used in contactless payment and access control systems [1].

Main part. The report discusses the implementation of NFC reader in the access control system. This reader is planned to be used to control access to the audience. Information about incoming people it will send to your PC via Wi-Fi technology.

A simplified block diagram is shown in fig. 1.



Fig. 1 — Simplified block diagram

The scheme includes: NFC reader, microcontroller and Wi-Fi.

As NFC reader has been selected, the module MFRC522. The choice of this module is due to the low price and availability. Simplified block diagram представлена на fig. 2.

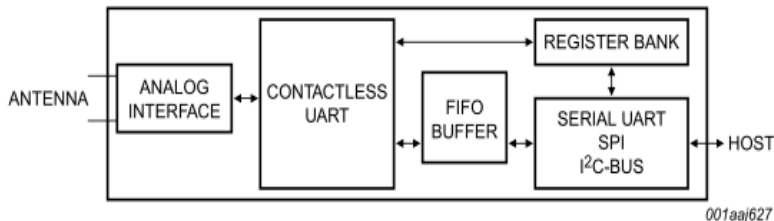


Fig. 2 — Simplified block diagram of the MFRC522

The analog interface handles the modulation and demodulation of the analog signals.

The contactless UART manages the protocol requirements for the communication protocols in cooperation with the host. The FIFO buffer ensures fast and convenient data transfer to and from the host and the contactless UART and vice versa.

Various host interfaces are implemented to meet different customer requirements [2].

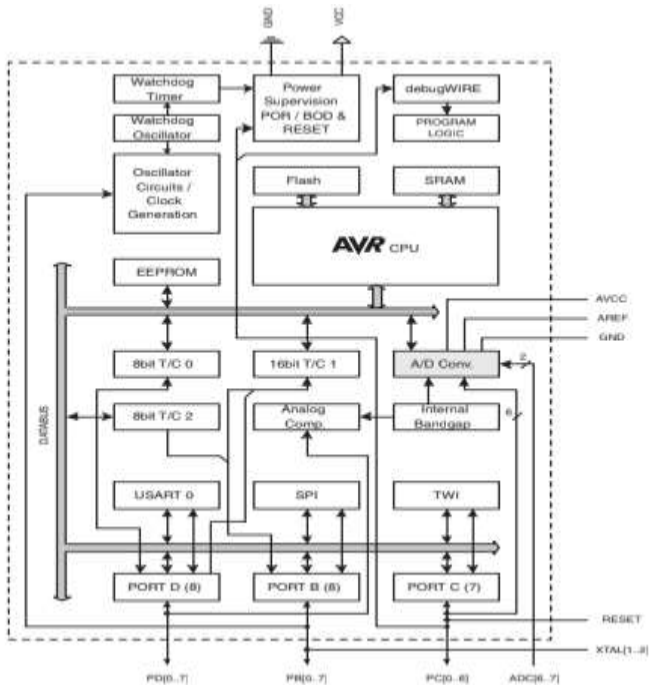


Fig. 3 — Functional block diagram of the ATmel mega 328T

ATmel mega 328T was chosen as the microcontroller. The AVR core combines a rich instruction set with 32 general purpose working registers [3]. All the 32 registers are directly connected to the Arithmetic Logic Unit (ALU), allowing two independent registers to be accessed in one single instruction executed in one clock cycle. The resulting architecture is more code efficient while achieving throughputs up to ten times faster than conventional CISC microcontrollers.

The ESP8266EX Board was chosen as Wi-Fi, its Functional Block Diagram is presented on fig. 4.

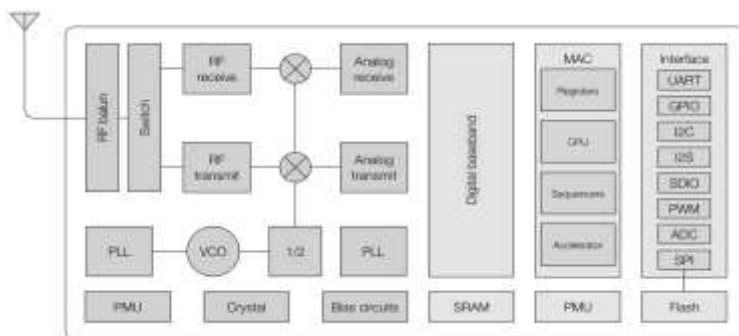


Fig. 4 — Functional block diagram of the ESP8266EX

The ESP8266EX integrates a Tensilica L106 32-bit RISC processor, which achieves extra-low power consumption and reaches a maximum clock speed of 160 MHz [4]. The Real-Time Operating System (RTOS) and Wi-Fi stack allow 80% of the processing power to be available for user application programming and development.

ESP8266EX Wi-Fi SoC integrates memory controller and memory units including SRAM and ROM. MCU can access the memory units through iBus, dBus, and AHB interfaces. All memory units can be accessed upon request, while a memory arbiter will decide the running sequence according to the time when these requests are received by the processor.

Conclusion. Thus, NFC reader for access control systems was developed. Different components for the device were selected and some of their characteristics were given.

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Аннотация. В докладе рассматривается вариант реализации NFC считывателя с возможностью передачи данных по Wi-Fi. Приведены блок-схемы выбранных узлов ридера.

Ключевые слова: Wi-Fi, NFC, считыватель, микроконтроллер, контроль доступа

Annotation. The report discusses the implementation of NFC reader with the ability to transfer data over Wi-Fi. Block diagrams of selected reader nodes are presented.

Keywords: Wi-Fi, NFC, reader, microcontroller, access control.

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COMPUTER TECHNOLOGIES OF THE RUSSIAN NUCLEAR INDUSTRY

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Introduction. Nuclear power faces some of the highest hurdles to commercial-scale deployment from all the carbon-free power options. The upfront costs for reactors are in the billions, the projects take years to site and build, and nuclear materials and designs have to undergo testing for decades to make sure they can be used in the field. That's one reason why nuclear research costs a whole lot of money and the pace of innovation seems incredibly slow. But that's also the reason why computer technologies have started to truly revolutionize the world of nuclear power innovation.

The purpose of this paper is to consider a domestic technology of supercomputers and show that the expected results of the use of supercomputer technologies in nuclear power are huge.

Main part. Computer technologies application in nuclear engineering allows to achieve higher levels of technical characteristics and safety of designed objects. Computer technologies enable to reduce the development and to cut down costs required to introduce new competitive samples of the equipment by optimizing some design elements and different operation modes based on the detailed analysis of physical processes proceeding in them.

Given the diversity and complexity of physical processes that must be simulated in fully describing the nuclear power plant operation, it is necessary to use special-purpose software packages describing these

processes. Besides, carrying out such simulations at the necessary level of detail requires a computer with sophisticated software packages.

In this context, in 2009 ROSATOM State Atomic Energy Corporation took a number of initiatives to develop a home-grown supercomputer and to implement domestic software for supercomputers at Hi-Tech enterprises. Principal strategic objectives and trends for the development supercomputer technologies in Russia were initiated. In addition, the project on the development on supercomputers and grid technologies was approved.

The project key goal is to develop the integrated 3D-simulation software for complex technical systems based on supercomputers and to integrate supercomputer technologies in such industries as nuclear engineering, aircraft and automotive construction, and space industry. Its participants are the largest industrial enterprises and leading Russian research and academic institutions.

Now a broad collaboration with leading nuclear enterprises allows to solve some challenges using supercomputer technologies.

Using DANKO software packages the calculation of the leakage restrictor in the event of a hypothetical accident was performed for a medium-size nuclear plant of the VBER-300 type. The behavior of the leakage restrictor was considered in the event of a hypothetical accident resulting from the guillotine type rupture of the nozzle during operation of the VBER-300 reactor. The simulation showed that the restrictor would prevent critical leakage of the primary coolant through the resulting gap. It proved the design to be safe without any natural experiment resulting in a significant reduction of the development time [2].

A number of simulations was carried out in order to predict the response of a NPP containment against aircraft crash. The simulation proved the sufficient strength of the reactor containment building to withstand aircraft crash followed by the fuel explosion. Due to the simulation along with other factors it became possible to extend the lifetime of nuclear reactors.

Prospects of supercomputer application in nuclear engineering are:

- minimizing expensive natural experiments to confirm the NPP equipment lifetime;
- reducing the volume of research and development for innovative projects by 40-50 %;
- decreasing the development and design period of nuclear plants by 20-50 % [2].

Supercomputer technologies refer to one of the priority directions of the Russian Federation. Supercomputer potential solves supersize problems which modelling and analyzing require great calculations.

Results. Sevastopol State University has a unique software and hardware complex for the training laboratory on Reactor Physics, NPP Control and its Safe Operation. It is designed for training students in Reactor Physics, NPP Control, Nuclear security and Safe Operation of NPPs. It is based on the computer system which is able to model nuclear, thermal-hydraulic and electric processes, various algorithms in control systems. Mathematical support and software were developed by researchers from the National Research Nuclear University MEPhI.

It is a model both for full-scope and analytical simulators implemented at the Rostov NPP, Kalinin NPP and others. The laboratory computer system includes a multi-functional analyzer for WWER-1000 nuclear power plants and a multi-functional analyzer for WWER-1000 reactor. To improve learning efficiency and the productivity of laboratory studies there is a reactor model used to simulate processes inside the reactor core as well as to calculate its thermal-hydraulic and neutron-physical characteristics.

In the laboratory there are different WWER-1000 technological systems – namely main circulation circuit, reactor core, pressurizer and pressure control system, emergency feed water supply system, emergency core cooling system, emergency boron injection system, primary circuit blow-down system, boron concentration system, reactor control system, etc that may be simulated for achieving different kinds of training objectives.

Conclusion. To sum up, we may say that nowadays almost all processes proceeding inside a nuclear power plant are computerized. Smart monitoring and controlling systems to prevent accidents, robotic complexes and similar innovations allow to reduce expenses for NPP design and maintenance significantly. Serious accidents and disasters at nuclear power plants have taught us the importance of nuclear safety. Major efforts are devoted to ensuring the security of nuclear facilities.

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Аннотация. Статья затрагивает проблемы применения компьютерных технологий в атомной энергетике, где сложные процессы и механизмы контролируются высокоразвитыми компьютерными технологиями. В работе рассмотрены отечественные технологии суперкомпьютеров и показано, что ожидаемые результаты применения суперкомпьютерных технологий в атомной энергетике велики. Особое внимание уделяется возможностям учебной лаборатории "Реакторная физика, управление и безопасная эксплуатация ЯЭУ", которой располагает Севастопольский государственный университет.

Ключевые слова: специальное программное обеспечение и оборудование, симуляция, моделирование, математическое и программное обеспечение, полномасштабные и аналитические тренажеры.

Annotation. This study aims to illuminate the role of computer application in the field of nuclear engineering, where complicated processes and mechanisms are controlled by sophisticated computer technologies. Russia is a world leader in nuclear power that develops reactor technologies, exports nuclear goods and services all over the world. Home-grown supercomputer technologies were examined and it was shown that prospects of supercomputer application in nuclear engineering are great. Much attention is given to the training laboratory on Reactor Physics, NPP Control and its Safe Operation that Sevastopol State University hosts.

Keywords: special-purpose software and hardware, supercomputer technologies, simulation, modelling, mathematical support and software, full-scope and analytical simulators.

UDC 621

ANALYSIS OF MODERN TOOLS FOR A MOBILE APPS DEVELOPMENT RUNNING ON ANDROID AND IOS

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Introduction. It is quite difficult to imagine your life without a smartphone in 2019. This is already an indispensable gadget for everyone.

It can be compared to a full-featured computer that can fit in your pocket. More and more users refuse to use PC, giving their priority to mobile devices. Smartphone stores photos, social network accounts, credit card numbers, etc. This gadget is equipped with a powerful operating system, which, in turn, allows you to work with many applications simultaneously. It is able to determine your position and tells you how much time you need to get to your home, University or office.

Over the last 15 years, the world has seen more than 10 operating systems for mobile devices. Unfortunately, most of these operating systems are now outdated. Now, there are two main operating systems - iOS and Android, they occupy 99.9% of the market of mobile operating systems. In 2017 it was sold 1.59 billion devices [1], 85,6% of them was on Android and 14% on iOS [1].

The **object** of the scientific article is to consider a mobile application developed by Sevastopol State University (SevSU) running on Android and iOS, which contains information about all events of the university life as well as a class timetable. On this basis, the topic of work related to the analysis and use of development tools for Android and iOS is also relevant.

Main part. Android is an operating system based on Linux kernel, the first version of which was released in 2008. This OS is designed for smartphones, watches, tablets and many other devices.

iOS is an operating system for iPhone, iPod and iPad from Apple. What is the difference between iOS and Android?

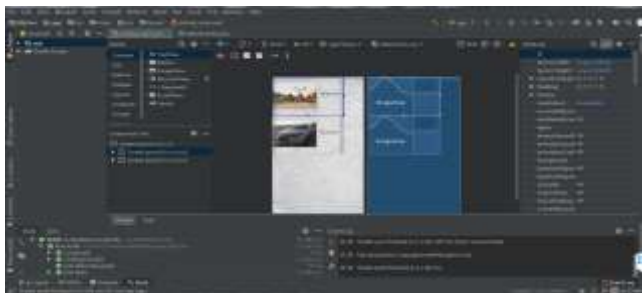
The first difference is a security of user data. Viruses are much more common on Android devices. In turn, they are almost absent on the smartphones from Apple. PlayMarket worse checks uploaded applications for Android. Apple is very concerned about its users' data security. Beginning with a thorough check of downloaded applications in the AppStore and ending with an individual chip responsible for data security installed on iPhone. The second difference is that Android is a completely open system. It is thoroughly studied, so everyone knows its strengths and weaknesses. The third difference is an ecosystem. Apple has been thoroughly working on it since 2007. Ecosystem is an easy and simple way of data exchange. This company has many technologies and convenient services, such as ApplePay, Air Drop, Car Play, password synchronization from Wi-Fi and social networks.

Software development is conducted using the Integrated Development Environments (IDE). IDE includes: text editing program, compiler and/or interpreter, build automation tools, debugger.

IntelliJ IDEA is one of the popular IDE for Android OS. IDEA is available in two versions: free Community edition and commercial

Ultimate edition with extended functionality [2]. Community edition is designed for JVM and Android development. The free version supports Kotlin, Java, Scala and Groovy. The version Ultimate edition is implemented for enterprise development and web development. IntelliJ IDEA stands out for its deep insight of code, smart ergonomics, multi-language support and built-in functions for development. IntelliJ IDEA analyzes code when loading and in the direct entering. It indicates suspected problems and offers a list of possible quick fixes. IDEA is also equipped with tools for assembly, test execution environment, coverage tools and a built-in terminal window.

The second IDE is the Android Studio development environment. It was created in cooperation with JetBrains и Google. Google recommends Android Studio for applications development [3]. This IDE has layouts to create UI elements. This development environment is designed for both small development teams and large international organizations with GIT or other management systems. Mobile applications running on Kotlin, Java, C++ can be developed in Android Studio. This environment contains a continuous integration concept, which allows to immediately determine existing problems [2].



Pic. 1 – Android Studio development environment

Xcode is the main IDE for a mobile applications development for iOS. This is the main and most popular application development environment for iOS. Xcode is a tool set created by Apple for applications development for PC, iPod, iPhone, iPad. The latest version of Xcode 10.2 is available to all for free in the App Store. Xcode contains components for an application developing, debugging and releasing in the AppStore [3].

Xcode tools include:

- Xcode Integrated Development Environment.
- Integrated Interface Builder to design an application interface.

- LLVM (Low Level Virtual Machine) compiler with full support for swift, C++ and Objective-C languages.
- Software package for applications debugging and testing - Instruments.
- iOS simulator.



Pic. 2 – Xcode development environment

Xcode uses a single window of workspace that contains most of the data needed for a job. The huge advantage of this IDE is the ability to simultaneously place a window in the workspace for writing a code and a window for developing an application interface. iOS SDK is constantly extending the Xcode tool set, adding compilers and frameworks needed for a job.

Conclusion. In this article, we regarded the most popular today tools for a native development of mobile applications running on Android and iOS. Analysis showed that the Android platform becomes more and more popular among both ordinary users and developers from year to year. This is because devices with this OS are much more accessible than devices from Apple. In turn, the last 10-12 years Apple has been setting the direction for development of mobile devices. Analysis of development environments showed that the development of applications for the Android platform can be made by various means with the programming language Java and Kotlin. In turn, the development for iOS is mainly made only in Xcode, which is supported by Apple in every possible way.

Therefore, we can conclude that the iOS and Android platform and development tools for this OS will be very popular in the near future.

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Аннотация. В статье рассматриваются мобильные операционные системы Android и iOS, а также основные инструменты для разработки мобильных приложений под управлением Android и iOS.

Ключевые слова: ios, android, мобильное приложение, разработка.

Annotation. The article considers Android and iOS mobile operating system as well as main tools for a mobile applications development running on Android and iOS.

Keywords: ios, android, mobile application, development.

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ARDUINO MICROCONTROLLER PROGRAMMING

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The given article discusses such popular brand of hardware and software as Arduino which is used for building automation systems and robotics and is focused on non-professional users – Arduino. Its history, characteristics of microcontrollers being produced, as well as features of their programming are to be analyzed.

First, let's see what is Arduino? Arduino is an effective hardware and software platform applied for designing and creating new devices developed by Arduino software. Free software integrated development environment is based on C/C++ programming languages and has the same name as the device itself. The availability of Arduino-compatible boards extends the user development capabilities with the use of hardware and software components [2].

It is worth mentioning that the first prototype of the controller was released in 2005, when Massimo Banzi developed it for students of the

Institute of interaction design in Ivrea, Italy. The device name comes from the name of king Arduin, who ruled Italy for only two years at the beginning of the XI century, in whose honor there was named a pub "di Re Arduino", owned by Massimo Banzi, and it is located on the very spot where according to the legend king Arduin was born.

This very event led to a real revolution in robotics and the creation of electrical devices at the international level [5].

And popularity made all the schemes, source codes and libraries of functions be available to all users because the payment costs are just couple of dollars or it is even possible to make the prototype of this payment.



Fig.1 – The first prototype of microcontroller Arduino.

As for construction, the Board itself consists of the following elements: power connector, pins, reset button, power indicator, TX and RX LEDs, main integrated circuit (IC) and voltage regulator [3].

As for features of programming we should say that before you begin to solve a specific problem on Arduino, it is best to have some basic background in the field of programming. So let's learn what that term actually means.

Programming is the task of certain algorithms translated into computer language in order to perform a specific task set by the user. Accordingly, absolutely any project is built on a phased block model, which describes what you need to do to your microcontroller and how to do it.



Fig. 2 – Arduino Uno chip.

To simplify the work of users in Arduino there have been created ready-made libraries of functions, you just need to enter commands from them to achieve some goal. It goes without saying that by this way you will

not achieve much, but to create your own libraries you will need this knowledge of the C++ language on which the chip firmware is built.

The key feature of the system is that the characteristics of Arduino can be improved with the help of purchased components, and you can always adjust them to a specific project. Accordingly, your only limitation is knowledge of the language and its capabilities, as well as your own imagination.

All functions are built from the simplest operands, which are typical for C++. These operands are variables of different types and how they are applied. Therefore, any function used in the microcontroller to receive information or send a signal is a set of simple operations that is recorded in the main library. And you will be limited until you have enough experience and practice to understand which library and for what purpose you should write.

The main disadvantage of designing complex projects with Arduino is that you will have to write code from scratch and select components for the system, so it is better to practice the simplest tasks first.

Also, keep in mind that the language of writing system libraries is low-level, and therefore consists of the simplest commands, unlike high-level python or pascal, convenient for users. On the other hand, it is also multiparadigmatic, so it is suitable for solving any problem with the help of a programming paradigm convenient to you [1].

Programming the Arduino Board is considered to be divided into three phases:

- 1) Creating or downloading a ready-made function library.

- 2) Loading these libraries into the permanent memory of the chip. This is also called firmware.

- 3) Entering these functions in the command line, for example, so that the Board performs certain actions.

However, for the programming itself you need a Board that some users can not afford, or you need more than one Board. The solution to this problem is to "copy" the original with your own hands.

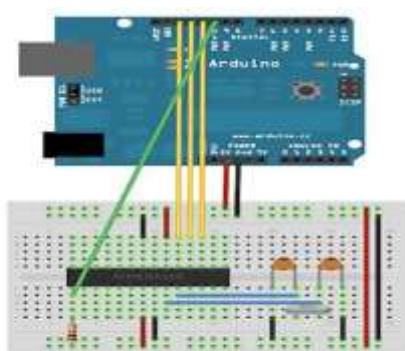
So, step-by-step creation of Arduino Board copy:

- a) Collect all necessary details. To speed up the process, use the breadboard. As is known from the technical parameters of the controller ATmega 328 IC, to run it in the minimum configuration we need:

- Arduino Duemilanove controller (will be used as a programmer);
- ATmega 328 IC chip ;
- quartz resonator for 16 MHz;
- resistors 100 Ohm 3 PCs.;
- capacitors 22pF 2 PCs – ;

- 3 PCs LEDs with red, green, and yellow glow;
 - voltage regulator at 5 Volts for example 7805;
 - any 9 battery with connector for connection;
 - USB cable;
 - computer or laptop with Arduino IDE software package installed;
 - breadboard and wires.
- b) Begin to model. Place the controller chip on the breadboard.
- c) Install voltage regulator and power supply circuit. Install the voltage regulator 17805 on the Board. Pin assignment chip 1-input (7-20 Volts), 2-housing, 3-output (5 Volts). Using the mounting wires, connect the stabilizer to the power source and the controller.
- d) Connect the power to the controller. In accordance with the numbering of the controller terminals, connect it with the mounting wires to the output of the voltage regulator and the common wire.
- e) Connect the quartz resonator. We have a resonator and capacitors of the oscillatory circuit on the Board. The installation procedure is as follows:
- put the 22pf capacitor between the ground and the 9 foot of the controller;
 - put the 22pf capacitor between the ground and the 10 foot of the controller;
 - turn on the resonator between the legs 9 and 10 of the controller;
 - resistor 10 kOm include between 1 foot controller and + 5 V (shunt signal "Reset").
- f) Add controller status indicators. LEDs are connected in series with 100 Ohm resistors, between the ground and our programmer.
- g) Connect the layout to the programmer Board. Connect the assembled layout to the Board Arduino Duemilanove as follows:
- the output of the yellow led is connected to the 9 pin on the connector of the programmer, its ripple will show us that the programmer is working;
 - the output of the red led is connected to the 8 pin on the connector of the programmer, it signals possible errors;
 - the output of the green led is connected to the 7 pin on the connector of the programmer, its glow signals the exchange of data between the programmer and the microcontroller. We connect our boards to each other with the other wires as shown in the figure, do not forget to connect the power wires + 5 V and the housing ween them.
- h) Turn the Arduino Duemilanove Board into a programmer. In order to load the bootloader into the ATmega328 IC microcontroller you need to turn our Arduino Duemilanove into a programmer. Connect our Assembly

to the computer using a USB cable. Open the Arduino IDE programming environment, select the sketch (program) AndurinoISP and load it into the Arduino Duemilanove. By flashing the yellow led, make sure that the sketch is loaded into our programmer.



Using an Arduino board to program an ATmega, with external crystal and associated capacitors (18 or 22 picofarads).

Fig. 3 – The scheme of connection of the layout with the platform

i) Download the bootloader. In AndurinoISP (menu item "Tools") select the desired type of controller (ATmega 328 IC). Give the command to download bootloader "Burn bootloader". Follow the messages AndurinoIDE, after downloading bootloader "Done Burning bootloader" our microcontroller is ready to record a sketch of the project of our new homemade.

On this programming and Assembly of the "second" Arduino platform is finished.

In conclusion, we can give examples of simple projects with Arduino microcontroller, which even an unprofessional user can make:

- Creating a light sensor that will adjust the special LED lamps to the brightness that is required in the room.
- Automation of anything at your home. For example, on-off light, opening doors, etc.
- Automation of the greenhouse.

It may sound scary enough but, thanks to the abundance of information on the Internet, you will not spend a lot of time and effort for most of these projects.

So, from the above-mentioned facts we cannot but make up a conclusion that Arduino is an essential advancement in automation and robotics systems.

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Аннотация. В статье рассматривается такая торговая марка аппаратно-программных средств для построения систем автоматики и робототехники, как Arduino, которая ориентирована на непрофессиональных пользователей.

Дана общая характеристика микроконтроллеров марки Arduino на примере Arduino Uno. А также, описаны особенности программирования и создания копии платформы Arduino, его недостатки и достоинства. Данная статья предназначена для студентов, обучающихся и непрофессиональных пользователей, имеющих дело с робототехникой и системами автоматики.

Ключевые слова: Arduino, Микроконтроллер Arduino Uno, программирование, особенности программирования, копирование платы Arduino.

Annotation. The article discusses such brand of hardware and software for building automation systems and robotics as Arduino, which is focused on non-professional users.

General characteristics of Arduino brand microcontrollers on example of Arduino Uno are presented. And also, the features of Arduino

programming and Arduino platform creation are described. Its disadvantages and advantages are presented. This article is intended for studying students and non-professional users, which deal with robotics and automation systems.

Keywords: Arduino, Arduino Uno Microcontroller, programming, programming features, copy the Arduino platform.

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APPLICATION OF IT-TECHNOLOGY IN EDUCATION

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Information technology development is running inevitably quickly. The 21st century is a century of informatization and technologization of all processes in society. That is why the information support of training activity is sure to be an important part of education. To describe all components of training, to give the chance at each stage optimum to solve necessary didactic problems on the basis of new information technologies is the purpose of modern training. This goal is achieved by means of use of the computer. Uniform information environment for functional educational tasks is provided with different software, for example, application in educational process multimedia, the Internet and Web technologies thanks to which information orientation of training is implemented. Fast and rather cheap access is one of the main advantages of the Internet. Availability content is one more essential advantage. It is possible to contact the help of e-mail when there are questions concerning training, a possibility of a discussion and exchange of information [1].

It is worth mentioning that the main assistant in mastering of a training material is the qualified specialist teacher who will not only organize independent work of students (testing, control and term papers),

but also select the most important aspects for studying in the conditions of strict time discipline. Nowadays teachers, pursuing the similar aims, create author's pedagogical software on the websites on the Internet [33 p. 185].

The concept Information and Communicative Technologies (ICT) also represents the system of the interpenetrating parts of informatization of education. The ICT allows to integrate several information spheres: text, graphics, photo, video, animation, speech, sound and music. Didactically this system of training can be implemented through the working program of discipline (WPD) or its electronic analog the electronic educational resource (EER) with model opportunities which are much larger, than at traditional resource.

One of the EOR components is assumed to be the electronic textbook intended for independent studying of theoretical course material and constructed on a hypertext basis. The electronic textbook is considered to be the special device or the software used in educational process, gradually replacing the traditional paper textbook. Unlike the printing edition the electronic version is a set text, graphics, video and photographic information. In various higher educational institutions of the Russian Federation specialists formulated the requirements for electronic courses and the principles of their creation. Let's enumerate some of them. The main requirement is a profitability and availability of information base of the textbook, mainly its visualization. As the main principles of creation of electronic courses we can distinguish logicity and structuredness of material, its functionality, attractiveness and usability, accurate division of a visual row into logical and functional zones (navigation elements, headings, the main information, the comment, outputs, tests, etc.) [2].

We cannot but add that the use of ICT on natural sciences allows the teacher of higher educational institution to make teaching natural disciplines more informative and more effective. As practice shows, computer technologies can be used in different situations at different stages, for example, the electronic version of the textbook performs at classes as powerful demonstration tool, providing the high level of visualization. Online testing is also one of significant forms of monitoring procedure of knowledge and skills. We can deduct a number of advantages of this form, mainly: saving of time when checking, objectivity in assessment of knowledge, statistics of digestion of material by the certain student and all group / flow).

Besides EOR the teacher and students can use Internet services which facilitate training and accelerate educational process. E-mail and social networks are the most commonly used.

We cannot but mention that E-mail is the service provided by computer networks with a possibility of transmission of messages, for obtaining necessary educational information from the Internet, for consultation of the student with the teacher, for mutual training at information exchange of students with each other.

Social networks in the interactive multiuser website are really vital tools. Didactically it is possible to use such resource as:

- bulletin board. It can be used by the teacher for official statements and announcements of the forthcoming events;
- directory of library resources on disciplines;
- the organization of theme groups for continued consulting and information support of all participants of educational process. The group on social network is an efficient method of the manual at which, students independently are set for themselves at standby mode [3].

The professional mobility of the graduate of educational institution needs to provide high quality of instructional results. The high-quality changes happening in education should be directed to satisfy the requirements of labor market, such as to create the competitive specialist with professional high level qualification having the sufficient level of knowledge, capable for adaptation to constantly changing working conditions. One of the possible directions of development of professional education at this stage is the application of modern information technologies in training and education. Let's consider in more detail the possibilities and modern education directions of information technologies application.

The first application is creation and development of information space. Information technologies allow easily to get an information access at any time. Students and teachers use information technologies for receiving a training material on the Internet. Information technologies accelerate transfer and dissemination of information. Specialists in IT create educational applications which can be used by students, now students can use digital library for mobile phones which saves their time and helps them to read and revise material in any place at any time.

The second application to be discussed is use of a multimedia and interactive payment. Application of multimedia means is important for increase in level of new material perception. There can be deducted the following advantages of multimedia means application: they allow to adapt to functions of students and change essential feed speed; allow to reduce non-productive costs of live work of the teacher; help to increase motivation; provide visualization which promotes difficult perception and the best learning of material.

The third application to be considered is remote learning. Information technologies permit students to study necessary disciplines and professional modules through online courses. The student receives all training materials and tasks in e-mail or on the website of educational institution. The remote form of education became very popular among those who want to get the second or additional professional education.

The fourth application to be mentioned is use of computer technologies at control of knowledge. The system of computer control allows to implement more effective technology of students knowledge control. It allows the teacher to reduce time for checking of tests, examinations, papers. Thus, it enables to carry out control more often and to reduce considerably human factor of which students often complain.

In conclusion, there is a real need to introduce new information technologies into educational process, significantly changing the traditional system of training. These absolutely new components of education content are necessary for training of competitive specialists. Use of modern information technologies is a vital condition of more effective development. Thus, ICT are new opportunities in educational activity where the major role will be still played by the teacher.

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Аннотация. Данная статья посвящена вопросу использования информационных технологий в учебном процессе и помощи получения высшего образования дистанционно. Описываются возможности, направления, а также преимущества использования информационных технологий в современном образовании. Кроме того, приводятся основные требования к электронным рабочим программам и тестовым заданиям. Особое внимание уделяется преимуществам применения информационно-коммуникационных технологий по сравнению с традиционными методами обучения.

Ключевые слова: информационные технологии, интерактивная доска, дистанционное обучение, социальные сети, высшее образование.

Annotation. This article is devoted to a question of use of information technologies in educational process and the help of receiving the higher education remotely. Opportunities and the directions of use of information technologies in modern education are described. Besides, the main requirements to electronic working programs and test tasks are considered. Special attention is paid to advantages of application of information and communication technologies in comparison with traditional methods of training.

Keywords: Information technologies, interactive board, remote learning, social networks, the higher education.

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RETOUCHER – PROFESSION OF THE FUTURE

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*That retouching is an art, not a commodity, and that the artistry and
the technical and problem-solving skills needed to contribute
effectively to an ad campaign take many years to develop.*

Daniel Meadows, a British freelance retoucher

Introduction. There is a perception that the profession of photo retoucher appeared simultaneously with graphic editors, that is, relatively recently. However, this is not quite true. The first photographers, either alone or with the help of an artist, drew the necessary details with a brush or painted the pictures manually. Of course, portraits were most often retouched: correcting skin tone, removing imperfections was almost a necessary condition. For example, in the famous Parisian portrait studio "Nadar" almost a third of the employees were engaged in retouching.

Today, when billions of photos are being taken on smartphones and DSLRs, the retoucher's profession has become even more in demand. Social media and internet forums are also great ways used by many creative professionals to market their work. Facebook, Twitter and especially LinkedIn and Behance are great platforms for networking.

Our article is **aimed** mostly at people who wish to pursue a career in professional retouching. Although, in reality, the advice holds true for most lines of work.

Main part. In his articles for Retouching Academy Daniel Meadows discussed the career paths available to budding retouching professionals, from remote-office workers to on-site staff. He said that if you were seriously considering a future career in retouching, you were undoubtedly aware of the huge range of potential options and specializations in the industry: from working fashion in-house, to remotely delivering an architectural [2]. You can't be a retoucher if you don't enjoy and consume art. One needs to develop an eye for color, aesthetics and composition.

"You don't take a photograph, you make it". Ansel Adams

Natalia Taffarel is a high end fashion retoucher and workshop instructor from Buenos Aires, Argentina advises that to be a good retoucher one needs to develop an eye for color, aesthetics and composition (pict.1). How do we "make" an image from the retoucher's perspective? "Taking into account the teachings of traditional art, such as composition, color theory and light behavior. Also, things involving drawing/illustration techniques are extremely helpful when it comes to retouching. Reason is, we are basically drawing over an existing gradient. You create your own limitations. If you don't spend your time consuming art and images (quality ones), then you can't train your brain to differentiate the good from the bad, and the bad from the ugly" [3, www].

When was the last time you visit an art show? exhibition? museum? Think about it.



Picture 1 – Natalia Taffarel's work

Source: <https://fstoppers.com/post-production/news-career-advice-professional-retoucher-5997>

Who is the photo retoucher and what does he do? The retoucher processes photos in graphic editors (most often Photoshop and Lightroom), bringing them to perfection. His responsibilities include working with color,

light, adjusting the exposure, tone, brightness and saturation of the image, cropping, correcting various shortcomings of the original photo.

A retoucher can “draw something” or vice versa, remove it from a photo, change the background, make an artistic image processing.

Advantage and cons of the profession of a retoucher (tbl. 1).

Table 1. Advantage and cons of a retoucher profession.

<i>Advantages</i>	<i>Disadvantages</i>
being in demand	irregular working hours.
decent pay	subjective assessment of work results.
different level of difficulty: some work for beginners and another duties for experienced professionals.	when working at home, it is necessary to purchase expensive equipment
creative work, not related to the implementation of monotonous work.	it is necessary to master computer programs.
Visible result of work	
the opportunity to work at home.	

You need to get some knowledge and you need to be selective to become a retoucher.

- the program for processing of drawings
- the rules of color combinations to create harmonious pictures
- the basics of visage, if you are going to work with photos of people. Makeup artists do about the same as retouchers, but with other tools.
- a good computer as laptops are poorly suited for processing photos. In addition, laptops have difficulty pulling the necessary programs - photoshop or lightroom.

- a convenient mouse and graphics tablet for work.
- understanding retouching genres: documentary, art, beauty, etc.

Look at photography books, National Geographic, photo journalism books and movies. Again, not just the latest hits, but older movies too [3]. The basics of retouching are given in the framework of some specialties in universities. You can also master the profession of a retoucher at courses, including online. Improving the profession will help the study of professional literature. Get advice from colleagues and feedback can be in professional forums and in the social networks.

In fact, retouchers are needed in almost all areas working with photographs and images. After all, each picture can be improved, made brighter, richer, more beautiful. Companies are not always able and willing to hire a permanent employee, and it is easier for them to hire a freelancer.

So if you do not want to work in the office, just create a portfolio (necessarily a photo before and after), a small commercial offer (you are good at what you know, why the remote employee is profitable) and send to companies.

Retouchers are required in different areas.

- Photographers and photo studios - mostly newcomers go to work precisely in this area. Photographers often need helpers when the amount of work increases. You will need to process photos, gloss over skin irregularities, work with color and make pictures beautiful, so that customers are satisfied with the result.

- Ad agencies. All photos for advertising are processed to look perfect and attractive. But not all companies keep staff of retouchers, so from time to time they look for remote workers. In some cases, hired remote employees for a permanent job.

- Online stores sometimes look for someone to handle photos.

“Some examples are advertising or design agencies, photography or retouching studios, or even simply retouching for a commercial or wedding photographer. After establishing yourself in the local scene and getting more client retouching experience, you can venture into bigger areas through contacting the decision makers in creative agencies. You can also contact editors of various magazines and see if anyone might be interested in using your skills” [1, www].

In conclusion it should be noted that we listed all the basic tips on how to become a retoucher: the work is serious and requires some knowledge. But if you learn to do this, you will always have orders and a good job.

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Аннотация. В статье представлены некоторые советы от известных ретушеров, как сделать карьеру в профессиональной ретуши. Хотя, на самом деле, этот совет справедлив для большинства направлений работы. Рассмотрены возможные места работы ретушера.

Ключевые слова: ретушер, графические редакторы, фотопшоп, фотографии, изображения, креатив.

Annotation. The article presents some advices from the famous retouchers how to to pursue a career in professional retouching. Although, in reality, the advice holds true for most lines of work. Possible places of retoucher's work are considered.

Keywords: retoucher, graphic editors, photoshop, photographs, images, creative.

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APPLICATION OF NEAR FIELD COMMUNICATION TECHNOLOGY

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To start with, lets describe NFC technology. It is known to be a technology working only at short ranges that allows communications to take place between devices that are held together or either touch. NFC or Near field communication is wireless short range high frequency communication technology. There below you can see the scheme of construction.

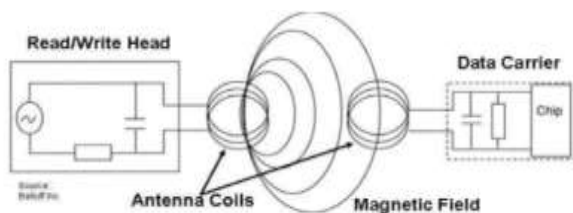


Fig. 1. – NFC technology construction.

The interaction between the devices occurs through high-frequency radio waves and is established when the devices are at a minimum distance from each other. This technology is mainly designed for handheld devices. NFC continues the ideas and expands the use of radio frequency identification or RFID technology, which is mainly used for tracking and identification by sending radio waves.

The NFC technology is sure not to be new, but it has reached its greatest development in the last few years.

It is essential to go through the standards. Standards of the NFC were set in 2004 on NFC forum, which was formed by Nokia, Philips and Sony. Every device with NFC will have "N mark" trademark developed by NFC Forum. It is an exciting fact that first mobile phone with NFC support was released by Nokia in 2006 (Nokia 6131), while the first mobile phone with NFC running on android operating system was released by Samsung in 2010 (samsung nexus s) [1].

The technology of near field communication is based on inductive coupling. NFC works using magnetic induction between two loop antennas located within each other near field'. The parameters are the following: operating frequency is 13.56 MHz, data rate is 106 kbit/s to 424 kbit/s. NFC uses an initiator and a target; the initiator actively generates an RF field that can power a passive target. There are two modes of operation. First one is an active mode. In active mode both devices with NFC chip generates an electromagnetic field and exchange data. Two NFC enabled devices to transfer data in active mode.

We cannot but describe the second operation mode passive mode. In passive mode there is only one active device, the other one uses field of the first one to exchange information. For example, a NFC enabled phone to be paired with a RFID- tagged "smart poster".

NFC works on 10 cm or less at 13.56 MHz on ISO/IEC 18000-3 air interface and at rates ranging from 106 Kbit/s to 424 Kbit/s. That is why it requires low power and is compatible with contactless RFID technology [2].

We cannot but add that there are a lot of applications that can be used with an Near Field Communication technologies, for example, touch and go applications such as access control or ticketing in transport or different events, where user needs only to bring device close to the reader to transfer ticket information or access code.

We have deducted the list of some advantages and disadvantages of Near Field Communication technology.

First of all, it is convenient for the final user, because the exchange of data is done by bringing two devices together. Also the power usage of a technology is low and the communication is secure because of the low distance. Moreover, no special software is involved and no manual configuration and settings. Finally, there is no search and pair procedure. Despite this, there are also some disadvantages.

Firstly, there is a distance and speed limitation. The range is only 10 cm and the data transfer rate is less than 424 kbps. Secondly, special hardware is needed [3].

In future NFC can be used in vehicles and in the smart houses: user will not need to carry the bunch of keys in the pocket, but only the one NFC device. Also the device may be used to control or display some processes via special app.

To conclude, NFC has a potential to be a technology, that will change the way we live, transform everyday tasks, make things easier, intuitive and effective. The technology is capable with existing RFID infrastructures. Also it can be used to setup longer-range wireless communication, such as Bluetooth or wifi. Though there are some security concerns, they can come through the use of different schemes like setting up secure channel, combined with which NFC can provide confidentiality, authenticity and integrity. The primary target of Near Field Communication technology is mobile handsets, now NFC is implemented in most handheld devices. Combining NFC with other technologies like Bluetooth can increase the range of applications, where it can be used.

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Аннотация. Статья посвящена технологии NFC – технологии беспроводной высокочастотной связи малого радиуса действия. Данная технология, безусловно, не нова, но достигла своего наибольшего развития за последние несколько лет. Составлен список достоинств и недостатков. Дается информация об истории. Приводятся технические детали. Анализируются режимы работы. Описаны перспективы технологии NFC. Данная статья будет полезна студентам, обучающимся и непрофессиональным пользователям, имеющим дело с техникой и системами автоматики.

Ключевые слова: Технология беспроводной высокочастотной связи малого радиуса действия, сетевая файловая система NFC, бесконтактная оплата, модули, программирование, особенности программирования.

Annotation. This article contains description of the Near Field Communication technology. The NFC technology is sure not to be new, but

it has reached its greatest development in the last few years. The list of advantages and disadvantages is composed. The information about the history of technology is given. The technical details are provided. The modes of operation are analyzed. The prospects of the NFC technology were described. This article will be useful to students and non-professional users dealing with equipment and automation systems.

Keywords: Near Field Communication technology, network file system, contactless payment, apple pay, modules, programming, programming features.

UDC 621

DAS PROGRAMMIEREN FÜR ANFÄNGER

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Was ist Programmieren für Anfänger? Jeder Anfänger muss wissen, was er machen will. Wofür lernt er Programmieren? Ausgehend davon muss man die Sprache des Programmierens wählen.

Aber zunächst soll man sagen, was macht einen Programmierer. Von einem Wort kontrolliert der Programmierer den Computer. Du bist der Chef und der Computer macht das, was du ihm sagst. Es ist faszinierend, seine eigene Software zu bauen und für Viele ein Grund, um das Programmieren zu lernen. Das Privileg des Programmierers ist das System zu planen, zu programmieren und zu kontrollieren.

Ebenso wollen Viele ein Programmierer werden, weil hinter dem Programmieren die Zukunft, der Beruf war und wird noch lange Zeit sehr gefordert.

Um Programmierer zu werden, muss man kein Übermensch oder Mathematiker sein. Etwas logisches Vorstellungsvermögen und die Motivation „Probleme zu lösen“ reicht aus [1].

Für Anfang muss man auf die Fragen antworten:

- Was möchtest Du entwickeln? Apps entwickeln? Eher für iPhone und Co? Oder Android?

- Vielleicht willst Du auch Webseiten erstellen?
- Desktopanwendungen? Für welche Plattform(en)?
- Oder Spiele?

Jetzt wählt man die Sprache des Programmierens. Wie fühlt sich die Arbeit mit der Programmiersprache an? Wie gefällt man die Syntax? Arbeit man ein paar gleich die unterschiedlichen Sprachen.

Die geläufigsten Programmiersprachen für Anfänger, die zum ersten Mal Programmieren lernen möchten, sind C, C++, und Java (Figura 1). C gehört zu den imperativen Sprachen, während die restlichen genannten Programmiersprachen der Gattung der Objektorientierten Sprachen zuzurechnen sind. Auf diese Unterscheidung werden wir gleich auch nochmal eingehen [1, s.7].

Diese 3 Programmiersprachen sind sich syntaktisch relativ ähnlich, sodass man, wenn man einmal ein aus dieser Sprachen beherrscht auch die anderen relativ zügig programmieren lernen kann.

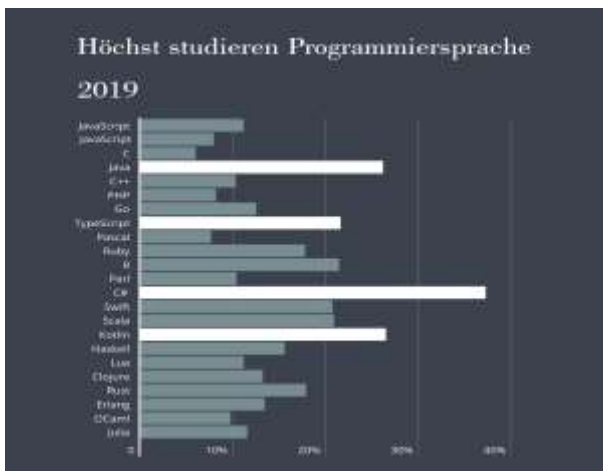


Figura 1- Höchsten studierten Programmiersprache 2019

Imperatives Programmieren ist das, was sich der Anfänger vorstellt, wenn will dem Programmieren lernen: ein Programm ist eine Folge von Befehlen, die vorgeben, in welcher Reihenfolge was vom Computer gemacht werden soll.

Die Objektorientierten Sprache hilft bei der Zusammenstellung die komplizierteren Programme.

Viele Programmierer empfehlen für Anfang JavaScript. Was ist das? JavaScript- die Sprache, die in einem beliebigen Web-Browser gestartet

sein kann, auch besetzt er die führenden Stellungen im Rating der Popularität verdient. Er hat den vielfältigen Satz der Funktionen: unterstützt die zwingenden, strukturierten, objekt-orientierten und von den Ereignissen verwalteten Paradigmen [2, s.13].

Die Sprachen des Programmierens haben eine Besonderheit - wenn zwei Sprachen die Ähnlichkeit in den Paradigmen haben, jener in der Regel sind sie und in der Syntax ähnlich. Nach dem Studium JavaScript können Sie bis zu 75 % die Coda auf Python oder Ruby verstehen, da sie ähnlich sind.

Also, welche Sprachen noch können wir lernen?

Die Sprache C++ ist ein Nachfolger der Sprache C - der Menge der Nutzungsdauern, der fertigen Bibliotheken und der Beispiele. Man kann die Programme einer beliebigen Komplexität für Windows, Linux und MacOS schaffen.

Die Sprache Delphi. Die prächtige Sprache mit der ausgezeichneten Umgebung des Programmierens für die Anfänger. Lässt in kürzester Frist zu, die Programme der mittleren Stufe der Komplexität zu entwickeln und sie im Folgenden zu begleiten. Hauptsächlich werden die Anlagen für Windows geschrieben, obwohl es den vollen Werkzeugsatz für die Wespen Linux gibt [3].

Die Sprache Visual Basic. Lässt zu, ins Leben einer beliebigen Komplexität die Projekte zu verwirklichen, dabei die visuelle Schnittstellen mit der auffallenden Einfachheit - die ausgezeichnete Auswahl für die Ausbildung schaffend, aber ist das Programmieren der Anlagen der Wespen Windows beschränkt [3].

Nach dem alles blieb übrig, die Ideen und die Träume zu verwirklichen. Erwinnere sich, das Programmieren ist eine Kunst zu denken und den Erfolg zu erreichen.

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Аннотация. Тема программирования является актуальной для начинающих. В первую очередь программист занимается разработкой алгоритмов и программ. Чтобы стать программистом не надо быть

сверхчеловеком или математиком. Есть много языков программирования, которые может учить каждый. Программирование – это искусство думать и достигать успеха.

Ключевые слова: программист, начинающий, язык программирования, императивное программирование, объектно-ориентированное программирование.

Die Inhaltsangabe: Das Thema des Programmierens für die Anfänger ist aktuell. In erster Linie kontrolliert entwickelt der Programmierer Algorithmen und Programme. Um Programmierer zu werden, muss man kein Übermensch oder Mathematiker sein. Es gibt viele Programmiersprache für die Anfänger, die jeden lernen können. Das Programmieren ist eine Kunst zu denken und den Erfolg zu erreichen.

Die Stichwörter: Programmierer, Anfänger, Programmiersprache, Imperatives Programmieren, Die Objektorientierten Programmieren.

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SCIENTIFIC APPLIATION OF CLOUD TECHNOLOGIES

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This article will consider a very entertaining and promising technology – cloud technology. Namely, the use of this technology in the field of science.

A range of cloud-based tools are collectively known as the “Internet of Things” (IoT) – can connect everything in a lab: from research protocols and pipettes to data storage and manuscripts. As these tools get easier to use and data become more secure, an increasing number of scientists and companies are likely to take advantage of complete connectivity.

It obvious that the cloud is revolutionizing the ability of organizations, and even individual households to store, access, and share information. But many life science researchers still refrain from taking the plunge. We have analyzed the viewpoints of main leaders in this sphere. According to the opinion of Silji Abraham, chief information officer at MilliporeSigma in Billerica, Massachusetts, outside the lab they have the easiest experience with their devices and connectivity, but in the lab they go back almost

decades, because of the lack of connectivity in life science labs. Abraham says that they are missing an opportunity to solve problems [3]. But nevertheless the scientists continue to worry about capturing and recording what they do.

So far, cloud-based technologies are typically used in very specific technologies, such as next-generation sequencing and some advanced forms of mass spectrometry. Kevin Barrett, senior vice president of strategic business development at Gilson, headquartered in Middleton, Wisconsin, believes that people are currently focused on using the technology in a sample-centric manner, and cloud-based data management is inevitable [1].

Ahead, Barrett and his Gilson colleagues see a much broader use of the cloud in life science labs and are expecting it to accomplish more than just simplifying scientific workflows. Cloud-based technology can have a significant impact on going on about verifiable science.

Let's discuss principle mode of operation of cloud technologies.

Three key application areas could benefit the most from cloud-based technology, according to Kamni Vijay, senior marketing director for software and informatics at Agilent Technologies. The first application area is collaborative applications that allow scientists and researchers to work together on a global real-time scale that hasn't been available before. And Vijay believes that Information sharing will become more commonplace and immediate [1].

The second area is applications that require advanced computing. Here, in Vijay opinion, cloud-based approaches will drop the capital investment needs and economize resources that are not available for laboratories. For example, instead of purchasing a large server farm, researchers will simply be able to send data for analysis into the cloud and ask for as many on-demand resources as they need.

According to Vijay words, the third area is any application that lends itself to zero-footprint deployment and can exist on both desktop and mobile versions. This capability could fit an increasing number of small-scale life science laboratories as IoT tools gain traction and include more instruments.

We cannot but explore the connecting ELNs.

In order to get the most out of their connection to the cloud, the laboratories technologies will need to be accommodated by the so called electronic lab notebooks (ELNs).

Jonathan Gross company (founder and chief technology officer of BioData), supplies several ELN options. They provide their electronic lab notebook through several different cloud providers – Amazon Web Services, Rackspace, and SoftLayer – and, in some cases, onsite or

noncloud. Cloud technologies enable them internally to ensure that all their work is backed up [1].

Gross pointed out the benefits of a cloud approach for scientists. They see a lot of work done remotely. for the success of the project is crucial to see the results in real time and share their experiences.

Gross talked about the distant time when scientists had tons of compact discs with microscopic images as backup copies. And nowadays, scientists upload them to the cloud, carry out remote analysis of these files and, if necessary, save the data there.

The key to cloud computing is assumed to come from a wider perspective. According to Gross, science generates huge amounts of data, and this is supported by cloud infrastructure and lower cost. They are already seeing equipment send data directly to the cloud and expect more technology providers to follow.

Some leading developers of research tools agree with Gross. For example, Abraham says that his company is on the way to creating a connection for their devices to the IoT platforms. They want to simplify laboratory life and in this way to automate the process of recording experiments and collecting data using cloud and IoT technologies so that scientists can focus on experiments and results [3].

We cannot but investigate the designing an ecosystem.

As IoT digs deeper into labs, the entire R&D “ecosystem” will change and grow more interconnected – like NASA combining a wide range of devices and locations to launch a rocket. Alok Tayi, CEO and cofounder of TetraScience in Allston, Massachusetts, describes his company’s technology this way, calling it mission control for R&D. He elaborates that with the help of IoT it is possible to connect individual experiments and instruments into a single online dashboard. Customers leverage the dashboard for three core functions: managing instruments and assets, automating experiments, and collecting and managing data [2].

By combining these capabilities and different versions of equipment, Tayi plans to change labs in fundamental ways. So they are trying to create an ecosystem of instruments, scientists, and research.

To achieve this, Tayi knows that he cannot force people to build completely new laboratories equipped with the most modern equipment. Instead, he explains that they only help laboratories to enter the digital age by upgrading existing equipment and placing it in the cloud, helping maintain this ecosystem as laboratories develop and conduct research.

One of the partnerships combines TetraScience with Consolidated Sterilizer Systems (CSS), also located in Allston, which manufactures autoclaves. Arthur Trapotsis, president and CEO of CSS said that him

company wanted to get their autoclaves to communicate through the cloud, like thermostat or TV at any home does [1].

Instead of having CSS build its own cloud, Trapotsis decided to team up with TetraScience. They went with the TetraScience ecosystem because manufacturers of different equipment types can theoretically plug into it. As a result, lab personnel can have one cloud platform to monitor their entire lab.

Despite all the exciting IoT activity underway, many more advances lie ahead. For example, one aspect that may see emerging in the next three to five years is the use of machine learning and artificial intelligence to enhance the user experience for the scientist, enabling predictive experimentation.

To explain, we can imagine a situation where laboratory informatics software can predict the result of any given protocol, taking into account previous experiments and public domain knowledge, or warn the scientist regarding a potential error or problem.

In conclusion, making science work better in its current form, digital lab management could create new ways of doing science that assumes what can be done today. And cloud technologies will help a lot to carry out undeniably important work for all scientists in much more convenient and effective way.

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Аннотация. В данной статье рассматриваются быстроразвивающиеся и активно внедряющиеся облачные технологии. Описывается их принцип работы. Дается анализ их применения в науке. Выявляются тенденции развития облачных технологий на рынке. Уделяется особое внимание проблемам их внедрения. Кроме того, приводятся высказывания лидеров ведущих компаний по внедрению облачных технологий в лаборатории учёных для упрощения систематизации полученных ими опытов и знаний.

Ключевые слова: облачные технологии, облачные данные, экосистема, лаборатория. резервное копирование.

Annotation. This article considers the rapidly developing and actively introducing cloud technologies. The principle of its operation is described. Their application in science is analyzed. Trends of cloud technologies development in the market are specified. Special attention is paid to the problems of their implementation. In addition the statements of the leaders of the leading companies in the implementation of cloud technologies in the laboratory of scientists to simplify the systematization of their experiences and knowledge are given.

Keywords: cloud technologies, cloud-based data, ecosystem, lab, backup.

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COMPUTER GRAPHICS CARDS APPLICATION

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A video card (also known as a video card, graphics card, graphics card) is an important and very complex part of a computer. Modern video card is a kind of specialized computer, consisting of its own processor, RAM, BIOS and other components, in its structure and organization of interaction adapted for the most effective solution of one task processing and formation of graphic data, as well as their output to the monitor.

The main developers of video cards are the American company Nvidia and the Canadian ATI Technologies acquired in 2006 by the American company AMD. Nvidia graphics cards are represented by GeForce brand. ATI graphics cards are known to everyone under the name Radeon [1].

To find out which video card is installed in your computer (laptop), you need to go to the Windows Device Manager or use one of the specialized programs, for example, GPU-Z.

Few people think about how difficult is actually the process of processing various graphic data in order to obtain the final image displayed on the monitor (for example, in computer games). It is worth mentioning that this process requires a huge number of accurate calculations (creating

vertices, collecting them into primitives (triangles, lines, points, etc.), creating pixel blocks, lighting, shading, texturing, color assignment, etc.). Since the picture in the game is constantly changing, all calculations must be made at a very high speed to ensure the formation of a sufficient number of frames displayed in 1 second. The level above 24 frames per second (FPS, Frames per Second) is comfortable for the human eye. If this figure is lower, the person will notice "braking".

Usually, when a user says that his / her graphics card "does not pull" a certain game, it means its inability to display a sufficient number of frames per second. The same phenomenon can be observed not only in games, but also when working with large graphics programs. The ability of the graphics card to process graphics at a certain speed depends on the power of the card, and the complexity of the processed graphics. That is why the problem can often be solved by reducing the graphics settings of the game.

We cannot but add that computer can do without a separate (discrete) graphics card, but only if it has a graphics processor integrated into the system logic of the motherboard (in the North bridge of the chipset) or is part of the CPU (for example, Intel i7). As video memory in such cases is used part of the main memory of the computer. The characteristics of graphics cards integrated into the chipset are not high performance, but their capabilities are enough to perform all office tasks, work on the Internet, watching videos and even playing computer games with simple graphics.

In other cases, the purchase of a separate (discrete) graphics card is a necessity.

Let's consider the graphics construction. Modern graphics card consists of the following parts:

- graphics processor (GPU, GPU (Graphics processing unit) - the processor engaged in calculations and formation of the graphic information displayed on the monitor is the basis of the graphics card and in its complexity is almost as good as the CPU of the computer, and sometimes surpasses it. In many ways, it determines the main characteristics of the video card;

- Video memory-serves as a kind of buffer, which temporarily placed the output to the monitor images created and constantly changing the graphics core. This buffer also contains the elements necessary for the processor to generate these images;

- Video controller is responsible for the correct formation and transmission of the necessary information from video memory to RAMDAC.

RAMDAC (Random Access Memory Digital-to Analog Converter) or digital-to-analog Converter (DAC) – a device that converts the digital

results of the video card into an analog signal displayed on the monitor. The capabilities of this device is determined by the number of displayed colors, picture saturation, etc. Digital monitors, projectors and other devices connected to the digital connectors of the video card, use their own digital-analog converters and RAMDAC video cards are independent;

- video ROM (Video ROM) chip that stores the basic input-output system of the video card, and in other words, its BIOS-a set of rules and algorithms defined by the manufacturer, by which the components of the video card work and interact with each other;

- Cooling system – a device that removes and dissipates heat from the video processor, video memory and other components of the graphics card in order to ensure the normal temperature of their operation.

It is obvious that the price of the video card depends on its performance. But in practice, you will not feel much difference between a budget graphics card worth \$ 150. USA, outstanding 30 FPS in a particular game, and video monster, in the same game producing 150 FPS and worth 5 times more expensive. The best option would be a card from the "Golden mean", providing a sufficient supply of performance at an affordable price. Moreover, given the rapid pace of development of computer technology, this monster in a year in comparison with new products will turn into a monster, and its cost will fall by 30 or even 50 % [2].

Expensive and heavy-duty graphics cards are usually bought by users who build systems of multiple monitors, professionals working with cool graphics, as well as the category of people who are just pleased to be the owner of "expensive iron".

People have different income levels and how to spend the earned money is a personal matter. How much you are willing to pay for a graphics accelerator to decide, of course, you. The main thing for the money spent to buy a video card with maximum performance.

Performance is the result of collaboration of all components of the graphics card, so when choosing it you need to take into account many important characteristics, not only the amount of video memory, which is a very common mistake.

The main characteristics of graphics cards that affect their performance:

- Video memory performance. As practice shows, video memory is often a weak point of graphics cards. And it is not primarily in its volume, but in the bandwidth that determines the speed of access to the data stored in it. Throughput depends on two parameters frequency (clock speed) and width (bit rate) of the memory bus - the amount of data transmitted per clock cycle.

For example, some video memory, having a bus width of 256 bits, operates at a frequency of 1000 MHz. This means that for 1 second it performs 1000 cycles, transmitting 256 bits of information ($1000 \times 256 = 256\,000$ bits/s) for each cycle. The other memory operates at a frequency of 1800 MHz, but it has a 128-bit bus ($128 \times 1800 = 230\,400$ bit/s). As you can see in the example, memory with a much higher frequency is less productive due to the narrow bus. This is, of course, a purely theoretical example, but it demonstrates the real state of things [3];

- Video memory type (GDDR2, GDDR3, GDDR4, GDDR5, etc.) indicates to which generation the memory of the graphics card belongs. Each next generation is more perfect than the previous one and provides a higher frequency of work. But as you can see from the previous example, the new generation memory with a narrow bus may be worse than the previous generation memory with a wide bus in terms of its actual bandwidth;

- The amount of video memory also affects the performance of the graphics card, but only up to a certain limit (when it is a weak point). It is much more profitable to buy a card with GDDR5 - 256 bits and 1 GB than with GDDR3 - 128 bits and 2 GB. In fact, a graphics card with a low bandwidth memory capacity of 2 GB, when used at home, is unlikely to ever need. Such cards are not aimed at achieving maximum performance in computer games. They are designed to work with graphics or are more a product of marketing tricks manufacturers, designed for inexperienced buyers who evaluate graphics accelerators solely on memory size [4].

Therefore, it is necessary to evaluate all these characteristics of the video card: frequency, bit rate and amount of video memory, their balance. These indicators are usually listed in catalogs and price lists of shops;

- Characteristics of the graphics core. The clock frequency of the GPU is important, but not the most important characteristic. Graphics core with a relatively low frequency is often very productive. It all depends on the architecture of the graphics core, the number and quality of its unified Shader blocks (the more, the better) and other elements that determine the pixel and texture fill rate (fillrate, fill rate) of the video card (the higher they are, the better).

These characteristics of graphics cards are rarely listed on the price tags and directories. Therefore, before choosing a graphics adapter from several possible options, it is desirable on the official website of their manufacturers (or other specialized sites) to ask the real situation and choose the option with the highest performance.

We can draw the conclusion that in practice, the newer the line of graphics cards to which the graphics accelerator belongs, the more powerful

it is, as a rule. The exception is the "Junior" models of the line. Not infrequently the characteristics of such graphics cards are less productive than the "senior" representatives of the previous line. For example, GeForce GTS450 will be significantly inferior to GeForce GTX280.

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Аннотация. В статье рассматривается один из основных компонентов персонального компьютера, а именно видеокарта (другое название – видеоадаптер). Описывается конструкция графических карт. Особое внимание уделено наиболее важным техническим характеристикам и их влиянию на формирование ценовой политики. Представлены недостатки и преимущества. Эта статья предназначена для студентов, непрофессиональных пользователей, обычных клиентов, которые имеют дело с компьютерными системами и технологиями и хотят сделать разумный выбор при покупке видеокарты.

Ключевые слова: процессор, видеокарта, видеопамять, видеоконтроллер, производительность, графическое ядро.

Annotation. The article considers one of the main components of a personal computer, such as a video card (another name is video adapter). Graphic cards construction is described. Special attention is paid to the most important technical characteristics and their impact on the formation of price policy. Its disadvantages and advantages are presented. This article is intended for students, non-professional users, common costumers, which deal with computer systems and technologies and want to make a reasonable choice when purchasing a video card.

Keywords: Processor, graphics card, video memory, video controller, performance, graphics core.

**PEOPLE AND THEIR SUSCEPTIBILITY TO SOCIAL
ENGINEERING**

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Since the time of ancient man, two ways have evolved to obtain something that belongs to another: by force and by deception. The first approach gave rise to an arms race, and the second – a whole class of techniques at the subconscious level. Available technologies are changing rapidly, but people and their habits are not.

The foundations of social engineering have not changed significantly over the centuries-only the forms and details of techniques have changed. For example, in 1906, on the outskirts of Berlin, the unemployed Wilhelm Voigt bought on the market a worn form of Prussian captain and went to the nearest barracks. There he met a Sergeant and ordered to seize the town hall. Voigt took from the surrendered burgomaster without the slightest resistance the entire city Treasury – four thousand marks! Then he ordered everyone to stay in place for another half an hour, and then left the city on the train already in civilian clothes [4].

English Newspapers for a long time remembered this story, pointing sarcastically that the person in the form had binding authority. However, the essence of such scams lies much deeper. They always work at the level of psychology of people regardless of their country of residence and are relevant to this day. It is them that the most effective tactics of network attacks on the neural network has grown from.

Briefly speaking, social engineering is a method of unauthorized access to information or information storage systems without the use of technical means. The method is based on the tactics of human weaknesses using and is very effective one (fig.1). For example, using real names in a conversation with technical support, an attacker tells a fictitious story that he cannot get to an important meeting on the site with his remote access account [1, p. 11].



fig.1

As world practice shows successful breakings – most of the problems are associated with problems with people. To be more precise – it is their ability to give any information.

It is assumed that each employee has their own level of competence in matters of security and their level of access. Line employees do not have access to critical information, that is, even capturing their accounts and getting all the data they know will not cause serious damage to the company. But, their data can be used to move to the next stage already inside the protected zone. For example, you can get the names of employees and call the level above, posing as one of them. In this case, you can play in the authority, but you can just ask a couple of innocent questions and get a piece of the puzzle. Or go further, to the next more knowledgeable employee, using the fact that the team decided to help each other, rather than include paranoia on questions about a number of important data. Even with strict instructions, there is a chance that emotions will always outweigh [1, p. 8].

Don't you believe? Imagine a situation where an attacker calls the same girl from a call center several times a week for a month. He seems to be an employee, brings a lot of positive, lively talking, clarifies some open little things, sometimes asks for small help. Clear authorization is replaced by the fact that a person calls often. Ten, twenty, thirty times. Until it becomes one of the phenomena of life. He is practically a fixture, because he is aware of the various details of the company and calls constantly. For the 31st time again, the attacker makes a small request, but this time relating to important data. And if necessary, he gives a logical and plausible justification for why it is required, and in what trouble he is. Of course, a normal person will help him [2].

If you think that only incompetent users are subject to such attacks, then we recommend reading the book "The Art of Deception", where right away in the introduction Mitnik talks about how he introduced himself as the leading developer of the project and forced the system administrator to provide the privileged access to the system. Notice, it was the man who knew exactly what he was doing!

Back in the old days to perform an attack with the use of social engineering an intruder had to collect information about the victim for a long time. He used to buy reference books, dig into corporate trash in the hope of finding a valuable document, get acquainted with secretaries and even hack telephone switches, as described by Kevin Mitnik in his book "The Art of Deception". Today the lion's share of dirty work for the hacker is performed by social networks. Facebook will tell you all about the interests of the company's employees and their families. Twitter is about habits and routines. The main part of "identity theft" now takes place before the attack [1, p. 14].

On forums or in social networks, you can find many stories telling about how sophisticated methods hackers can penetrate into other people's computers. The mere thought that any attacker could gain access to the archives of the company forces management to abandon the use of open information networks [3, P. 303].

In conclusion, people tend to stick to the unwritten obligations: to answer the favor, concession to concession, favor for a favor. Without taking such a retaliatory step, people tend to experience "social awkwardness". In this case, the "response" may be disproportionately more valuable. Social engineering, using such features of human behavior, deftly manipulates the information and directs it in a certain direction, which in most cases harms the owner of the information. What is to be done to get rid of such manipulation?! One of the advices that we could give is:



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Аннотация. В этой статье описывается, как социальной инженерией пользуются хакеры. В частности, описываются социальные и психологические особенности человека, которые делают его восприимчивым к социальной инженерии.

Ключевые слова: социальная инженерия, хакер, сеть, информация, взлом.

Annotation. This article describes how social engineering is used by hackers. In particular, it describes the social and psychological characteristics of a person that make him susceptible to social engineering.

Keywords: social engineering, hacker, network, information, hacking.

UDC 004.91

INFORMATION TECHNOLOGY IN PUBLIC ADMINISTRATION

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Currently, the Russian Federation is gradually introducing information and communication technologies (ICT) into the public administration system. The introduction of ICT substantially changes all social relations. There is a formation of a new, information society. Information and communication technologies are understood as processes describing various devices, methods, mechanisms, algorithms for information processing. An integral part of ICT is a computer equipped with appropriate software [1, p. 11].

Information and communication technologies are being introduced in order to save time and money, as well as to speed up data processing and increase the degree of reasonableness of management decision-making. ICTs are universal and are becoming simpler and easier to use for many people. The distinguishing feature of such technologies is that they help people to collect and process information. The use of ICT is crucial for increasing the efficiency and effectiveness of public servants. It is precisely the informatization of civil servants that is today one of the most important tasks of the state authorities of our country. State authorities should apply the latest information and communication technologies. ICTs help public authorities to work closely with the population, organizations, business entities, for citizens and legal entities, the benefit is that they have access to various documents and necessary information [2, p.187].

Today, the largest state IT program is the Information Society (2011–2020) program. This program is a continuation of the program "Electronic Russia (2002-2010) and contains the main provisions that should guide the introduction of IT in various structures, and the results that need to be achieved. A major project in this regard is “e-government” [3, p.41].

E-government is a convenient and effective way to connect citizens with the state. The introduction of e-government increases the effectiveness and efficiency of government management, reduces the risk of corruption, reduces bureaucratic barriers, and at the same time significantly reduces government spending. According to estimates of the Ministry of Communications and Mass Communications of the Russian Federation, about 2 thousand types of public services can be obtained through the Internet [4, p.133-134].

Most of these services are collected on the State Services website

(www.gosuslugi.ru). In recent years, it has been regularly updated and upgraded to facilitate its use.

It should be noted that in the implementation of e-government, there are a number of problems, such as:

- unwillingness of state bodies to innovate and change;
- low quality of execution of state programs;
- Illiteracy in the use of modern systems by the public and by public servants.

To solve these problems, government agencies introduce advanced training courses, as well as additional education. The current process of increasing professional competence in the use of ICT by government employees takes place during the passage of various types of supplementary education programs, in particular during the passage of advanced training courses and self-education. These procedures help employees of state authorities to obtain more up-to-date information, as well as update the knowledge gained, due to the fact that the legislative base is updated systematically in accordance with modern requirements. This is what allows employees to be more competent and sociable in their field.

The process of e-government implementation consists of 2 stages:

- The first stage: the site of a state body is created and on this site their functions and tasks are indicated;
- The second stage: the placement of examples of documents necessary for obtaining public services, as well as the placement of documents of a state body [5, p. 39-40].

In order to find out the opinion of citizens about e-government and its implementation in the Russian Federation, experts conducted the First All-Russian Sociological Survey on the need to develop e-government in the country (3,200 people from 146 locations of 42 subjects of the Russian Federation participated in the survey). As a result of this event, the areas most in need of this project were identified: housing and utilities (71% of respondents), health care (58% of respondents), social welfare of citizens (50% of respondents), security and law and order issues (46% of respondents), population employment (42% of respondents).

Taking into account the speed with which information technologies develop in general, their introduction into various spheres of human activity, especially into the public administration system, will quickly and effectively improve communication between society and government and accelerate the development of the information society.

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Аннотация. Статья посвящена проблеме внедрения информационных технологий в сферу государственного управления. Авторы повествуют о том, что правительство предпринимает, чтобы поддерживать обратную связь с обществом, какие технологии внедряются, какие программы развития приняты и ключевые аспекты данных программ. В статье описываются такие процессы, как повышение квалификации государственных служащих, «электронное правительство» и др.

Ключевые слова: Информационные технологии, электронное правительство, государство, информационное общество, внутренняя политика, общество.

Annotation. The article is devoted to the problem of introducing information technologies in the field of public administration. The authors narrate what the government is doing to maintain feedback with society, what technologies are being introduced, what development programs have been adopted, and key aspects of these programs. The article describes such processes as the development of civil servants, "e-government", etc.

Keywords: information technology, e-government, state, information society, domestic policy, society.

SECTION 3 MATHEMATICS



UDC 514

APPLICATION OF CONSTANT WIDTH CURVES IN THE MODERN WORLD

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In this paper we are going to define some causes and the effects, advantages and disadvantages of different figures, interrelation between their curves and width alongside with their properties influencing our everyday life and the progress.

Manhole covers, saving pedestrians from falling into wells and interfering with motorists, most often have a round shape. Have you ever asked yourself why? The choice of such a form is explained by security considerations – a square cover may fail while shifting, since the side of the square is smaller than its diagonal. But the circle has a remarkable property – it is a figure of constant width.

Constant width means that when the shape is “girded” by two parallel straight lines, the width of the resulting strip will be constant, independent of the choice of direction of the straight lines.

Are there any other figures of constant width on the plane besides the circle? It turns out there is, and there are infinitely many of them (fig.1).

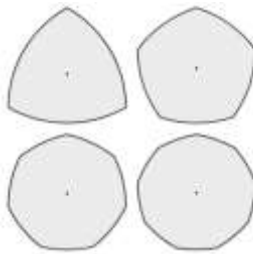


Figure 1 – Different types of curves of constant width

The simplest and the most famous such figure is the Reuleaux triangle. Precisely speaking, this figure only resembles a triangle, its border being the arcs of three circles with centers at the vertexes of a regular triangle and same radii equal to the length of the side of the triangle (fig.2). It can be shown (and “checked” with a caliper) when a figure is girded with parallel straights points of tangency of lines for the Reuleaux triangle will be one of its vertexes and some point on the opposing this vertex arc of the circle. Since the radii of all arcs are equal, the result of the "measurement" will always be the same.

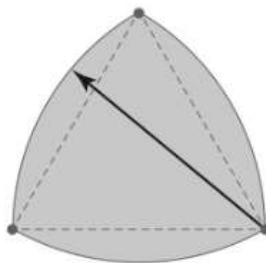


Figure 2 – Reuleaux triangle construction

By the same scheme as for a triangle, a figure of constant width can be constructed on any regular rectangle having an odd number of vertexes. You can build asymmetric shapes of constant width too.

Every day, the property of a constant width of a figure can be demonstrated by making a set of rollers with profiles of various shapes of a fixed constant width. If you put the rollers on a horizontal surface and cover with a plate, then as the rollers roll, the plate will move horizontally.

The figures of constant width have many interesting properties. For example, all figures of this constant width have the same perimeter. They also have a peculiar hierarchy. Namely, among the all figures of this constant width the largest area is at the circle, the smallest one being at the Reuleaux triangle.

Curves of constant width are often used in various areas due to their geometric properties. Let's look at some examples.

The first example is: you drop the coin into the machine and it sets off along the coin acceptor. If you want the coin not to get stuck you can of course expand the tube. But you can make coins in the form of figures of constant width, then the coin will not get stuck even while rotating.

The simplest figure of constant width, as we know, is a circle, the shape of which has the majority of coins. But there are exceptions. In the UK, 20 and 50 penny coins have the shape of a figure of constant width, built on a regular heptagon. The same form is represented by a coin of half dinar dignity, which is in use in Jordan. Making coins in the form of figures of constant width, other than a circle, saves metal. After all, as we know, a round coin is the most metal consuming.

In two other examples, the Reuleaux triangle is hidden from view, but is the main ideological component of the design.

Before the digital age, films were filmed on cine-film. Both in movie cameras and film projectors there were grab mechanisms, which provided an abrupt movement of the film along the lens (18 jumps per second normally). The movement of these mechanisms was assigned by the Reuleaux triangle.

In the automotive industry at the end of the 1940s Felix Heinrich Wankel invented an engine diagram without a crankshaft – a device that converts the translational motion of pistons into rotation of a motor shaft. In this engine there are no cylinders. The body, called the rotor, is constantly touching the walls of the motor chamber while rotating, dividing the working space into three parts. In the Wankel engine the shape of the rotor in cross section is the Reuleaux triangle.

Returning to the geometry, we can note that if the center of the Reuleaux triangle moves along a special closed curve, and the triangle itself rotates around the center, then the sweeping area has the shape of a square, the corners of which are slightly rounded. Using this idea, a drill, which allows to get almost square holes, had been developed and patented!

Now, few people can imagine what would have happened to humanity if we had not invented the wheel. Did a man understand in the past, that inventing the wheel, he created the science? Constant width curves have made the process easier. For this we have to thank mathematics! Everything that surrounds us is essentially the maths!

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Аннотация. Статья посвящена рассмотрению основных свойств и областей применения фигур постоянной ширины. Авторы на примере простейшей кривой постоянной ширины – окружности – обобщают особенности рассматриваемого объекта. Также была описана наиболее распространенная фигура – треугольник Рёло, на примере которого было рассмотрено разнообразие применения его в современной технике и повседневной жизни. Сделаны выводы о важности данного открытия и последующих исследований в данной области геометрии.

Ключевые слова: Треугольник Рёло, фигуры постоянной ширины, двигатель Ванкеля, планиметрия, геометрия.

Annotation. The article is devoted to consideration of the basic properties and areas of application of curves of constant width. The authors summarize the features of the object under consideration by the example of the simplest curve of constant width – a circle. Also there is a description of the most common figure of the Ryoulot triangle, on the example of which the diversity of its use in modern technology and everyday life was considered. Conclusions are made concerning the importance of this discovery and subsequent research in this area of geometry.

Keywords: Reuleaux triangle, curves of constant width, Wankel engine, planimetry, geometry.

SECTION 4

ECOLOGICAL PROBLEMS AND THEIR SOLUTIONS



UDC 504.43

CONTAMINATION BY NITRATE IONS OF LARGE SPRINGS OF THE SEVASTOPOL REGION

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Introduction. In connection with the constant increase in the anthropogenic load on the environment, the emergence of new foci of chemical pollution is increasingly observed. Thus, the hydrosphere, like the rest of the earth, suffers from the ingestion of artificially synthesized compounds and natural substances that exceed their natural volumes by tens and hundreds of thousands of times.

One of these substances are nitrates. Industry, agriculture and even household activities introduce huge amounts of nitrate ions into the hydrosphere, which, as a result of nitrate pollution, can cause significant damage to both humans and ecosystems.

Since nitrate poisoning is dangerous to humans, it is important to monitor sources in which water may have an increased content of nitrate ions. The reason for the increased attention to the underground sources of

the Crimean and Sevastopol regions is the proven possibility in practice of using underground water as a stable source of water supply. Already today in the Sevastopol region about 30% of all water consumed is water from wells and springs [1].

The purpose and formulation of the research problem. Scientists of the department "Technosphere safety" of *Sevastopol State University* conducted a study of spring water on the content of nitrate ions from 2013, the results are given in publications [2-5]. Studies on this indicator alone indicate significant pollution of spring waters and unsuitability of their use for drinking purposes. The concentration of nitrates in some springs located within the city limits exceeds the standard value several times.

Contamination of water with nitrates can lead to serious consequences for human health and even death. Thus, in the human body, with the participation of specific bacteria under alkaline conditions, nitrates are reduced to nitrites, leading to the formation of methemoglobin [6]. Increasing the concentration of this compound leads to the emergence of the disease methemoglobinemia. The toxic effect of nitrates is manifested by tissue hypoxia, suppression of immunity and an increased risk of malignant tumors (since nitrates are considered as one of the main precursors of carcinogenic N-nitroso compounds) [7, 8]. For this reason, the content of nitrate ions in drinking water is strictly controlled. According to the standards of maximum permissible concentration of nitrates in water in the Russian Federation is 45 mg per liter [9].

Since the main source of groundwater nitrate-ions is contaminated with municipal waste as a result of the high pressure on the natural environment of cities, special attention was paid to the study of springs located in cities. Two large springs in the territory of Sevastopol were subject to the most detailed study: a spring in the Sarandinakin's ravine and a spring in the territory of the natural park of regional importance "Maksimov's dacha". Perennial data indicate a steady excess of the MPC in the water of the investigated springs.

The spring of "Maksimov's dacha" is very polluted. For the entire period of studies, the average concentration value exceeds the maximum permissible almost 3.4 times and amounts to 151.0 mg / l (Fig. 1, d-f).

The dynamics of the indicator was considered for the entire period and separately for each calendar year. Thus, the average annual concentration for 2013 is equal to 102.2 mg / l (which is the minimum value for the entire observation period. In 2014, the same indicator is 133.5 mg / l, and in 2015 - 190.5 mg / l.

In 2016, the average concentration is 192.2 mg / l, which is the maximum value over the entire observation period. In 2017, the average

annual concentration drops to 143.4 mg / l, but it is precisely this year that two peaks of concentration are observed: in April (390.6 mg / l) and December (277.7 mg / l). In 2018, the average concentration is 130.48 mg / l, the indicator is stable from September to December.

In 2018, the average concentration is 130.48 mg / l, which is lower than the same indicator in 2017 by 10.1%. Smoothing of the curve and stable concentration indices are observed from September to December (Fig. 1, f).

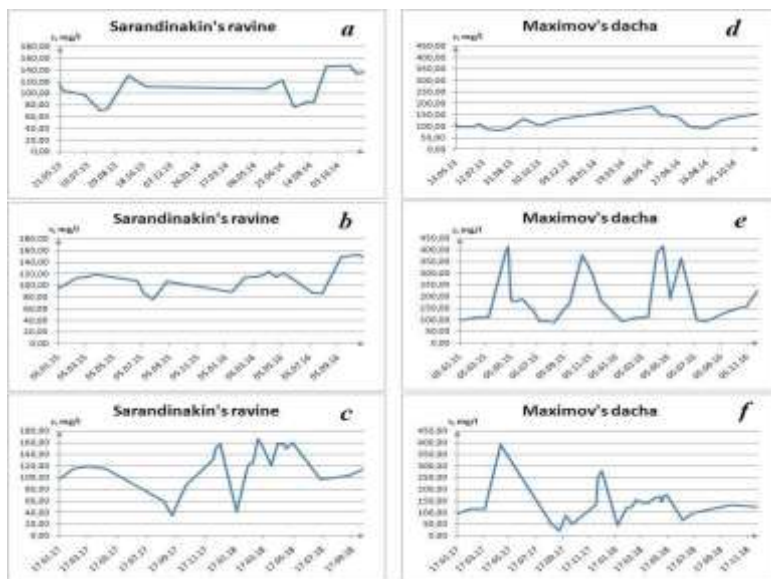


Figure 1. The change in the concentration of nitrate ions the Sarandinakin's ravine (a-c) and on the territory of "Maksimov's dacha" (d-f) 2013-2018.

In the spring in the Sarandinakin's ravine, the ecological situation is more favorable. The average concentration values are 111.5 mg / l: which is about 2.5 times the MPC (Fig. 1, a-c). Annual changes are also characterized by smoother changes in the measured indicator.

In 2013, the average is 98 mg / l. The value of the indicator is stable throughout the entire calendar year. In 2014, the average is 114.8 mg / l, and in 2015 it decreases to 100.7 mg / l, by 14.1 mg / l. In 2015, the nitrate ion content is most stable over the entire observation period.

In 2016, the average concentration of nitrate ions is 116.9 mg / l and is the maximum annual average over the entire observation period. In 2017, the average concentration decreases again and amounts to 113.6 mg / l. In 2018, the average is 135.26 mg / l. As in the case of the spring on the territory of "Maksimov's dacha", from July to December the concentration value is stable and is in the region of 100-110 milligrams per liter. Conducted research allows us to predict a change in the situation in the future.

Findings. There is a tendency to increase the concentration of nitrate ions in the springs studied, however, the highest growth rate of the indicator was observed in 2016-2017. Now concentration values are more stable, the rate of growth of groundwater pollution has decreased, but it has not stopped.

The following measures can be proposed to reduce the concentration of nitrate ions:

- repair and modernization of sewer systems is necessary in order to avoid sewage leaks;
- conducting operational control and liquidation of unauthorized dumps;
- for the timely adoption of measures to control the pollution of groundwater, state monitoring is extremely necessary.

To inform the public about the quality of groundwater, it is necessary to timely receive monitoring data to the interregional office of the Federal Service for Supervision of Consumer Rights Protection and Human Welfare in the Republic of Crimea and the city of federal significance Sevastopol.

"The study was carried out with the support of the Russian Foundation for Basic Research and the city of Sevastopol in the framework of the research project No. 18-35-50004".

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Аннотация. Исследована динамика изменения концентрации нитрат-ионов в двух наиболее загрязненных источниках Севастопольского региона. Построены и изучены графики изменения концентрации нитрат-ионов с течением времени. Выявлена тенденция к повышению уровня загрязнения родников нитратами. Выявлены причины загрязнения и предложены меры по снижению уровня нитрат-ионов. Проведенные исследования позволяют прогнозировать изменение ситуации в будущем.

Ключевые слова: Севастополь, экология, нитрат-ионы, весна, загрязнение, концентрация, динамика.

Annotation. The dynamics of changes in the concentration of nitrate ions in the two most polluted springs of the Sevastopol region was investigated. Graphs of changes in the concentration of nitrate ions over time were constructed and studied. The tendency to increase the level of contamination of springs by nitrates is revealed. The causes of pollution have been identified and measures have been proposed to reduce the level of nitrate ions. Conducted research allows us to predict a change in the situation in the future.

Keywords: Sevastopol, ecology, nitrate ions, spring, pollution, concentration, dynamics.

WHAT HAVE WE DONE TO THE WORLD?

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"What have we done to the world?" – this question is of great concern for every inhabitant of our planet. The title of this article is derived from Michael Jackson's song "The Song of the Earth". The song was one of several Jackson's songs, focusing listeners on the problems of poaching and environmental protection.

Today along with military conflicts and the issue of nuclear disarmament environmental problems are among the most acute for humanity [8, P. 342].

Currently, environmental problems can be divided into:

- ❖ atmospheric (air pollution: mechanical, thermal one; from chemical industry);
- ❖ water (pollution of rivers, seas and oceans);
- ❖ soil (soil pollution, salinization, etc.);

- ❖ biotic (reduction of species diversity of flora and fauna);
- ❖ complex (landscape) – reduction of biodiversity, violation of the regime of protected areas, etc.

The urgent environmental problem is the chemical industry, as well as its impact on the flora and fauna.

Compared to energy and transport, global pollution through the chemical industry is small, but it is a significant local impact. Oil-producing, oil-refining and petrochemical industries are the sources of such pollutions as with hydrocarbons, acid impurities, and solid particles. Plants dump a large amount of waste water into water bodies. Wastes from companies in this industry adversely affect the biosphere. Every year, the industry produces 14.0 million tons of toxic wastes. Only 20% of them is neutralized. The remaining 80% of the waste accumulates and causes huge and irreparable damage to the flora and fauna. Such sources of pollution as sewage, petroleum oil, plastics and other waste of human life not only spoil beautiful seascapes, but also have a negative influence on marine life [7, P. 335].

There are 5 classes of chemical waste hazard:

1. The first class includes gases (SO_2 , CO_2 , H_2S , CS_2 , NH_3 , hydrocarbons, etc.).
2. The second class includes liquid substances (acids, alkalis, organic substances, liquid metals and their salts).
3. The third class represents solid products (soot, dust, resins, lead compounds, etc.).
4. The fourth class has a low degree of danger.
5. The fifth grade is almost harmless. The class is represented by natural sawdust, paper, food residues, unpolluted polyethylene waste, etc. [2].

Chemical production uses both water and natural resources (fossil minerals). A sufficient amount of water resources is not purified, drains merge into natural reservoirs and rivers. Consequently, most of the waste gets into animal organisms, thereby poisoning them. There are sub-sectors of the chemical industry such as inorganic chemistry, organic chemistry, ceramics, petrochemistry, agrochemistry, polymers, explosives, pharmaceutical chemistry, perfumes and cosmetics. Of all the types of chemical industries, the most pollution is brought by the manufacture of varnishes and paints. This is due to the fact that varnishes and paints are often made on the basis of alkyd and other polymeric materials, they usually contain a large percentage of the solvent. Emissions of organic substances production associated with the use of paints and varnishes is 350 thousand tons per year [4].

Oil and gas, petrochemical and metallurgical companies have a negative and dangerous impact on the environment. The world ocean waters are polluted by tankers that transport petroleum products, most of the inhabitants of marine flora and fauna suffering from these products. The processes occurring in lithosphere (which is home to humanity) are closely related to the processes taking place in the hydrosphere. The problem of pollution of the oceans is extremely urgent, since it affects the flora and fauna of not only the oceans, but also, indirectly, the flora and fauna of the land [8, P. 342].

Accidents at chemical and nuclear industry enterprises pose a significant danger to living beings, populations of organisms in ecosystems and flora. Most of the known accidents at the chemical plant in Bhopal (India), at the 4th unit of the Chernobyl nuclear power plant, accidents with oil tankers [1].

The factors that constrain the development of the industry include:

- ❖ accumulation and disposal of industrial and human activities wastes;
- ❖ predominance of enterprises producing alkalis, acids, fertilizers;
- ❖ minimum processing of secondary products, raw materials;
- ❖ environmental hazards of petroleum products, polymers, microplastics and microbeads, alkalis, acids, fertilizers.

Depending on their properties and structure, chemicals affect organisms in different ways. Most chemicals interact with the enzymes of the body, thereby changing their structure and represent molecular biological effects causing violation of metabolism and regulatory processes in the cell.

Substances such as DDT (dichlorodiphenyltrichloroethane), PCBF (Powder Coating Bonding Free) and polyaromatic hydrocarbons have mutagenic and carcinogenic effects. They are dangerous for humans and animals. This is manifested in prolonged contact with the living organism to these substances in air and food products [5].

Biodegradable plastics still exist on the planet as invisible pieces of microplastic and microbeads. Plastic can also contain all sorts of toxic substances such as antistatic and softening agents and even metals. Scientists have found a high concentration of toxic substances on the porous surface of plastic particles. Microplastic is used in textile and cosmetics can contain: Polyethylene (PE), Polyethylene Glycol (you can find them as PEG-followed by a number for example PEG-32), Polypropylene (PP), Polymethyl methacrylate (PMMA), Polyethylene terephthalate (PET), Nylon [8. P 345].

Currently, we can state the fact that the state of the animal world is experiencing dramatic changes, which is the main environmental problem of the modern world. The animal world is a set of all species and individuals of wild animals inhabiting our planet. As the famous composer Michael Jackson wrote: "What about animals? We've turned their Kingdom to dust... What about forest trails...". This quote will describe the problem as a whole. After all, soon the world can be left without such inhabitants as: chimpanzees, rhinoceros, Galapagos penguin, kakapo, big Panda, white-billed woodpecker, tiger, California Condor, elephant, lemur, orangutan, Amur leopard, pangolin, blue whale and axolotl. All these animal species are endangered. Therefore, it is necessary to protect the environment and animals from dangerous man-made impacts of industrial enterprises.

According to estimates of the world wildlife Fund by the middle of the 21st century in the world can disappear not only the above listed species of animals, but also commercial and among them ungulates (fallow deer, chamois, antelope, etc.), fur (sable, muskrat, sea otter), sea animals (dolphin, walrus, sea-cat), as well as some waterfowl [6].

The main reasons for these problems are:

- ❖ violation of the environment;
- ❖ overexploitation, fishing in prohibited areas;
- ❖ direct destruction aimed to protect products;
- ❖ environmental pollution.

Emissions of industrial wastes have a great impact as well. Pesticides have recently become a powerful factor in the negative impact on animals. The drainage of wetlands is especially destructive for biodiversity. The rate of wetlands disappearance is increasing.

In order to solve environmental problems and preserve the planet's biodiversity wildlife sanctuaries, protected landscapes, unique wildlife areas, nature reserves, etc. have been created. There are several ways to solve this problem and prevent an adverse effect on flora and fauna:

- ❖ creation of waste-free production, treatment facilities;
- ❖ use of clean energy sources;
- ❖ ecological expertise of technical projects;
- ❖ reasonable restriction in the use of natural resources;
- ❖ establishment of protected breeding centers for rare and endangered species of animals and plants;
- ❖ formation of ecological consciousness and ecological culture.

Each species saved from death is a natural resource preserved for the national economy. The realization of the unpredictable value of biological diversity and its importance for the maintenance of natural evolution should lead humanity to understand and consciously realize the threat posed by the

reduction of biological diversity resulting from certain human activities, more precisely – in the production of various chemical and petrochemical substances. At the moment, humanity is trying to actively apply centralized measures to protect the environment [3]. For this purpose the uniform international rules and regulations for the protection of climate, forests, World Ocean, atmosphere – the Earth environment must be created.



And, in the final of the present article we can't help echoing the Michael Jackson's lyrics:

let us try to cooperate and save the crying Earth and the weeping shores!

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Аннотация. Данная статья представляет обзор такой экологической проблемы как химическая промышленность и её воздействие на животный и растительный мир. Рассмотрены факторы, которые сдерживают данную отрасль, а также главные причины этой проблемы. Существует классы опасности отходов выбрасываемых предприятиями, которые описываются в данной статье. Большинство растительного и животного мира страдают от негативного влияние выбросов некоторых отходов в среду их обитания. Так же рассмотрены некоторые пути решения этой проблемы.

Ключевые слова: Химическая промышленность, отходы, животный мир, факторы, опасность, загрязнение, флора, фауна, нефтедобыча, выбросы.

Annotation. This article represents an overview of such environmental problems as chemical industry and its impact on flora and fauna. Factors which constrain this branch, and also the main reasons of this problem are considered. There are hazard classes of wastes emitted by enterprises, which are described in this article. Most of the flora and fauna suffer from the negative impact of emissions of some wastes into their

environment. Some ways of this problem solution are also considered in the article.

Keywords: Chemical industry, waste, fauna, factors, danger, pollution, flora, fauna, oil production, emissions.

UDC 504.054

THE ACID RAIN IMPACT ON THE ENVIRONMENT

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Acid rain is a serious environmental problem caused by environmental pollution.

Acid rains are all types of precipitations in which there is a decrease in the pH of rainfall due to air pollution with acid oxides, usually sulfur oxides and nitrogen oxides.

The impact of acid rain on the environment is quite diverse. For normal precipitation the pH being equal to 5,6, even a small change being able to lead to serious consequences for living organisms in the affected area. A large change in pH causes the death of marine life, insects and amphibians. In areas where such precipitations were present, you can see acid burns on the leaves of trees, the withering away of some plants.

Acid rains expose large impact on soil, flora and fauna, as well as hydrosphere. Their frequent appearance scares people, as these precipitations can adversely affect human health. After a heavy rainfall,

toxic gases accumulate in the atmosphere and they are not recommended to be inhaled. A short walk in the acid rain can cause asthma, heart and lung diseases.

There are two types of causes for toxic rains' fallout: natural and artificial (anthropogenic). As a result of the development of industry and technology plants, factories and various enterprises started to emit huge amounts of sulphur dioxide (SO₂) and nitrogen oxides of NO_x composition, such as nitrogen monoxide (NO) and nitrogen dioxide (NO₂) into the air.

Sulfur dioxide (SO₂) enters the earth's atmosphere because of natural and anthropogenic emissions. The sources of natural emissions are mainly volcanic eruptions and forest fires. Most of the total sulphur dioxide contained in the atmosphere is represented by industrial emissions from energy, ferrous and non-ferrous metallurgy (about 100 million tonnes per year, while natural emissions are about 20 million tonnes per year).

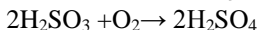
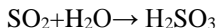
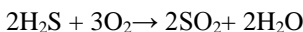
Sources of natural emissions of nitrogen oxides in the first place are lightning discharges resulting in formation of monoxide at first followed by the nitrogen dioxide formation.

Industrial emissions of nitrogen oxides constitute about 70 million tonnes per year, while natural emissions are about 700 million tonnes per year. The main sources of industrial emissions are fuel combustion, motor transport and other types of motor vehicles, mining, processing and use of various minerals, as well as the building materials' production process. The latter causes the formation of harmful emissions, provoking acid rain fallout.

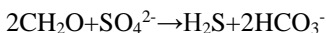
There are also two types of acid rains, which are not yet monitored – they are aerosols of hydrochloric and hydrofluoric acids.

Mechanism of Acid Rain Formation

In the process of volcanic activity, hydrogen sulfide (H₂S) is formed, which, entering the atmosphere, with the help of air oxygen turns into sulfur dioxide. The latter interacting with moist air, forms sulfurous acid (H₂SO₃), which in moist air is oxidized to sulfuric (H₂SO₄):

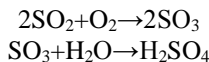


The composition of the soil and the ocean contains a large number of sulfates being reduced to hydrogen sulfide due to microorganisms:



Fuel combustion, smelting of metal ores leads to the formation of sulfur dioxide. The latter, entering the atmosphere, forms sulfurous acid (H₂SO₃), which is oxidized to sulfuric acid (H₂SO₄) in moist air. Also,

sulfur dioxide (2SO_2) is partially oxidized to sulfuric anhydride (2SO_3), which reacts with atmospheric water vapor (H_2O) to form sulfuric acid:



Aerosols of sulfuric and sulphurous acids condense in a humid air atmosphere, causing the acid rain fallout (Figure 1).

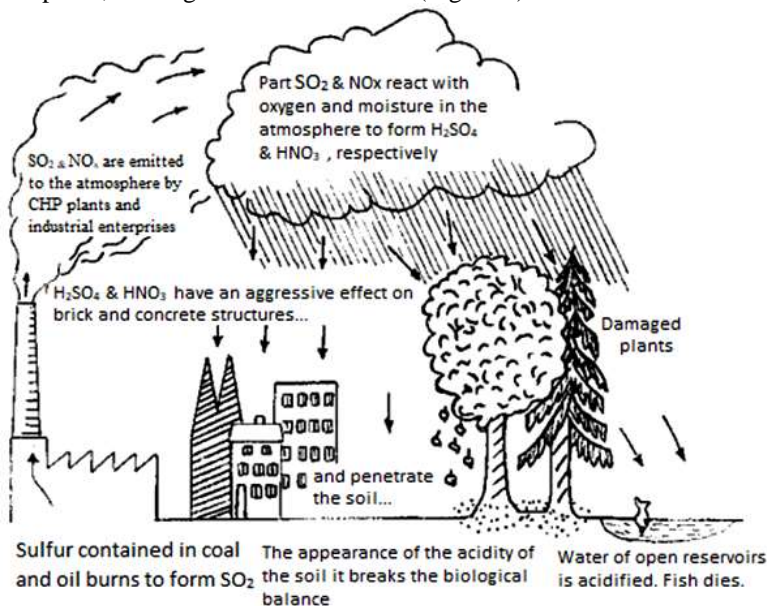
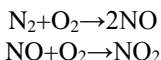


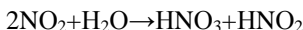
Figure 1. Scheme of acid rain formation

The formation of nitric acid aerosols occurs in the so-called "day" and "night" reactions.

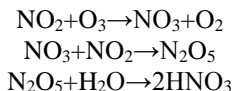
Nitrogen contained in the air, because of the high temperature (about $1200\text{--}1300^\circ\text{C}$) of the thunderstorm discharge reacts with air oxygen to form nitric oxide (II), the latter immediately being oxidized to nitrogen dioxide:



Nitrogen dioxide interacting with moist air, a mixture of nitric (HNO_3) and nitric (HNO_2) acids is obtained:

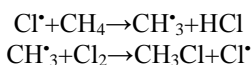


The "night" reaction occurs between nitrogen dioxide and ozone to produce radical NO_3 , which reacts with moist air to form nitric acid aerosols:



This reaction is not carried out during the day, as radical NO_3 rapidly decomposes under the action of sunlight.

Emissions from chemical plants and waste incineration result in the formation of chlorine radicals. The chlorine radical (Cl^\bullet) is combined with methane (CH_4) released from rice fields or by permafrost thawing producing hydrogen chloride (HCl), which dissolves easily in water to form hydrochloric acid (CH_3Cl) aerosols:



As a result of emissions from the glass and aluminum industry, hydrogen fluoride (HF) enters the atmosphere and, dissolving in moist air, forms hydrofluoric acid.

Effects of Acid Rain and Its Impact on the Environment and on Humans

One of the less dangerous consequences of toxic precipitations is the destruction of stone monuments and architectural objects (Figure 2). All this can lead to the collapse of public buildings and houses of a large number of people.



Figure 2. Destruction of architectural objects with acid rains

The Impact on the Soil

Getting on the soil acid rain reduces its fertility, which leads to the soil pollution and decrease in yields. Absorbing water from the affected soils,

trees dry up and become more sensitive to ambient temperature, their root systems being inhibited in development and metabolic processes being disrupted.

The Impact on Plants

On the surface of plants there is a protective wax cover, necessary to protect against pathogens such as fungi and harmful insects. Getting on plants acid rain destroys this protective cover, making plants more vulnerable. These damages are very dangerous especially during a drought as moisture evaporates through them quicker and the plant dries up. Besides, the biogenic elements necessary for normal functioning of a plant are washed out through those damages. This is due to the fact that the ions Na^+ , Ca^+ , NH_4^+ contained in the soil are replaced by hydrogen ions H^+ , and also because of a decrease in the activity of nitrogen fixators. The lack of these elements leads to slower growth of plants and reduction of their protection against pests.

The composition of all clays mainly contains kaolin ($\text{Al}_2\text{O}_3 \cdot 2\text{SiO}_2 \cdot 2\text{H}_2\text{O}$), which passes into solution under the action of acids, this process being called aluminum mobilization. Aluminum solutions are very toxic to the root system of plants, as they destroy the root hairs, and this leads to metabolic disorders.

Also, because of the increase in soil acidity heavy metals begin to move into solutions, which also negatively affects the soil at first, and then on plants. Microorganisms such as fungi, bacteria, etc. contained in the soil decompose organic compounds and fallen leaves. Solutions of heavy metals greatly reduce the activity of these microorganisms, leading to deterioration of soil quality.

First of all, lichens, which show how clean the air environment is, suffer. Shrubs and trees also fall under the negative influence of acid precipitations causing premature leaf fall, the leaves' color change, the bark damage, the drying of huge areas of forests occurring (Figure 3).



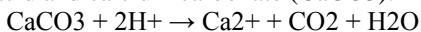
Figure 3. The effect of acid rain on the plant world.

Especially coniferous forests suffer, as their needles fall less often than the leaves, accumulating a greater amount of pollutants.

Impact on Aquatic Ecosystems

Acid rain has a strong negative impact on the inhabitants of marine and fresh water bodies. Because of the leaching of aluminum from the soil by its transition from insoluble compounds into soluble – fish and marine animals can absorb them, and this will lead to abnormal development of the inhabitants and their death, damage to the Gill apparatus, the disappearance of entire populations of fish. The death of fish causes the death of animals feeding on these fish.

Not all water bodies are equally sensitive to acid precipitations. It all depends on the type of underlying soil. For example, if the soil contains limestone, such soil resists the action of acid rain, as there is a neutralization reaction between acid and calcium carbonate (CaCO_3):



If granite acts as a litter, such reservoirs on the contrary are very sensitive to acid rain.

Fresh water ecosystems have $\text{pH}=6-7$. The inhabitants of these reservoirs are very sensitive to changes in the pH of the environment, as only at a certain level of acidity there is normal metabolism, activity of hormones and enzymes, growth and development of the body. Because of the high acidity the female fish can not spawn. If it managed to lay eggs, they are likely to die, or the hatched fries die due to exposure to great stress. This leads to the fact that mainly adults are found in these bodies of water. This, for example, occurs during the snow melting, as accumulated during the winter acid precipitations are washed into rivers and lakes during spawning, this fact making it impossible to reproduce fish.

Impact on People

Sulfuric acid, formed by the interaction of sulfur dioxide with water, causes the destruction of human and animal lung tissue, increases the risk of asthma, severe pulmonary disease – silicosis.

Irritation and corrosion of mucous membranes, reduced immunity, bronchitis and pneumonia are caused by nitrogen oxides. Especially dangerous mixture is a nitrogen oxides and sulfur dioxide mixture causing an increase in air toxicity, called synergism.

Protection against Acid Rains

Taking into account all the above mentioned problems the urgent task is to find correct measures to protect the Earth against acid rains, impact. How could we do this? There are several undertakings that possibly could help:

1. Reduction of sulfur content in various fuels through the use of low-sulfur oil and coal, sulfur removal from fuel oil, multi-stage flotation, electrostatic separation, oil agglomeration, chemical and microbiological purification of coal.

2. Cleaning oil from sulfur by catalytic hydrogenation and special chemical additives, such as pyrrolin, disulfuram, bhasin, troughs etc.

3. Improvement of fuel processing technologies.

4. Cleaning of the end gases by bubbling through a solution of limestone.

5. The addition of substances exhibiting alkaline nature and neutralizing acids, the so-called liming.

6. Replacement of dead populations of animals and plants with new ones that better tolerate oxidation.

7. Treatment of architectural monuments with special protective substances.

Acid Rain – the Earth feels pain!

Acid Rain – plants can't grow!

Acid Rain – animals die!

Acid Rain – fish can't spawn!

Acid Rain – architecture is destroyed!

Acid Rain – kills the living world!

Acid Rain – the Earth cries: "Friends!

Save me from these killing rains!

The salvation is in Human's hands!"

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Аннотация. В данной статье поднимается проблема воздействия кислотных дождей на почву, растительный мир и водные экосистемы, а также на человека. Рассмотрены механизм и причины появления кислотных дождей при помощи описания химической составляющей процесса. Главная причина выпадения кислотных осадков – техногенное воздействие на окружающую среду, заключающееся в промышленных выбросах кислотообразующих оксидов, таких как серный ангидрид, монооксид и диоксид азота. Представлены катастрофические последствия выпадения кислотных дождей и возможные меры защиты от них.

Ключевые слова: Кислотные дожди, оксид, кислота, окружающая среда, почва, растения, человек, водные экосистемы, защита, механизм.

Annotation. This article raises the problem of the impact of acid rain on the soil, flora and aquatic ecosystems, as well as on humans. The mechanism and causes of acid rain are considered through the chemistry of the process. The main cause of acid precipitation is the anthropogenic impact on the environment, consisting in industrial emissions of acid-forming oxides such as sulfur anhydride, monoxide and nitrogen dioxide. The catastrophic consequences of acid rain and possible measures of protection against them are also presented in the article.

Keywords: Acid rain, environment, acid, oxide, soil, plants, human, aquatic ecosystems, protection, mechanism.

UDC 535.3

RESEARCH AND ANALYSIS OF PLEXIGLASS AS A FACTOR IN THE CONSERVATION OF THE ENERGY RESOURCES OF THE PLANET EARTH

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Along with the accelerating growth and development of the planet's population, the depletion of the energy resources of the planet Earth began to be observed. Such a course of events requires an active search for a solution to the problem of preserving and renewing resources. One of the solutions is to use Plexiglas with different permeability.

Consider a few examples from everyday life. Smelting workshops equipped with special windows with high transmission Plexiglas will pass the heat generated by the units (or as these things are called) heat outside the workshop, which will create more comfortable conditions for the operating personnel and will also play a role in protecting the smelting equipment from overheating.

Another good example is greenhouses. This is an essential element for growing plants and food.

The quantity of the crop and its quality depend on the quality of the selected materials for the construction of greenhouses. For the most favorable growing conditions, Plexiglas with low light transmission is used to achieve the greenhouse effect. The light passing through the Plexiglas is not refracted or distorted, which means that flowers or food will receive a sufficient amount of light, and this is very important. Also, Plexiglas is very durable and weather resistant, which gives another advantage in the use of Plexiglas with different bandwidth.

Types of glass with different transmission

Glass is an amorphous substance that does not possess the properties of a crystalline substance in a solid form. It is an inorganic melting product cooled to a solid state without crystallization.

We distinguish several types of glass with different light transmission:

1) Reinforced glass is sheet glass, inside of which, in the process of its production, a metal grid is laid parallel to the surface plane. Light transmission is 60-65%.

2) Safety glass - tempered glass that does not form fragments with sharp edges during its destruction. Light transmission is 85%.

3) Borosilicate glass - silicate glass containing boron as a characterizing component. Light transmission is 90%.

4) Protective glass is the common name for structurally different types of glass designed to protect personnel and property from dangerous influences, as well as premises from penetration. Light transmission is 60%.

5) Tinted glass - has a low coefficient of light transmission.

The picture below (pict/1) shows that the dependence of the transmission of glass can be divided into three areas: “low” (150-300 nm), “medium” (after 950 nm) and “high” (400-650 nm). What is remarkable: the area of "high" light transmission corresponds to the maxima of the intensity of thermal radiation in approximately 4000–7000 K temperature ranges.



Picture 1 – The dependence of the transmission of glass

These ratios are easily obtained from the law of Wien displacement:

$$\lambda_{\max} = b / T,$$

where λ_{\max} is the radiation wavelength with maximum intensity (m), b is the coefficient called the Wien constant, in the International System of Units (SI) has a value of $0.002898 \text{ m} \cdot \text{K}$ and T is the absolute value of temperature (K).

The law of Wien displacement says that the wavelength corresponding to the maximum emissivity is inversely proportional to temperature. Since the wavelength of maximum radiation determines the perceived color, although radiation occurs in all spectral ranges, we have an explanation for the change in the color of the glow of the heated iron rod from red to white with increasing degree of heating. As the temperature rises, red light with a longer wavelength becomes visible first. A higher temperature then leads to the appearance of additional colors corresponding to shorter wavelengths. In the end, when the temperature is already high enough, the radiation consists of all the wavelengths of the visible spectrum, and therefore it appears bright white. For the same reasons, in order for a filament in an incandescent lamp to become a good emitter of visible light, it must be heated to thousands of degrees K, while infrared lamps operate at lower temperatures.

Conclusion: We considered two cases of using Plexiglas. Also types of glasses with different light transmission were considered. Thus, it can be noted that for the smelting workshops, borosilicate glasses with the highest transmittance = 90% will be most suitable. For greenhouses, tinted glass with low transmittance will be the best option.

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Аннотация. В данной статье рассматривается проблема истощения энергетических ресурсов планеты Земля, а также предложены некоторые пути её решения посредством использования оргстекла с различной проницаемостью на производстве.

Ключевые слова: оргстекло, сохранение и возобновление ресурсов, плавильные мастерские, теплицы, пропускная способность, светопропускание.

Annotation. This article deals with the problem of depleting the energy resources of planet Earth, and also suggests some ways to solve it through the use of Plexiglas with different permeability in production.

Keywords: plexiglas, preserving and renewing resources, Smelting workshops, greenhouses, bandwidth, light transmission.

SECTION 5: THE ACTUAL PROBLEMS OF ECONOMICS



UDC 330.322

DYNAMICS OF WORLD INVESTMENT PROCESSES IN TERMS OF GLOBALIZATION

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The globalization of the world economy leads to significant changes on the continents, which are caused primarily by the expansion and deepening of economic integration, significant changes in the structure of national economies, long-term transformations, social and economic, geopolitical challenges. Under these conditions, the economic systems of some countries are becoming increasingly open, and the global reproduction process impacts the movement of resources, including investment, in different regions and world countries [1, c. 1].

The scientific works of many domestic (A. Yu. Arkhipova, V. P. Dobrovolsky, A. G. Ivashenko, E. G. Ishchenko, M. L. Luchko, Yu. G. Makarenko, Ya. I. Nikonov, A. A. Pakhomov, E. V. Fomicheva, and others) and foreign (Z. Bodi, J.-C. Bui, A. Damodaran, A. Kane, A. D. Marcus, Liu Juyuan, Yang Chen Yui and others) scientists are devoted to the theoretical and methodological problems of investment. At the same time, the dynamism of investment activity in the context of globalization requires constant attention. In the context of the modern world multipolarity formation, world geopolitics, and consequently, the multipolarity of the world economy, the study of investment processes requires scientific reflection.

The research goal is to analyze the dynamics of contemporary global investment processes in the context of globalization.

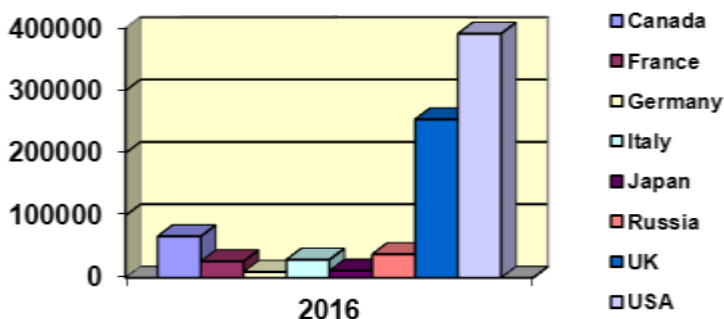
In the modern world economy, the movement of world investment resources is characterized by three forms of capital movement: cash and financial flows associated with the trade in goods and services; foreign direct investment (movement of financial capital, fixed assets, human resources, technology); portfolio investment and various financial transactions (including speculative transactions) inherent in a single world process [4].

In contemporary investment process, the boundaries between many types of sources of financing are blurred. In the process of enhancing internationalization, investments acquired the features of «global funds», often without a specific subject link. There is a diversification of sources of investment, primarily through specific sources: state subsidies, funds of non-state funds, tax credits, leasing investment, franchising, barter, investing in PSA (Production Sharing Agreement), capital repatriation.

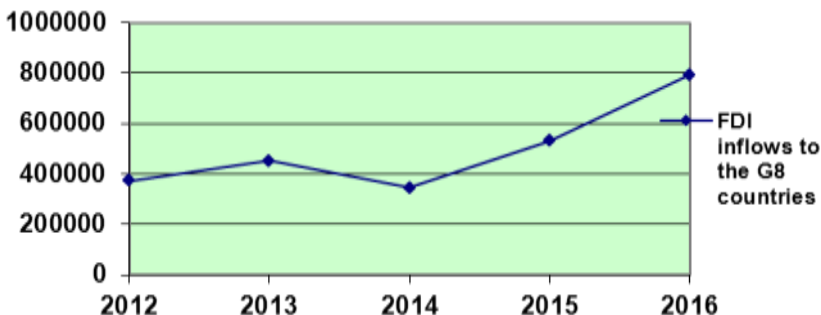
Because the global investment sector is part of the global financial system, a necessary condition for the investment market globalization is the liberalization of the movement of financial resources.

According to the UNCTAD reports, by the end of 2016, the volume of global direct investment fell by 2% to \$ 1.746 trillion dollars, against the backdrop of weak global growth and a high degree of political risk for multinational companies. The picture 1 shows the amount of foreign direct investment attracted to the G8 countries, including the Russian Federation in 2016.

The largest recipient of FDI remained the United States, which attracted \$ 391 billion over the year (an increase of 12%). UK increased the rate of 7.7 times. America significantly surpassed competitors in terms of funds raised.



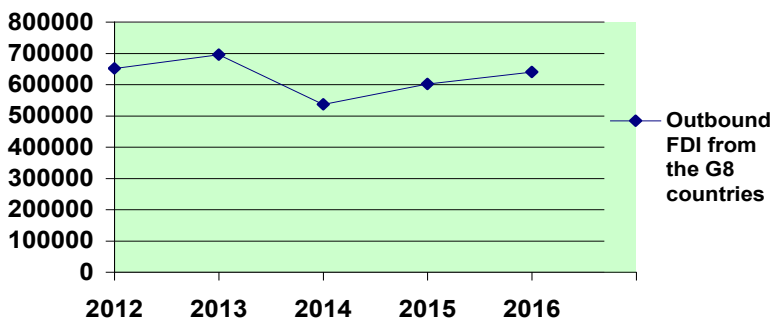
Pic. 1 – FDI inflows to the G8 countries in 2016 [5]



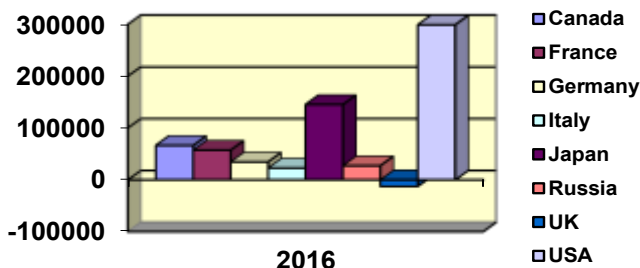
Pic. 2 – Dynamics of foreign direct investment in the G8 countries in 2012-2016 [5]

In 2016, foreign investors invested 479.4 billion dollars in the American economy. The largest investors in 2016 were Canada and the United Kingdom. The United Kingdom received \$ 299.7 billion in FDI in 2016.

According to the UK Statistics Office, only 1.2% of British companies received investment from abroad. FDI to Germany reached \$ 52.5 billion. The first European economy especially attracts foreign investors with a developed infrastructure and car industry, which is considered one of the main drivers of growth of the German economy. The picture 3 shows the dynamics of outbound foreign direct investment from the G-8 countries, including the Russian Federation in 2012-2016, the picture 4 shows outbound foreign direct investment from the G8 countries in 2016 :



Pic. 3 – Dynamics of outbound foreign direct investment from the G8 countries 2012-2016 [5]



Pic. 4 – Outbound foreign direct investment from the G8 countries in 2016 [5]

Capital investments of developed countries in 2016 decreased by 11% to \$ 1 trillion, a similar indicator for developing countries almost did not change - \$ 383 billion. USA investment in foreign economies fell by 1% to \$ 299 billion, but the country remained the world leader in this indicator. Chinese investments in other countries increased by 44% and reached \$ 183 billion, which allowed China to take second place, overtaking the Netherlands (\$ 174 billion, an increase of 26%) and Japan [6]

The liberalization of world economic relations (particularly, the world financial market), the stabilization of the investment climate in market economy countries (providing conditions for TNC activities), the liberalization of FDI regimes contributed to strengthening of global investment processes at the turn of the XX – XXI centuries.

As a result of the world economy globalization, there was a modification of the world market for loan capital: the intensification of the credit mechanism, and the terms, prices, and conditions for countries' access to international borrowed funds.

The transformation of international investment activities into the global investment process is facilitated by the maturity of the global financial market, the rapid development of the securities market, the formation of large foci of capital concentration, the erasure of inter-country economic boundaries, information exchange tools, the emergence of informal financial markets, the development of debt markets and concessions.

Under the influence of these factors, specialized markets appear: securities, guarantees, capital construction objects, debts, etc., affecting the development of the global reproduction process and determining the global movement of investment resources: scope, geographical segmentation, forms of movement and realization.

The analysis shows that the impact of globalization on the contemporary global investment market development is characterized by such features:

1. Unification of the investment process by international organizations and a number of developed countries, on conditions of non-discrimination and competitiveness.

2. Insurance and guaranteeing the subjects of the world economy from country, regional crises and their transformation into global ones.

3. Institutionalization and the impact of international standards on the state regulation of the investment sphere to ensure global stability, economic sustainability, and environmental safety of countries.

4. Stimulation of state support by open markets for investments based on the provision of protection against political and commercial risks (through risk-sharing and social security systems).

The global investment process is characterized by a wide regional and institutional coverage that does not reveal the «nationality» [3, с.95-96.].

Conclusions. The global investment process is largely based on TNK and TNB activities, which operate on the global capital market and determine its nature. The main impact instrument of TNC and TNB for formation the global investment process is FDI-strategy. Strategic approaches of TNC, implemented through FDI-strategy, were accelerators of the global investment process [2].

Thus, the globalization of the global investment process ensures the necessary movement of investment, technological, raw materials, human and information resources, which in turn contributes to the emergence and development of world production factors.

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Аннотация. Рассматриваются проблемы инвестиционных процессов в условиях глобализации мировой экономики. Акцентируется стратегическая роль прямых иностранных инвестиций в обеспечении мирового экономического роста. Проанализированы прямые иностранные инвестиции ведущих мировых стран-производителей. Представлена аналитико-оценочная характеристика динамики прямых иностранных инвестиций этих стран. Аргументирована роль инструментом влияния ТНК и ТНБ на формирование мирового инвестиционного процесса.

Ключевые слова: инвестиционные процессы, прямые иностранные инвестиции, мировой рынок инвестиций, глобализация.

Annotation. The problems of investment processes in terms of world economy globalization are considered. The strategic role of foreign direct investment in global economic growth is emphasized. Foreign direct investment of the world's leading producing countries have been analyzed. The analytical and estimated characteristics of the dynamics of foreign direct investment of these countries have been presented. The role of the TNC and TNB impact instrument on the formation of the global investment process has been argued.

Keywords: investment processes, foreign direct investment, global investment market, globalization.

UDC 338

INSURANCE OR BUDGET MODEL OF FINANCING OF HEALTH SYSTEM: WHAT IS BETTER FOR RUSSIA?

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Nowadays the problem of reforming the health care system is acute. This process is a task that can be solved only with the help of financial and economics levers. In Russia, the Current budget and insurance model is imperfect, as it is, according to many medical practitioners, including the

Professor I. A. Gundarov, has a number of significant shortcomings, among which there is a low level of equity in the distribution of services, bureaucratization is high, significant financial costs, changing the main purpose of providing medical services – from health promotion and disease prevention to increase the duration of the treatment process. In the insurance model, the funds generated from employers contributions are transferred to the FCHI, and then in the prescribed manner are transferred to medical organizations. In the budget model, money in the form of taxes goes directly to the Federal budget, excluding funds. In the insurance model, the effectiveness of the work is estimated not by medical, but by economic indicators. Accordingly, doctors seek to extend the time of outpatient stay of the patient, to carry out a greater number of diagnostic procedures to maximize profits from the provision of paid medical services. It should be noted that the budget model has the main goal to provide quality care to the patient as soon as possible. However, the budget model also requires optimization – improving the technical equipment of medical institutions and increasing the responsibility of the doctor to the patient.

The modern health care system of the Russian Federation is a symbiosis of medical opposing cultures – Soviet and North American. Under the first concept, medicine is an economic sphere and, as a consequence, a kind of business: the doctor is a provider of medical services, and the patient is a consumer, respectively, their relationship is based on the principles of a market economy. The Soviet model defines medical activity as service to the patient, that is, medicine is a sphere of unselfish relations, where the doctor shows compassion, sympathy and mercy. The current budget-insurance model in Russia is focused on foreign experience. Mainly insurance model operates in Austria, Belgium, France, Turkey, Israel and Holland. It was assumed that the introduction of such a model in Russia would solve the problem of low budget funding by attracting additional funds from the compulsory health insurance Fund to Finance health care [1, p. 22][2, p. 35]. However, the most effective, in the author's opinion, would be to direct funds not to the FCHI, but directly to the Federal budget, and from there on distribution – to health care. At the same time, the volume of medical services guaranteed to the population should be scientifically justified. In particular, it is advisable to involve the Academy of medical Sciences in this development.

According to the model of compulsory health insurance, the guaranteed list of services includes emergency medical care for injuries and acute diseases that are life-threatening, in the treatment of outpatient conditions, treatment and diagnosis at home, dental, drug and hospital care. It should be noted that medical care is provided regardless of the place of

residence free of charge at the expense of CHI funds. Initially, the mandatory health insurance funds were established within the framework of the Federal law №326-FL «On health insurance of citizens in the Russian Federation» [4]. Financial funds are in state ownership and not included in other funds. The financial support of FCHI is formed at the expense of insurance contributions of employers, budget allocations and income from the use of temporarily free funds of funds. According to the Tax code, the amount of insurance premiums for compulsory health insurance is 5.1% of amount of employee benefits. It is important to clarify that the current budget and insurance model of financial support of medical care with a significant predominance of insurance is supported by the current Minister of health V.I. Skvortsova, which, at the same time, believes that insurance representatives should effectively protect the right of every citizen to maintain health. The created three-level Institute of insurance representatives, consisting of the Ministry of health, FCHI and insurance companies allows providing optimal medical care [5].

However, the auditors of the Accounts chamber, according to the report of the Federal compulsory health insurance Fund on budget performance for 2016, found that insurers have not built a comprehensive quality control system, and recommended that the government exclude insurance companies from the health care system. It was also found that members of the FCHI, according to paragraph 5 of section 1 of the government Of the Russian Federation of 29.07.1998 № 857 (ed. from 29.12.2018) «On approval of the Charter of the Federal compulsory health insurance Fund», often formally approach their duties: partially the decisions taken by the FCHI are illegal, as at the meetings there are about 30% of the Board members.

In addition, FCHI reduced the standards set by the compulsory health insurance program, and sent its employees to improve their skills in Greek resorts and «58% of the report was devoted to social insurance and pension law of Greece» [5]. The current system of compulsory health insurance is ineffective. It was proposed to direct funds for the treatment of citizens directly from the Federal and regional budgets, bypassing the CHI Fund, and makes a system of voluntary insurance. According to the Central Bank, in 2018 the number of concluded contracts on voluntary health insurance increased by about 10% compared to 2017 (Figure 1).

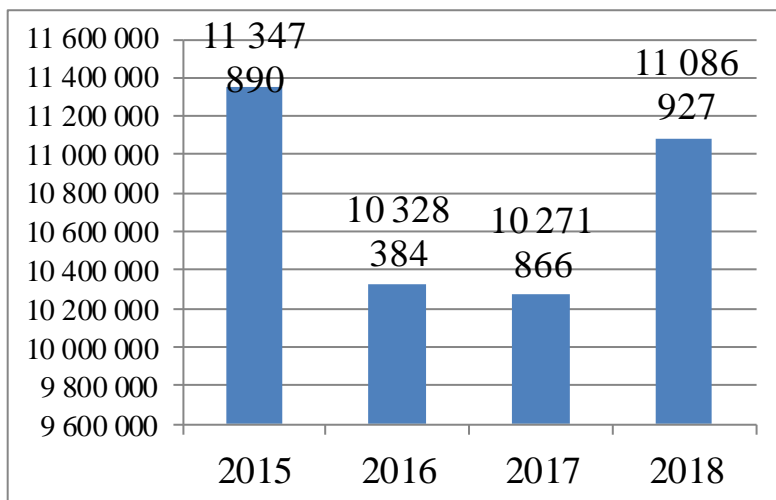


Figure 1 – The number of contracts by the DPA

Source: by the author on the basis of data from the Central Bank of the Russian Federation [6]

Significant cash flows coming to the FCHI from the budget go to the maintenance of the apparatus and pay for the services of insurance companies that do not control the quality of medical services. Much more effective is the creation of a voluntary basis of insurance: funds for health care will be deducted directly from the regional and Federal budget, and wishing citizens can be insured in private clinics through funds. Employers will transfer 5.1% to the Federal budget rather than to the FCHI. Thus, the country will continue to operate a budget and insurance model of health financing based on co-financing of citizens and the state [3, p. 356].

It is also fair to mention the effect of the ambiguity of the insurance model of financial support for health care: in countries with such a model, the duration of hospitalization is lower, the turnover rate of the bed Fund is higher, but the increase in the structural efficiency of health care is reduced. However, doctors note the contradiction: the duration of hospitalization in practice in connection with the introduction of the insurance model of financial security has increased, as insurance companies inpatient treatment is paid more than outpatient. In addition, at the Federal level, there are no uniform principles for the formation of financial support for the basic program of CHI and a full tariff for medical care. Thus, in 2017, the cost of outpatient visits to the urologist with preventive purposes for CHI in the Ulyanovsk region amounted to 55 rubles, and in the Republic of Tatarstan –

292 rubles. At the same time, the tariffs of CHI are 2-10 times less than the real cost of the service. The average tariff for CHI for the reception of a therapist – 138 rubles, and the real average cost of services – from 300 to 900 rubles (the cost of services in a state medical institution is not under the policy of CHI).

Thus, to optimize the health financing model, the following decisions need to be made:

1. Maintain and optimize the existing budget and insurance model, abandoning the FCHI.

2. To direct money (accumulated as a result of collection of insurance premiums) on medical support not in FCHI, and in the Federal budget. This will help to eliminate «middlemen» and the savings to be split between healthcare institutions.

3. To popularize the system of voluntary health insurance, to introduce benefits for employers who pay for VMI policies to socially vulnerable groups (orphans, pensioners, veterans).

4. Increase the level of medical care by automating some functions for what. In particular, to create a single database containing profiles with the medical history of citizens to reduce the time of filling in documentation and increase the flow of reception of citizens.

5. To improve approaches to the definition of tariffs for services within the MLA, ensuring maximum compliance with the real cost, taking into account regional characteristics.

The implementation of the above proposals will make it possible to successfully improve the financial provision of health care in Russia, and, consequently, to improve the quality of life of Russians.

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Аннотация. Одним из приоритетных направлений социальной политики государства является здравоохранение. Реформирование системы здравоохранения должно иметь комплексный подход, учитывающий как медицинские, так и финансово-экономические аспекты. В статье рассмотрены ключевые проблемы в выборе модели финансового обеспечения здравоохранения в Российской Федерации: действующая бюджетно-страховая модель имеет существенные недостатки и требует оптимизации. Автором предложен и обоснован отказ от ФОМС и переход к бюджетному обеспечению здравоохранения. Отмечена возможность популяризация системы добровольного медицинского страхования (ДМС).

Ключевые слова: система здравоохранения, бюджетно-страховая модель, ФОМС.

Annotation. One of the priorities of the social policy of the state is health care. The reform of the health system should have an integrated approach that takes into account both medical and financial and economic aspects. The article deals with the key problems in choosing a model of financial health care in the Russian Federation: the current budget and insurance model has significant shortcomings and requires optimization. The author proposes the rejection of FCHI and the transition to the budgetary provision of health care. The possibility of popularization of the system of voluntary health insurance is noted.

Keywords: health care system, budget and insurance model, FCHI.

UDC 338

ESTABLISHING PUBLIC-PRIVATE PARTNERSHIPS IN DEVELOPING COUNTRIES

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Support for public-private partnerships (PPPs) for infrastructure seems stronger than ever before. Several development banks have been considering adjustments to their business models to give more attention to regional infrastructure PPPs. In particular, the World Bank proposed using International Development Association funding to help develop transformational PPP projects. Those proposals have now evolved into the Bank's design of the Global Infrastructure Facility, an entity meant to coordinate the efforts of MDBs, private investors, and governments to prepare and structure PPPs [1].

But as this enthusiasm for PPPs is growing, so is a less widely-recognized body of research that takes a much more measured approach; it still represents a kind of advocacy, but one that incorporates a greater degree of critical analysis of PPP successes and failures. For example, it is evident in a World Bank working paper by Michael Klein [2], an influential PPP advocate during the 1990s and early 2000s. Klein notes that despite more than two decades of use and refinement of the PPP mechanism, there are still no consistent geographical patterns of usage: "The general picture is one of waves of enthusiasm for PPPs followed by some disenchantment and consolidation. Different countries were caught up in the waves at different times." What accounts for this lack of sustained enthusiasm? Klein says that evaluations show that PPPs can outperform public sector firms, and "are useful tools for reform of service delivery". But it is no longer clear that PPPs are consistently better run than public firms. "The evidence suggests that well-run public firms tend to match the performance of private firms in regulated sectors".

Klein's comments are a reminder that a significant amount of evidence-based research on PPPs has accumulated since the late 1990s. But a good deal of it, particularly over the last decade, has not been uniformly positive about PPPs, at least not in the fashion of the largely promotional literature published by MDBs and donors in the 1990s and early 2000s. Some of this research, for example by economist Antonio Estache, is now being used to bolster PPP criticisms prepared by civil society groups. These groups have long been critical of PPPs, but in the past their arguments against private participation have often seemed more ideological than evidence-based, and therefore not very compelling. But the growing use of evidence-based research reported on by respected social scientists like Estache, Klein, and others has added weight to their arguments, warranting more careful consideration by PPP advocates.

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Аннотация. На протяжении более двух десятилетий, по мере накопления опыта проектов государственно-частных партнёрств как в развитых так и в развивающихся странах, возникла их разноплановая критика, основанная на неидеологических эмпирических исследованиях, а иногда выражаемая даже сторонниками государственно-частных партнёрств. Эти исследования часто фокусируются на отдельных аспектах государственно-частного партнёрства и обычно не выражают мнения об их общей ценности. Это исследование суммирует некоторые примеры возникающей критики в отношении государственно-частного партнёрства в странах с низким уровнем дохода.

Ключевые слова: государственное, частное, партнёрство, развивающаяся, страна

Annotation. For more than two decades, as the experience with public-private partnerships has increased in both developed and developing countries, a different kind of critique has emerged, one that is based on non-ideological empirical research, and is sometimes expressed by public-private partnerships advocates. These studies often focus on individual aspects of public-private partnerships, and usually do not express opinions on the overall value of public-private partnerships. This research summarizes some examples of emerging critique on public-private partnerships in low-income countries.

Keywords: public, private, partnership, developing, country.

UDC 334.723

FEATURES OF DIGITIZATION RUSSIAN ENTERPRISES IN MODERN CONDITIONS

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Currently, the market economy has moved into a new phase of development – the era of digitalization, which has changed the usual views of the business community to conduct their business. Of course, this also affected Russian enterprises, many of which were not ready for such changes.

The features of the digital economy today are:

The main and inexhaustible resource is information;

A company of any kind (small, medium, large) can be a full-fledged participant in such a market and create competition on it;

The same resource (product) of the enterprise can be sold repeatedly;

The scale of business activity is limited only by the Internet space (in this case we can talk about infinity);

Orientation to the buyer (consumer).

All of the above features should be taken into account when moving to a new level of business.

Currently, those enterprises that have focused (perhaps even changed the profile of their activities) on the production of digital technologies and digital products have already felt the economic effect of such activities in the new conditions. For example, Apple remains one of the most successful companies in the digital services market for several years in a row. Such companies as Google, Microsoft, China Mobile and many others are not less successful at the end of last year. These companies are active supporters of the information society, releasing to the market a lot of the latest equipment, digital and software, without which to date it is impossible to conduct any activity. Figure 1 shows a list of the most successful companies in 2017, developing in this direction and successfully operating in the digital economy. the international rating companies in terms of capitalization for 1999

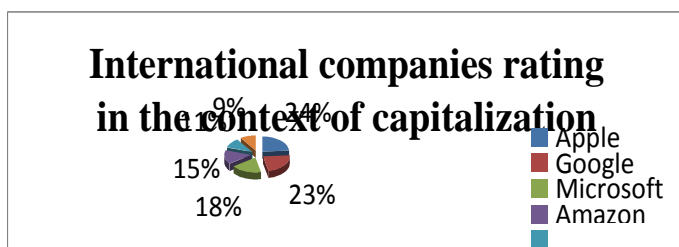


Figure 1 – Rating of international companies in terms of capitalization for 2017, billion rubles.

Thus, it becomes obvious that Russian enterprises need to use the best practices of those countries and companies that are already successfully

coping with new trends in the economy, caused primarily by the processes of globalization and integration, society informatization.

It should be noted that the process of digitalization implies the creation of a new product in digital form, which, of course. It is a competitive advantage in the market. In Russia, the share of the digital economy in GDP is 2.8%, or \$ 75 billion (according to BCG). The turning point in understanding the need for digitalization was 2017, when the program of the "Digital economy" of the Russian Federation was adopted. At the same time, Russia falls behind the leading countries of digitalization for 5-8 years. If the current growth rate of Russia's digital economy remains at the same level, by 2020, due to the high rate of global change and innovation, this gap will be 15-20 years.

Digitalization of the Russian manufacturing sector by 2025 will be able to annually increase the country's GDP in the amount of 1.3 trillion up to 4.1 trillion rub. Digital technologies application will increase the productivity of enterprises by 45-55%, as well as reduce the time of product release to the market — their length is now the main "scourge" of Russian business — by 20-50%.

Now the level of Russian industry digitalization is lower than that in the US, Germany or China. The proportion of business leaders who are actively testing or already use the tools of digitalization does not exceed 10-15%. In general, the industry is characterized by a stable increase in the degree of depreciation of fixed assets. The average age of capacities in oil refining is 19 years, in metallurgy — 17 years, in chemical production — 14 years, according to Rosstat. Digitalization of production is reduced by insufficient penetration of industrial automation systems (MES-systems, digital lines, etc.).

Digitalization of all spheres of industry is no longer just a trend, it is the main condition for economic growth and competitiveness.

In conclusion it should be said that the development of the digital economy provides an opportunity for communication, exchange of ideas and experience. Platforms in the Internet space join efforts to create new forms of business, investment, search for employees, partners, resources and markets.

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Аннотация. В статье проведен анализ специфики функционирования российских предприятий в условиях цифровой экономики, являющейся новой, по сути, стадией развития рыночного механизма. Для более быстрого и эффективного перехода российских предприятий в условия цифровизации экономики, необходимо использовать опыт стран и предприятий, которые уже успешно функционируют в новых условиях.

Ключевые слова: цифровая экономика, информация, глобализация, информационные технологии

Annotation. The article analyzes the specifics of the functioning of Russian enterprises in the digital economy, which is a new stage of the market mechanism development. For a faster and more effective transition of Russian enterprises in the conditions of digitalization of the economy, it is necessary to use the experience of countries and enterprises that are already successfully operating in the new environment.

Keywords: digital economy, information, globalization, information technologies.

UDC 334

THE INTERACTION OF STATE EXTRABUDGETARY FUNDS OF THE RUSSIAN FEDERATION WITH THE PUBLIC THROUGH MODERN DIGITAL TECHNOLOGY

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Currently, the era of digitalization of the economy. Now the population on the Internet can obtain all the necessary information.

However, the level of financial literacy remains generally at the highest level in Russia, which indicates that now the websites that provide financial data, economic indicators and the state of the country's economy are not fully developed and require significant improvement. It should be noted that the improvement of sites of state extra-budgetary funds occurs every day, that is, the site does not stand still: there are always topical news, always published all the necessary information, various statistics, and there are social calculators for the population [1].

In connection with the purpose of obtaining an assessment of sites of extra-budgetary funds, we will use the author's methodology.

First, it is necessary to understand the basic criteria by which sites will be evaluated. There are three main ones: content, interface, feedback. The content criterion is an assessment of how fully the information is disclosed, how much it is available to the public. Interface - an assessment of the visual design of the site, which in fact is also a very important indicator, since the information will be more accessible on the site with a more beautiful design and a simple search for information. The feedback criterion implies a link with extra-budgetary funds: is it possible to clarify any information in addition [2, 4, 6-9].

Secondly, in each of the criteria it is necessary to develop specific indicators, based on the results of which, the criteria will be evaluated and which can be seen in Table 1.

Thirdly, we develop specific weights for each of the evaluation criteria. Because we evaluate the relationship with the population, the specific weights are proposed as follows: content - 0.5, feedback - 0.35, interface - 0.15.

Table 1. Indicators of each criterion

Criteria	Indicator
Content	<ol style="list-style-type: none"> 1. Activity Reports 2. availability of statistical data 3. quantity and quality of news 4. informational content 5. body information
Interface	<ol style="list-style-type: none"> 1. navigation and search 2. design
Feedback	<ol style="list-style-type: none"> 1. hotline 2. form of electronic request 3. frequently asked questions section

Source: proposed by the author.

Content in this case is the most significant indicator, since it is by means of its evaluation that we will be able to understand whether there is all the necessary information on the site or it may be missing. Feedback is also important to assess transparency; the interface can affect the quality of information search on the site [3].

Fourth, the full assessment scheme is proposed in stages:

Stage one - evaluation of indicators on a ten-point scale.

Stage two- each criterion is evaluated by finding the average value of the indicators.

Stage three - adjustment for specific weights.

Stage four - summarizes the three obtained adjustment results.

So let's start the assessment. To begin, let us estimate all the indicators on a ten-point scale in Table 2.

Table 2. Evaluation of indicators.

Criteria	Indicator	Pension Fund of the Russian Federation	Federal Mandatory Medical Insurance Fund	Social Insurance Fund
Content	1. Activity Reports	10	9	9
	2. availability of statistical data	9	9	10
	3. quantity and quality of news	8	8	8
	4. informational content	9,5	8,75	9,5
	5. body information	10	10	10
Interface	1. navigation and search	8	10	5
	2. design	8	10	4
Feedback	1. hotline	10	10	10
	2. form of electronic request	10	10	10
	3. frequently asked questions section	10	10	10

Source: compiled and calculated on the basis of the practical implementation of the methodology proposed by the author.

Next, we find the average values of these indicators, thereby evaluating all three criteria on a ten-point scale. We have: for PFRF: content - 9.3, feedback - 10, interface - 8; FMMIF: content - 8.95, feedback - 10, interface - 10; SIF: content - 9.3, feedback - 9, interface - 4.5.

After we correct the obtained estimates for specific weights and add the obtained values. We receive for the pension fund: 9.35, for the Federal Mandatory Medical Insurance Fund: 9.475, for the Social Insurance Fund: 8.475. Moreover, each of the pension funds has a connection with the population through modern technologies, through a variety of social networks, as well as applications for smartphones. So, for example, the pension fund has its pages on social networks Facebook, Twitter, YouTube, VKontakte, Odnoklassniki [5].

In the application of public services on smartphones there are services provided by the pension fund. With regards to the federal compulsory health insurance fund, the site does not indicate any contacts on social networks or any applications. The Social Security Fund, in turn, has pages on the social networks Facebook, VKontakte, Odnoklassniki.

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Аннотация. В статье рассматривается качество коммуникации между государственными внебюджетными фондами Российской Федерации и населением. На основе разработанной автором методики проведена оценка официальных сайтов государственных внебюджетных фондов Российской Федерации. Апробация позволяет заключить о том, что наилучшим сайт у Федерального фонда обязательного медицинского страхования. Также автором рассмотрены иные механизмы взаимодействия посредством развитых цифровых технологий, такие как социальные сети: Facebook, Twitter, YouTube, ВКонтакте, Одноклассники, а также приложение государственных и муниципальных услуг.

Ключевые слова: внебюджетные фонды, цифровые технологии, социальные сети, цифровизация, финансовая грамотность.

Annotation. The article considers the quality of communication between the state off-budget funds of the Russian Federation and the population. On the basis of the methodology developed by the author, the official websites of the state extra-budgetary funds of the Russian Federation were evaluated. Testing allows us to conclude that the best site of the Federal Mandatory Medical Insurance Fund. Also, the author considers other mechanisms of interaction through advanced digital technologies, such as social networks: Facebook, Twitter, YouTube, Vkontakte, Odnoklassniki, as well as the application of state and municipal services.

Keywords: extra-budgetary funds, digital technologies, evaluation, social networks, digitalization, financial literacy.

UDC 334.71: 330.33

PROBLEMS OF SMALL BUSINESS DEVELOPMENT IN RUSSIA

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Small business plays an important role in any country: it causes healthy competition, provides employment, saturates the market with new goods and services and meets the needs of large enterprises.

The growth rate of the number of registered individual entrepreneurs in our country remains low-annually their number increases by 4%, while the number of sole traders who have ceased their activities increases by 11% [3, p.13].

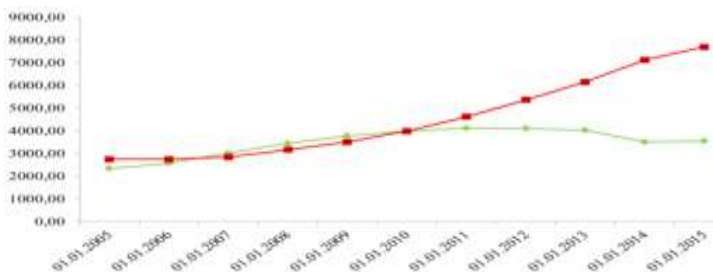


Figure 1 – Number of registered and terminated individual entrepreneurs and farms

The green color represents registered individual entrepreneurs, and the red color has ceased its activities.

The main problems of development of small entrepreneurship in Russia:

- 1) Insufficient start-up capital and working capital;
- 2) Difficulties in obtaining Bank loans;
- 3) Lack of qualified staff accountants, managers, consultants;
- 4) the difficulty of obtaining space and extremely high rents;
- 5) limitations on the possibility of obtaining leasing services;
- 6) Lack of social security and the personal safety of the owners and employees of small businesses [1, p. 5].

Small business is one of the important conditions for sustainable development of the country and the region, which affects not only the satisfaction of the needs of the population in goods and services, the alleviation of unemployment, but also ensures the achievement of such imperatives of sustainability as resource conservation and social stability. Although in recent years small business has become the object of special attention of regional authorities and science, its situation in the regions remains difficult.

Small businesses face a number of difficulties: saved almost stifling taxation, limited access to credit, there is no mechanism of self-financing, researched the mechanism of information support, etc. Domestic business only is on the way to becoming the driving force of the domestic regional economy [2, p. 7].

The main reasons for this situation are the lack of targeted state policy in relation to small business, the imperfection of the legislation governing the activities of small businesses. Moreover, Russian legislation in this area is not only inefficient, and does not affect a number of problems of the existence and activities of small enterprises.

For small enterprises, the problems of creating a healthy competitive environment with larger companies are also relevant, since in most cases small enterprises have neither the strength nor the means to resist unfair competition, which has recently become increasingly stringent.

In conclusion it should be noted that the improvement of the regulatory framework aimed at the development and support of small business and the creation of conditions for fair competition is necessary for the development of this sector of the economy. First of all, there is a question of adoption of a special law defining the basic principles of development and support of small business [5, p. 3].

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Аннотация. Развитие малого предпринимательства является стратегическим направлением развития экономики. Благодаря развитию малого бизнеса происходит формирование благоприятной экономической среды, увеличивается конкуренция среди товаропроизводителей, появляются новые рабочие места, происходит развитие рыночных отношений. Однако развитие малого бизнеса неизбежно сопровождается рядом проблем – недостаток финансирования, коррупция, нестабильность в налогообложении и другие.

Ключевые слова: предпринимательство, малый бизнес, рыночная структура, налогообложение, конкуренция, экономическая среда.

Annotation. The development of small business is a strategic direction of economic development. Due to the development of small business, a favorable economic environment is being formed, competition among producers is increasing, new jobs are being created, and market relations are developing. However, the development of small business is inevitably accompanied by a number of problems – lack of financing, corruption, instability in taxation and others.

Keywords: entrepreneurship, small business, market structure, taxation, competition, economic environment.

UDC 336

SCORING ON THE BASIS OF "ALTERNATIVE" DATA

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Today, realities require that the banking sector improve technology, apply the most significant and relevant innovative solutions that will ensure high-quality customer selection and help maintain and improve competitiveness in the Russian financial market. One of the most important areas of banking activity is the reduction of potential risks in assessing the creditworthiness of individual borrowers, which is achieved by using scoring (from the English "score" – "account").

Scoring is a mathematical analysis of statistical data, on the basis of which a client's score is formed, expressed in standard points and used by banking and microfinance structures primarily to calculate the riskiness of lending funds. At the heart of scoring systems is the assumption that people with similar social indicators behave the same way. The recognition of this postulate allows you to build various statistical models that are used, including in lending.

Statistics show that by now 30 million Russians are in the process of fulfilling their debt obligations to banks. As a result, there is an increase in the general debt level of the population (for example, according to the

Svyaznoy bank, the number of 5 or more loans increased 3 times in 2018), the number of bankrupts and those willing to refinance their debt obligations grows [1].

Against the background of increasing competition among financial market participants, reducing the inflow of high-rated and new consumers of banking services, banks are forced to reduce the requirements for applicants, while striving to serve as many of them as possible in a short time.

Under these conditions, the synergy of traditional ways of assessing consumers (a credit expert's opinion after analyzing personal data, scoring from credit bureaus, a bank security check) is not enough to calculate the level of riskiness when considering or satisfying a loan application. Financial institutions are forced to apply more sophisticated combined client rating systems that improve the quality of decisions made. For this, Big Data features are used, in particular, scoring based on the so-called "alternative data", i.e. those who have no direct connection with the credit behavior of the client [2, p. 14]. Such experience has existed for a long time in the credit business abroad. For example, in the United States and European countries, banking and microfinance organizations regularly obtain consumer data from Internet service providers, mobile operators and large information companies.

Credit organizations took into account that the most productive is cooperation with mobile operators (MO). This took into account a number of factors. In particular, the high integration of mobile communications in the life of Russian citizens and the coverage of mobile communications. This provides operators with access to large arrays of accurate and complete data (Big Data). For each of their clients, they are able to process up to 400 different aggregates (input parameters): personal data, additional, including financial, information, geolocation data, and much more [3]. In addition, "MTS", "Tele2", "Megafon" can also analyze about 100 metrics for clients of other mobile companies. The information database provides for the possibility of periodic updates and has a significant depth of the storefront. The wide scope of input parameters for analysis allows operators to build a large number of different analytical models with a high level of predictability.

Launched in 2015, the pilot project dispelled doubts about the effectiveness of cooperation and marked the beginning of a constructive interaction between leading cellular operators ("MTS", "VimpelCom", "Megafon", etc.) and the largest banking and microfinance companies [4]. First of all, this concerns the use by credit organizations of scoring mobile operators (MO).

Currently, operators are ready to form for the customer several types of different scoring, of which risk and fraud are most in demand. Risk scoring is a model that allows to evaluate in points the degree of probability of client default. Fraud scoring establishes the degree of reliability of the data that the applicant indicated in the questionnaire.

However, MO opportunities turned out to be much wider than determining the likelihood of the risk of delays in payments or fraud of potential customers. So, E. Koneva notes the special relevance of using the MO scoring when it comes to "credit invisibility" – the "cold" segment of the population, whose representatives have not previously used borrowed funds, and therefore the Bureau of Credit Histories does not have or has very little information on them [5, p. 43]. In Russia, at present, the traditional banking scoring from the BCH is not subject to about 30 million "credit invisibles". Determination of the degree of reliability of such borrowers becomes a priority task, in which the evaluation of the MO is assigned a key role. The opinion of E. Konevoy is shared by leading experts of various banking institutions: Makhova O. ("Rosbank"), Gubanov D. ("Russian Standard"), and others.

Experts also talk about the growing demand for another type of scoring from MO – marketing, which has a differently directed direction, especially in relation to consumers who prefer online lending [4; 6]. Marketing scoring assesses the loyalty of the subscriber as a whole to a specific bank, the likelihood of his transition to service at another credit institution (Attrition scoring – "loss scoring") or its propensity to acquire any financial product (Response scoring – "scoring response"). Mobile communication companies Megafon and Beeline were among the first in 2016 to offer banks and microfinance companies (MFI) a service to prepare a module – assessing the consumer's response to a new or existing loan product. Based on the experience of organizing banking and microfinance activities in countries with a developed financial and economic system, additional analytical modules from MO such as Pre-sale ("pre-sale scoring" or "pre-scoring") can be successfully used in Russia, which allows on the basis of the credit history, determine the potential needs of the client and create proposals that are obviously interesting to him, Up-Sale (the choice of the more expensive product line of the same type), etc.

Not only banks, but also MFI are interested in scoring from the MO. According to expert estimates, here in the field of PDL-lending rational integration MO- scoring in the microfinance environment, its correlation using other marketing tools can increase the average statistical rate of clients' circulation in the MFI by 1,5-2 times, which automatically increases

the total profit received a particular company during the cooperation with the client [3].

It should be noted that the high degree of predictability significantly expands the functionality of mobile companies, transforming their activities from the sphere of a communications provider to the provision of financial services. So, from 2017, operators began to offer MFI a collaboration in the form of providing microloans to their subscribers (for example, "Tele2" offered this service to the microfinance service "Centrofinance") [7]. At the same time, the operator can issue borrowed funds from microfinance services, offering them to those citizens who need them more, which establishes a scoring check of geo-data and behavioral characteristics of potential consumers. For example, reducing the regularity of using a private car or taxi, switching to travel by public transport, replacing restaurant food with fast food can serve as an indirect sign that a person is in financial difficulties, which means that they are likely to accept the offer of financial support received from the operator.

Another additional source, based on Big Data technologies for professional lenders to evaluate potential borrowers, is social scoring. Social scoring is a type of scoring, which assesses a client by his social characteristics and predicts his behavior by analyzing the presence in various social networks ("VKontakte", "Facebook", "Twitter", "Instagram"). Here, Russian credit organizations again turned to foreign experience. For example, the American company Big Data Scoring has been using social scoring in the credit field for more than 30 years.

Prior to issuing a loan, the main goal is to confirm the identity of the borrower and to draw up a general idea of his portrait (for example, establishing a place of work, an estimated income level, etc.). The check and analysis of the personal profile of the user and his friends, a selection of music, photo albums, records on the "wall", the history of visiting sites. Here, negative markers can be, for example, suspicious posts that confirm the author's connection with a marginal culture or contain calls for extremism, frequent changes in workplaces, income levels, interest in dubious ways of earning money, etc. Social scoring performance services are provided by "Klout", which is a company called "Klout Score". The higher it is, the more trust there is in the client.

When checking a profile, close attention is paid to the availability of real information, etc. That the page in question is valid and not fake. As in the case of scoring of telecom operators, the analysis from social networks is of particular value when checking the financial, property status of a "cold" audience of potential borrowers. If the loan was issued, the analysis of social network profiles is needed to search for additional communication

channels and contacts. If the loan was issued, the analysis of social network profiles is needed to search for additional communication channels and contacts. In addition, geolocation in social networks and photo analysis also allow us to establish the exact location of malicious defaulters to establish contact and resolve the issue of their debt obligations. However, the data from social networks, as well as the assessment from the MO, are not part of the procedure for verifying customer data when granting a loan, but serve only as an indirect confirmation of the financial condition of the borrower and do not act as a final argument when making a decision [5].

According to information from the profile of a banking client in social networks, as with the use of scoring operators, financial institutions can also track the tastes and lifestyle of a person in order to offer products and services that are more suitable for him. In addition to banking and MFI marketing, both types of scoring are used (but less often) by personnel search specialists (headhunters, HR-managers), bailiffs, private detectives, collectors. Experts note that from 2018, banks and the MFI in the lending process more often resort to using MO-scoring due to its greater final productivity.

Thus, today credit organizations are increasingly using foreign experience in the implementation of such promising innovative technologies for the modern Russian retail credit market, such as scoring mobile operators and social networks. The use of their final analytical calculations not only significantly increases the potential of classical scoring models of banks and MFI in terms of enhancing the quality of selection of creditors and borrowers, but also represents an effective tool for developing and implementing a marketing strategy to preserve and expand the customer base, as well as increase profitability credit institutions and enhancing their competitiveness.

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Аннотация. В статье рассматриваются такие инструменты цифровой идентичности, как скоринги операторов мобильной связи и социальных сетей. Инновационные для российского кредитного рынка «альтернативные» источники на основе технологий Big Data, которыми активно пользуются на современном этапе банки и МФК, позволяют совершать быстрый и качественный анализ платёжеспособности потенциальных заёмщиков, тем самым снижая риски кредитных организаций, а также проводить наиболее эффективную маркетинговую политику.

Ключевые слова: клиенты, банки, МФК, риски, скоринг мобильных операторов, скоринг социальных сетей.

Annotation. The article discusses such digital identity tools as scoring mobile operators and social networks. Innovative “alternative” sources for the Russian credit market based on Big Data technologies, which banks and MFI are actively using at the current stage, allow making a quick and qualitative analysis of the solvency of potential borrowers, thereby reducing the risks of credit institutions, as well as conducting the most effective marketing policy.

Keywords: customers, banks, MFI, risks, scoring of mobile operators, scoring of social networks.

**END-TO-END INTERNAL CONTROL AS A NECESSARY
ELEMENT IN INCREASING THE EFFECTIVENESS OF SCIENCE
FINANCING**

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Science is one of the main drivers of economic development, which is extremely important for the Russian Federation in the current political and economic conditions. The financing of science over the past decade, if not reduced, has stagnated, which was reflected both in the lack of proposals and solutions from the scientific community that would allow technological transformations and become the growth driver of the national economy, and the “brain drain” - an increase in migration outflow from the country of young scientists and highly qualified specialists who do not have sufficient opportunities to realize their potential at home.

In 2016, experts from the Institute of Statistical Studies and Economics of Knowledge of the HSE recorded a reduction in science funding in nominal terms to the 2012 level. In 2016, from budgets of all levels, and extrabudgetary funds for civil science, 402.7 billion rubles were allocated (8.5% less than in 2015) [6]. However, the lack of sufficient economic growth to ensure the well-being of the population forces the current government to reconsider the policy of financing science, against the background of the launch of the national project “Science” from October 1, 2018 (which will last until December 31, 2024) within which 636 billion rubles plan as investments [7]. In addition, in 2018, President V. Putin repeatedly stressed that the amount of funding for science, in particular, basic scientific research, needs to be increased from the current 1.1% of GDP to 2% - the level of advanced economies.

However, an increase in the financing of scientific activities in the Russian Federation does not guarantee an increase in the effectiveness of scientific research and an increase in their quantity and quality in principle. In order to achieve a positive result from an increase in the financing of science, it is necessary to control the distribution and use of budget funds in order to have reasonable confidence in their effective use.

In March 2018, Putin, in a message to the Federal Assembly, set the task of providing a technological breakthrough for the development of the economy, which is not possible without increasing funding, efficiency and effectiveness of scientific research. However, in order for the goals and objectives set in this area to be fulfilled, it is necessary to ensure the

implementation and development of public and state control over the allocation and use of budgetary funds.

The basic element in this matter is the organization of the system of internal control in scientific institutions, in respect of which funding for research from research funds and state bodies is distributed. The COSO concept proposes the definition of internal control as a process carried out by top management bodies and organization personnel aimed at ensuring reasonable confidence in achieving goals related to operations, reporting and compliance [3]. Russian legislation in the Recommendations of the Ministry of Finance defines internal control as a process carried out to obtain sufficient confidence that an economic entity provides:

- a) the effectiveness and efficiency of its activities, including the achievement of financial and operational indicators, the safety of assets;

- b) accuracy and timeliness of accounting (financial) and other statements;

- c) compliance with applicable laws, including when making the facts of economic life and maintaining accounting records - which, in general, is an interpretation of the definition from the COSO model.

However, in the case of the financing of science and the organization of control activities over the distribution and use of budget funds, it is necessary to understand that the internal control system alone in the organization - the recipient of budget funds - is not enough. Monitoring should be carried out by different actors involved in the process of allocating and using funding, as well as in the process of direct implementation of scientific activities, as well as reporting. Thus, it can be concluded that it is necessary to organize such a control system that will allow at all the described stages to obtain sufficient confidence in the effectiveness of both the use of funding and the results of scientific activity. At the same time, the control system should not be continuous (total), in which the control objects are all the facts and processes of the organization's economic activities.

The only reasonable solution is to introduce a conceptual system (model) of end-to-end internal control based on a risk-based approach to identifying the most vulnerable places in processes or actions of people [2]. End-to-end control basically has such a model of internal control in which those elements of the management system and the implementation of some activity or process, which at the preliminary stage of their assessment and analysis were identified as the most risky, are subject to control. End-to-end control, unlike continuous, does not affect all, but only the key elements of the process or system, as if "penetrating" them at all levels, on a selective, analytically defined basis [1].

The conceptual model of end-to-end internal control is a methodological model of internal economic control. By expanding the model of end-to-end internal control to the characteristics of the economic entity as a whole and its management systems and functional, consisting of a large number of subsystems, each of which always implements internal control functions, we obtain a end-to-end internal control model that combines all conceptual approaches to the definition of the "internal control" category "and all existing principles of its organization. A model of end-to-end internal control should describe the organizational concept of the internal control system as a whole, not only its economic component.

The conceptual model of end-to-end internal control is based on applying risk-based control methods to each subsystem of the management system to identify the most vulnerable actions or processes.

The model of end-to-end internal control implies such an organization of control activity in which the distribution and use of funding for science, as well as the results of scientific research, will be monitoring and control both by scientists themselves and their management in the person of the top management of a scientific institution, as well as special units or employees responsible for internal control, economic security, risk management, etc., as well as public authorities, which are acting as the main budget administrators and managers.

Thus, to effect a technological breakthrough and increase economic growth, it is necessary to solve not only the task of increasing the financing of science, but also controlling the distribution and use of financial resources, using a risk-based approach and without unnecessary bureaucratic procedures and difficult control and supervisory measures distract scientists from the main activity, or hinder its implementation.

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Аннотация. Статья посвящена проблеме повышения эффективности контроля за распределением и использованием бюджетных средств в сфере научно-исследовательской деятельности. На основе проведенного анализа выявлены проблемы и обозначены направления их решения, в т.ч. путем разработки и внедрения системы сквозного внутреннего контроля. Наиболее передовой с точки зрения охвата процессов и деятельности, является система сквозного внутреннего контроля, которая предполагает контроль на всех уровнях распределения и использования государственных ресурсов как со стороны самого государства, так и со стороны служб внутреннего контроля внутри экономических субъектов.

Ключевые слова: финансирование науки; экономический рост; внутренний контроль; сквозной контроль; эффективность науки; бюджетные средства.

Annotation. The article is devoted to the problem of increasing the effectiveness of control over the distribution and use of budgetary funds in the field of research and development. On the basis of the analysis performed, problems were identified and directions for their solution were indicated, incl. through the development and implementation of end-to-end internal control system. The most advanced in terms of the scope of processes and activities is a system of end-to-end internal control, which involves control at all levels of the distribution and use of public resources from both the state itself and the internal control services within economic entities.

Keywords: science funding; the economic growth; internal control; end-to-end control; the effectiveness of science; budget resources.

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Investment environment is a relatively new and quite capacious concept. In a broad sense, the investment environment should be understood as a set of economic, political, social, legal, technological and other conditions designed to promote the effective transformation of society's savings into the creation of new capital, i.e. the expansion of production, and ultimately — to improve social welfare.

Not everyone understands that investing in the modern world is done by absolutely everyone. In fact, even education is a special kind of investment, as it is a contribution to the future, because it is a quality education that will help to find a good job with a decent salary. For example, the same principle applies in sports. Regularly engaged, a person makes a contribution to beauty and health. If he is a professional athlete, every training is an investment in future victories.

Unfortunately, the level of financial literacy in Russia, as well as in the countries of the former USSR, is quite low. The result is a lack of proper knowledge about the prospects of financial investments. Also, prevalence of the American movies about cool businessmen from wall street, formed in consciousness of the majority of people idea that investment is a path for very rich people or business which is engaged in the large investment companies. This is not really the case. In fact, everyone can make investments. It is enough to have the desire, as well as theoretical and practical training.

Investment in the economic sense has several definitions. We will give the easiest to understand. Investing is attachment in a variety of tangible and intangible assets for the sake of their multiplication. The types of investments and their safety will be discussed later in this article.

All investment operations are implemented to obtain a good profit in the form of dividends or other, but necessarily in the order of financial effect. In the global economy at the time of conducting the classification of investments by various parameters presented in the table 1.

The role of investment in the economy can not be overestimated, thanks to the active investment of finance it is possible to avoid protracted crises and make the economy more energetic.

Table 1. – Classification of investments by various parameters

Investment object	Real investment
	Financial investment
	Smart investments
Investor	Investments of citizens
	Investments of legal entities
	Public investment
	Foreign investment
	Cooperative investment
Tasks to be solved	Mandatory investments
	Investments to improve the efficiency of enterprises
	Investments in the development of enterprises
	Investments in diversification of production

Without regular injections of capital into the economy of any country, its functioning is impossible, in other words – without investment. The multiplication of national wealth is a complex process that depends on a combination of inherent factors.

Based on the data of Rosstat, we present the graph «Dynamics of investment activity in Russia» (millions dollars' USA) in Fig.1:

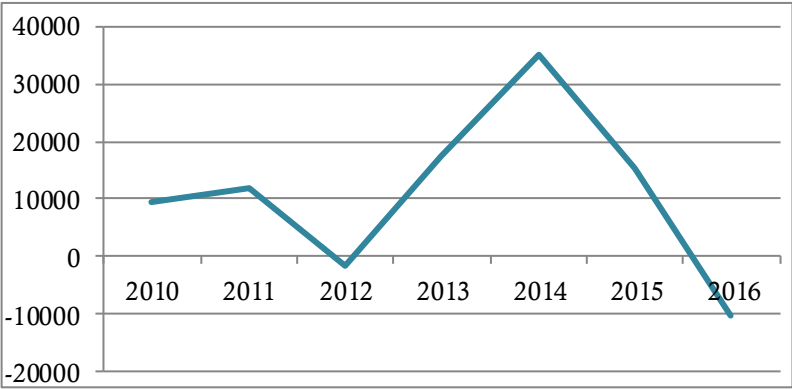


Figure 1 – Dynamics of investment activity in Russia.

We see that investment performance in Russia sometimes falls below zero. Currently, due to the aggravated foreign policy disagreements, the Russian economy is in a difficult situation. Economic security is under threat, as the main problem in the conditions of sanctions is the dependence of our economy, its self-sufficiency. In such circumstances, the issue of investment security, which is an integral part of economic security, becomes the most urgent.

The state and development of the investment market in the era of import substitution is very important. The launch of innovative business projects and start-UPS requires investments, and investors require new, promising ideas.

The investment market in Russia today is underdeveloped. The domestic stock market has a fairly limited volume and does not fully meet the investment needs of Russian companies, so it lags behind the largest world markets. Our stock market is currently in a developing but not growing stage. The development of the Russian financial market, in particular the stock market, will help to ensure more balanced and stable economic growth in the long term.

For the implementation of investment security, taking into account the above conditions and factors, it is necessary to pay special attention to the sphere of legal regulation of investment activities, its legal framework. In order to avoid investment risks, it is necessary to assess the investment risk, analyze different financial instruments and find the most optimal risk-return ratio.

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Аннотация. В статье рассматривается актуальность инвестирования в современной экономической ситуации в России. Представлены виды инвестиций и затрагивается вопрос инвестиционных рисков.

Ключевые слова: инвестиции, динамика инвестиций, инвестиционная безопасность

Annotation. The article discusses the relevance of investment in the current economic situation in Russia. The article presents the types of investments and touches upon the issue of investment risks.

Keywords: investments, dynamics of investment activity, investment security.

ECONOMIST: DEMAND THROUGH THE AGES

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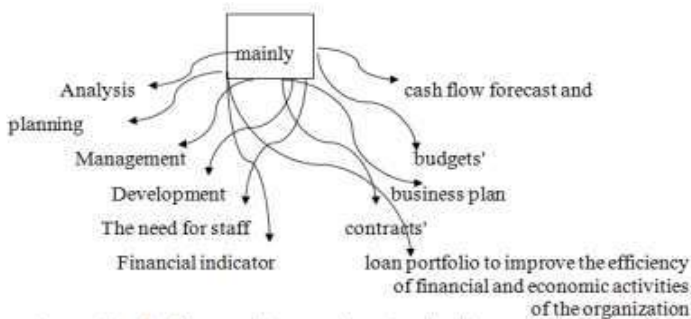
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The profession of economist appeared several centuries ago, when mankind began to use such concepts as money, goods, exchange. But society is still a progressive, and so the economist's functions have also changed and expanded. To better understand we deal with all the subtleties of the profession, turn to the history of occurrence.

For the first time the term —economy appeared in Ancient Greece. It comes from two Greek words: "Oikos" – House, Economy and "Nomos" is the law. In literal translation it means "art Household management ".The economy is now being conducted not only within a family or city, but also within a region, a country, a total of World. It is organized not only by territorial, but also by Industrial characteristics – within the framework of enterprises, firms, Associations, industries [1]. For a long time, economic theory has evolved in different directions and in different countries. The so-called classical economy was created by the famous scientists Adam Smith, David Ricardo, John Stuart Mill. Karl Marx and Friedrich Engels with their Marxist political economy, made a significant contribution to the development of the economy. For a long time this concept was dominant in the Soviet Union. In the era of the global market economy, the profession of economist is the most popular in the labor market. This is a "multifaceted" universal profession in any sphere of the economy with its advantages and disadvantages [2].

It all depends on the scope of the organization, but no less important for todays this profession is well paid. The most profitable: banking, construction, trade.

The economist is mainly engaged in:



Areas of work of economists are quite extensive, they are: the public service, financial structures, restaurant and hotel business, enterprises, research institutes, private organizations of different forms of ownership.

Depending on the specific type of activity conditionally allocate accountant-economist, engineer economist and manager-economist. With a degree in Economics you can take on a company as an accountant, an auditor, financial director and analyst.

From this we can conclude that the economist's knowledge may be needed in all financial sectors.

In order to give a more accurate assessment of the profession, you can make a table of advantages and disadvantages (table 1).

The important fact is that a person who wants to connect his life with the profession of economist should love mathematics and deal with it since school.

Table 1. Advantages and disadvantages of economist's profession

Advantages	Disadvantages
The demand for the profession	High competition in the labor market, requiring constant improvement of their knowledge
High salaries for specialists	Responsibility for results of financial and economic activity of the enterprise
The opportunity to work in any field or business	Work requiring attention, monotonous work with calculator

The worker the economic sphere must be neat and accurate. In the future, the economist will have to protect the interests of enterprises more than once, so he must adhere to certain principles, and be a man of the word.

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Аннотация. В данной статье поднята проблема актуальная для молодых людей, которые захотели связать свою жизнь с профессией экономиста. Эта профессия рассмотрена как с точки зрения её исторического прогресса, так и с современными запросами. Разработана таблица обязанностей экономиста.

Предоставлен список сфер деятельности для экономиста. Показана оценка профессии.

Ключевые слова: экономист, сфера деятельности, предприятие, высокая конкуренция, финансовая сфера, достоинства, недостатки.

Annotation. This article raises the problem of relevance for young people who want to connect their lives with the profession of an economist. This profession is considered within its historical progress and according to the modern demands. The table of economist obligations is worked out. The list of activities for the economist is given. The assessment of the profession is shown.

Keywords: economist, sphere of activity, enterprise, high competition, financial sphere, advantages, disadvantages.

UDC 338.1

DEVELOPMENT OF INITIATIVE BUDGETING IN THE RUSSIAN FEDERATION: MAIN DIRECTIONS AND INDICATORS OF EVALUATION

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The practice of initiative budgeting (the foreign equivalent of the name – participatory budgeting) was first applied in the 80s of the XX century in Brazil (Porto Alegre) to solve acute urban problems. This successful experience was used in other Latin American countries, and then spread around the world (especially in North America and Europe) [1, 6].

Initiative budgeting (hereinafter-IB), as an analogue of foreign participatory budgeting, has become widespread in the Russian Federation. Many Russian scientists-economists in their works describe and analyze various projects implemented in municipalities of the Russian Federation, which is especially important in the context of modernization of their financial support [2, p. 103]. So, in the work of Vagin V. V. it is noted that “the increasing degree of dissemination of projects in Russia necessitates a comprehensive analysis of the state of practices in order to identify factors that impede or stimulate civil initiatives” [4, p. 2086]. The article identifies 4 groups of factors contributing to the development of IB (administrative, social, economic and institutional). It is difficult to disagree with the author, as the constant analysis of the results of the projects, the identification of best practices, search and systematization of the parameters of the evaluation of projects are really necessary for the further development of citizens' participation in the budget process and its transition to a new level.

So, the lack of a unified methodology of assessment of practices budgeting initiative implemented in the regions of Russia, writes Tsurkan M. V. The author noted that regional specifics of each project IB are the main problems in the development of a unified system of evaluation, in addition, “the complexity of evaluating non-quantitative factors reflecting the effect of the implementation of the project IB also prevents the development of a unified methodology” [5, p.165]. To assess such factors, a method of testing and conducting a sociological survey among the population is proposed. As a method of assessing budget efficiency, the author proposes a method based on the calculation of net discounted income for a number of years. In our view, such an assessment approach is ineffective. Since the public benefits (hence the effectiveness of the project) in most cases are not only material and can not be reduced solely to the amount of budget savings and income from the project. Thus, first, it is necessary to develop a different approach to the assessment of budgetary efficiency of projects of information security, taking into account intangible societal benefits of the project and overstate its cost, and secondly, it is necessary to develop a comprehensive integrated methodology for the evaluation of efficiency of IB projects in general and their impact on the territory of implementation.

As an alternative method for assessing the budgetary efficiency of IB projects, the SROI (Social Return On Investment) method can be proposed, which allows to estimate both budgetary and social benefits from the implementation of a social project financed from the budget. Thus, in the work of I. S. Antsyferova the question of the need to apply the methodology of "social return on investment" in assessing the effectiveness of initiative

budgeting projects is raised, since “the effect of the implementation of such projects can not always be estimated with the help of quantitative (including monetary) indicators” [6, p.48]. The SROI methodology is proposed to be used in calculating the return on investment costs when co-financing projects by citizens: in other words, which benefits citizens receive from each ruble invested in the project. In addition, the technique of SROI shows the opportunity cost (loss of benefits) when implementing a particular project. That is, SROI will add a rational element to the selection process between several objects. The decision will be made not only on the basis of the number of votes of residents, but also on the basis of calculation: what benefits will be if project 1 is built, in comparison with the benefits that will be obtained during the construction of project 2. However, the author does not propose formalized methods of using this concept in relation to IB projects, only a general idea of SROI is given and the expediency of using this method of evaluating the effectiveness in the projects of initiative budgeting is justified. It is proposed to prescribe a recommendation for calculating the benefits of projects within the framework of the SROI concept in the documents regulating the activity on initiative budgeting.

In addition to the problem associated with the lack of a common methodology for evaluating IB projects, there are other difficulties in implementing this practice. For example, in the work of N. Sergienko. “The main problems are the distrust of residents of municipalities to such projects and their lack of motivation to participate in them’ [7, p.212]. In other words, the emphasis is on apolitical citizens. In our opinion, the sources of the problem of distrust and non-participation of citizens in IB should be sought not in their political culture, but in the poor information about the existence of such projects in general and the possibility of participation in them. If the population is aware of such projects, the reason for their passivity is the lack of basic knowledge about the budget process and budget at all. Based on this, in our opinion, a possible solution to the problem can be, firstly, the active dissemination and publication of information about the possibility of each citizen to become a participant in the budget process at the level of its municipality, to express the ideas and wishes regarding the allocation of budget funds (through the official websites of the subject, municipality, regional media), and secondly, activities to improve the financial literacy of citizens – potential participants of IB projects (through training seminars, organization of free courses).

As mentioned above, the forms of involvement of citizens in the budget process vary. A comparison of the different forms of civic initiatives is presented in table 1.

Table 1 – Comparison of different forms of civic initiatives at the local level

Criterion	Initiative budgeting	Self taxation	Public hearing
Voluntariness of participation	+	+/- (after the decision on self-taxation in a referendum, all residents of the municipality there is a duty to make payments to the budget)	+
Initiator	Citizens residing in the municipality	municipal authority	municipal authority or citizens
Who formulates the "agenda" (idea, project)?	Citizens	municipal authority	municipal authority
The main purpose	Effectively taking into account the wishes of citizens to allocate available financial resources	To find additional sources of income for the local budget to finance a particular project	Informing citizens, exchange of opinions public hearings on local issues
The ability of citizens to control the implementation of the project	There is a possibility	There is not a possibility	There is not a possibility

Source: the table is compiled by the author on the basis of scientific and practical research [1, p.7].

Different practices of involving citizens in the solution of public issues have similar features. As can be seen from the table, to the greatest extent the opinion and wishes of citizens are taken into account in the implementation of projects within the framework of the initiative budgeting: citizens themselves form the agenda, offer projects and ideas that would like to implement in the territory of their municipality, by “voting choose the best project or the most relevant for implementation at the moment, have the opportunity to control each stage of its implementation” [8, p.218].

In our opinion, in order to ensure truly equal opportunities for citizens to participate in the projects of initiative budgeting, it is necessary to return the permit for non-monetary forms of co-financing of projects for less well-off families living in the municipality. Since co-financing of the project by citizens is a prerequisite for the grant from the regional budget, low-income

families will not be able/willing to participate in such a project, in case of the requirement of exclusively monetary form of co-financing.

Thus, the initiative budgeting is a mechanism by which the issues of optimization of municipal finance management can be solved. However, to improve the practice of initiative budgeting, in our opinion, it is necessary to implement the following.

1. To develop a comprehensive methodology for evaluating the effectiveness of initiative budgeting projects, which would allow to measure not only economic benefits, but also social effects (through social surveys, questionnaires, the use of methods to assess the social return on investment, social discount rate).

2. A comprehensive assessment would provide an opportunity to compare IB projects at the local level, identify best practices, apply and adapt them to "newcomers" in the field of IB.

3. In order to increase the interest of citizens in initiative budgeting, it is necessary to actively disseminate and publish information about the possibility of each citizen to become a participant in the budget process at the level of his municipality (the site of the municipality, local media).

4. Improving the financial literacy of the population and obtaining basic ideas about the budget process will also contribute to the manifestation of interest on the part of the population to become a member of the initiative group in the is project. In these circumstances, the data published in the framework of the project "Budget for citizens" is importance and relevance.

5. The proposal to consolidate the basic principles of organization and co-financing of initiative budgeting projects at the municipal level in one regulatory legal act of the Federal level, and not at the level of individual subjects of the Russian Federation, is appropriate.

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Аннотация. Несбалансированность бюджетов муниципальных образований препятствует эффективной реализации возложенных на них полномочий. В связи с этим актуальным является вопрос о поиске механизмов, которые бы оптимизировали управление муниципальными финансами. Привлечение граждан к участию в бюджетном процессе на уровне муниципалитетов - механизм, который бы позволил изыскать новые источники финансовых ресурсов и рационально распределить имеющиеся. В работе проанализировано инициативное бюджетирование в Российской Федерации, как практика привлечения граждан в процесс принятия бюджетных решений.

Ключевые слова: инициативное бюджетирование, гражданские инициативы, местные бюджеты, практика самообложения, муниципальные образования.

Annotation. The imbalance in the budgets of municipalities impedes the effective realization of their powers. The question of finding mechanisms that would optimize the management of municipal finances is topical. The involvement of citizens in the budget process at the municipal level is a mechanism that would make it possible to find new sources of financial resources and rationally allocate existing ones. The paper analyzes the development of initiative budgeting in the Russian Federation as a practice of involving citizens in the process of budget decision-making.

Keywords: initiative budgeting, civil initiatives, local budgets, self-taxation practice, municipalities.

THE MAIN PROBLEMS OF BUSINESS COMMUNICATION

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Ethics and culture of business communication are an integral part of the professional and moral culture of the auditor. Business communication is an integral part of a moral relationship that is morally measurable. Business communication is a kind of connection between moral consciousness and moral behavior. First, forms of business communication are formed in the moral consciousness of the auditor, and ultimately discover themselves in his professional behavior, taken in its moral and ethical aspects.

As a tool designed to help in solving the problems of business communication is used in practical psychology, which stood out now in an independent field. She actively interacts with other Sciences and disciplines. Methods of practical psychology – the result of combining the efforts of theoretical psychology, pedagogics, psychotherapy, theory of speech communication, non-rhetoric, "game theories", applied ethics, philosophy and sociology. Practical psychology helps people to better adapt to the stringent requirements of business ethics and culture [3].

The process of business communication for many is associated with certain difficulties. And it's not even that such people are difficult to develop their communication skills through training, but rather that the very situation of business communication generates psychological and moral problems. Business communication due to its complexity and specificity, researchers distinguish in a special socio-psychological phenomenon (phenomenon), which develops according to its laws, has its own character and its "rules of the game", which has certain features.

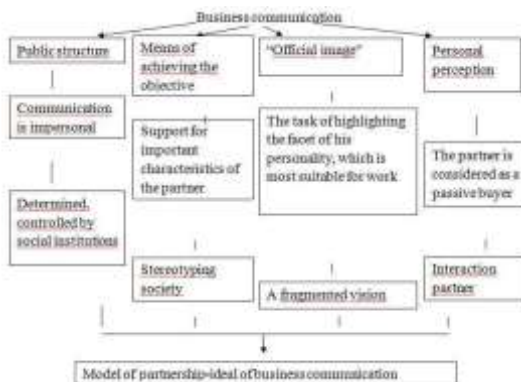


Figure 1 – The pattern of behavior in business communication

Ethics and culture of business communication set its norms, rules and principles. The ideal of business communication is a model of partnership that is alternative to authoritarian and manipulative. Each expert in the field of audit faces a difficult task to achieve their professional goals without using morally condemned models of authoritarian or manipulative behavior. It is impossible to carry out this task without proper training [4].

Failure to comply with legal, regulatory and ethical requirements is punishable. Practical psychology with the help of various technologies, methods helps auditors to fulfill the requirements of ethics and culture of business communication in accordance with the achieved standards and with less mental and moral costs.

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Аннотация. Статья посвящена проблеме делового общения. Практическая психология с помощью различных технологий, методов помогает аудиторам выполнять требования этики и культуры делового общения в соответствии с достигнутыми стандартами и с меньшими психическими и моральными затратами.

Ключевые слова: деловое общение, практическая психология, этика и культура делового общения, идеал делового общения.

Annotation. The article is devoted to the question of business communication. Practical psychology with the help of various technologies, methods helps the auditors to fulfill the requirements of ethics and culture of business communication in accordance with the achieved standards and with less mental and moral costs.

Keywords: business communication, practical psychology, ethics and culture of business communication, the ideal of business communication.

SECTION 6: PHYSICS AND BIOLOGY



UDC 520.1

INVESTIGATION OF LONG-TERM CHANGES IN THE LEVEL OF SKY ILLUMINATION AS A BIOPHYSICAL FACTOR

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With the development of civilization, with the growth of the territory of cities, anthropogenic factors increasingly have an impact on the environment. One of these factors, which has become extremely important in recent decades for the population of large cities, is light pollution [1]. Light pollution ("illumination") – illumination of the night sky by artificial light sources. This phenomenon is caused by the suboptimal and inefficient design of many urban lighting systems that dissipate part of the energy upwards. The effect of lightening the sky is enhanced by common aerosols in the air. These particles additionally refract, reflect and scatter the emitted light [2]. The main sources of light pollution are large cities and industrial complexes [3]. The light directed upwards creates "light domes" over the cities.

To study the degree of light pollution and its dynamics, the archive of images of the AZT-8 telescope at the Crimean astrophysical Observatory was analyzed. The images were obtained in the process of photometric observations of active galactic nuclei in Krao in 2002-2016 by CCD camera AP7p, located in the primary focus of the telescope AZT-8.

From the archive images were excluded images with lunar illumination. Processing of photos was carried out by the program developed by the employee of the Kourovskaya Observatory Vadim Krushinsky specially for determination of brightness of a background. The program is written in Python programming language using numpy and scipy libraries. In the process of processing, the program was carried out to clean the image from high-frequency noise.

Analysis of data processing showed a slight increase in background illumination at the entire stage of the study. In a detailed study, during the year revealed the annual cyclic course of illumination of the sky, well described by a polynomial of degree 6.

When considering changes in the level of illumination by season for the entire period of observation, it was found that the greatest increase in the level of illumination occurs in the winter season and is 22.2 %, the lowest – 1.41 % in spring. The summer period shows a decrease in the level of illumination by 20.32 %.

The data obtained in the study on the change in the illumination of the night sky show an increase in light pollution. Also, it is necessary to know that light pollution affects the established ecosystem and has numerous consequences. One of the consequences of excessive use of artificial light is the loss of energy. Artificial clarification of the environment affects the growth cycle of many plants. Artificial light at night completely changes the habitat of all nocturnal creatures and leads to the death of birds, amphibians, insects and mammals – nocturnal predators [4].

The increase in night sky illumination also affects human health [5]. In the dark, a person produces 70 % of the important hormone melatonin, which is produced only at night, and is one of the strongest antioxidants. Melatonin primarily protects the DNA of cells, thus reducing the risk of cancer and cardiovascular diseases [6]. It acts as a natural immunostimulator.

To reduce the impact of industry growth and urbanization on the night sky, a number of measures should be taken to reduce the dispersion of light sources up. A number of such measures are proposed in the article by Kaptsov et al. [1]. One of them is the use of lamps with closed lamps, directing the light only down, which are used, for example, in Crao.

To control the level of light pollution International Dark-Sky Association (IDA) was established. This organization seeks to bring the problem of light pollution to citizens, government and owners of large industrial enterprises.

According to the recommendation of International Dark-Sky Association for the control of light pollution, to minimize the harmful

effects of light pollution, as well as energy savings:

- Street lighting should only be switched on when necessary (e.g. motion sensors)
- Illuminate only objects that really need lighting
- Objects that do not require lighting should not be exposed to light
- Lamps must have a special design of the reflector, directing the luminous flux can only go down

Thus, due to the negative impact of increasing night sky lightening on astronomical observations, ecology and human health, it is necessary to further investigate this phenomenon and find ways to solve it.

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Аннотация. С ростом территории городов Крыма и увеличения системы городского освещения, за последние 14 лет освещенность ночного неба, по данным телескопа АЗТ-8 Крымской астрофизической обсерватории (КрАО), возросла на 2.57 %, что может негативно сказаться как на астрономических наблюдениях в КрАО, так и на экологии и здоровье человека. Источником увеличения засветки ночного неба являются несовершенные системы городского освещения крупных городов Крыма, рассеивающие часть энергии вверх. Годовой ход засветки нелинеен и сопряжен с сезонами года. Наибольший рост засветки по сезонам за исследуемое время выпадает на зимний сезон -

22.2%, в летний сезон наблюдается уменьшение засветки на 20.32%. Режим экономного расхода электроэнергии в зимние и весенние периоды 2014 и 2015 гг показал снижение влияния светового загрязнения на 13.48 % по сравнению с зимними сезонами 2013-2016 гг . В курортный летний сезон 2014-2016 за трехлетний период наблюдался рост засветки на 18.48 % в отличие от ее уменьшения в 2011-2013 гг. на 18.33 %.

Ключевые слова: засвечивание ночного неба, световое загрязнение, астрономические наблюдения, CrAO, АЗТ-8 .

Annotation. With the growth of the territory of the cities of Crimea and the increase in urban lighting, over the past 14 years, the illumination of the night sky, according to the telescope AMT-8 of the Crimean astrophysical Observatory (CrAO), increased by 2.57%, which can adversely affect both astronomical observations in the CrAO, and the environment and human health. The source of increasing the illumination of the night sky is imperfect urban lighting systems of large cities of Crimea, dissipating part of the energy up. The annual course of illumination is non-linear and is associated with the seasons of the year. The greatest increase in illumination by season for the studied time falls on the winter season - 22.2%, in the summer season there is a decrease in illumination by 20.32%. The regime of economical power consumption in winter and spring 2014 and 2015 showed a decrease in the influence of light pollution by 13.48% for the winter seasons of 2013-2016 . In the holiday summer season 2014-2016 for the three-year period there was an increase of illumination by 18.48 % in contrast to its decrease in 2011-2013 by 18.33 %.

Keywords: night sky illumination, light pollution, astronomical observations, CrAO, AMT-8.

UDC 524.33

DISCOVERY OF VARIABLE STARS BASED ON PHOTOMETRIC ANALYSIS OF IMAGES

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This article presents the results and description of the search process for variable stars in the database of the astronomical mirror telescope (AZT-

8) using the MaxIM DL, MuniWin, Vast software, as well as software developed by the Crimean Astrophysical Observatory.

The aim of the work is the discovery of unknown variable stars.

The relevance of the work lies in the fact that the search and further study of variable stars is very important for the study of the characteristics of stars and their evolution.

From the mid-60s of the 20th century, the Crimean Astrophysical Observatory (CrAO) regularly explores the active galactic nuclei using spectral and photographic methods, using several telescopes [4].

In 2001, the project of continuous photometric monitoring of the selected AGN series [6] was launched on the 70-cm telescope of AZT-8 [5]. The observation program includes about a hundred square sites with active cores of 15x15 angular minutes. Since that time, about half a million frames have been accumulated on a telescope in Johnson's BVRI filters. Each image has a penetration of up to 18-19 magnitude with characteristic exposures from 1 to 3 minutes.

The large temporal scale of the archive contributes to its additional multilateral research, one of the directions of which is the search for variable stars.

Variable stars are stars that change their brightness during a single observation [7]. Long photographing of certain parts of the sky allows detecting variable stars of many types.

Bright variable stars, up to 9-10 magnitudes, almost all are open. And the range of stars with less bright brilliance: from 13-14 magnitude and deeper began to study in detail only in our time. In this regard, images from AZT-8, with deep penetration to 18-19 stellar magnitude, have a great advantage when searching for variable stars.

The search for variable stars does not require high qualifications, so schoolchildren, students and astronomy enthusiasts can also contribute to the development of this direction. Professional astronomers are simply not able to cover such a mass of stars with regular observations, and for an amateur in this area the opportunity to make a contribution to science is open.

With the help of the fits-calibrator program, developed by the engineer of the CrAO O. Kutkov, the frames were sorted and calibrated with AZT-8 [1]. The MaxIM DL software package was used for manual search, and for checking the reliability of the results, an automatic search program for variable stars Vast was used by an employee of the P. Sternberg State Astronomical Institute of Moscow State University K. Sokolovsky [2]. Also, to automatically search for variable stars, we worked with the Muniwin software package. The WinEff software package, developed by V.

P. Goransky, a researcher at the P. Sternberg State Astronomical Institute of Moscow State University, was used to determine the periods and types of stars. During the work about 20,000 frames were investigated. All open objects are registered in the international database of variable stars AAVSO VSX [3].

During the search period, 8 previously unexplored variable stars in different constellations were discovered: Eagle, Chanterelle, Dragon, Charioteer, Aquarius

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Аннотация. Любый астроном-любитель хотя бы однажды мечтал привнести свою лепту в чарующую науку – астрономию. Поиск переменных звёзд – это тот самый шанс внести свой вклад в науку. Открытие новых переменных звёзд полезно для исследования Вселенной, но немногие астрономы могут годами просиживать у телескопа в поисках переменных звёзд. Для этого и создали программы автоматического и ручного поиска переменных звёзд. Об этих программах и пойдет речь в данной статье.

Ключевые слова: Переменные звезды, яркость, астрономы-любители, фотометрический мониторинг, ручной поиск, телескопы.

Annotation. Any non-professional astronomer at least once dreamed to bring his contribution to the fascinating science - astronomy. The search for variable stars is the very chance to contribute to science. The discovery of new variable stars is useful for exploring the universe, but few astronomers have been able to sit at a telescope for years looking for

variable stars. For this purpose, we created programs for automatic and manual search for variable stars. About these programs and will be discussed in this article.

Keywords: Variable stars, brightness, non-professional astronomers, photometric monitoring, manual search, telescopes.

UDC 523.44

ASTEROIDS SEARCH AND MINING PROBLEMS ON ASTEROIDS

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Along with the accelerating growth and development of the planet's population, the depletion of the mineral reserves of the planet Earth began to be observed. Such a course of events requires an active search for a solution to the problem of preserving and renewing resources. One of the solutions is mining of asteroids.

We all understand that asteroids can cause great damage to our planet with its destructive power. However, as it is no wonder, along with the damage, asteroids can also bring benefit to mankind. Recent technological developments have allowed to look at asteroids as a valuable source for mining - and not only.

The main goal of this article is to consider the problems of mining of minerals on asteroids, as well as the discovery of unknown asteroids.

The relevance of the work lies in the fact that the search and further study of asteroids is important for the extraction of minerals from asteroids.

The search for asteroids does not require high qualifications, so students can also contribute to the development of this direction. Manual Search for asteroids can be done using the MaxIM DL software package

Let's try to figure out what problems are separating humanity from mining on asteroids:

1. Use of expensive fuel.

At the moment, rockets that go into outer space use liquid fuel and liquefied oxygen. They occupy a significant amount of space and mass in the device being launched. Because of this problem, the delivery of

resources from an asteroid can cost many times more than that obtained on Earth.

2. The absence of a mineral detection system.

For the extraction of resources on asteroids to be profitable, they must be rich in precious metals and minerals. To track such asteroids is very problematic, since they are at significant distances from the Earth. At the moment there is a method for determining the composition of asteroids by spectral characteristics, which has a small accuracy.

3. Development of a mining system in space.

Conditions on the asteroid are very different from conditions on Earth. Under conditions of weak gravity, completely different tools will be required, which, when operated, will have to be firmly fixed on the surface of the asteroid. Otherwise, at the slightest jolt or impact, when valuable rock is mined, the equipment will safely fly into outer space. In the absence of an atmosphere, the only source of energy for the equipment will be solar energy, which, as the asteroid is more remote, will be less accessible.

4. Full automation of the resource extraction process.

To organize a mining colony with the permanent residence of people is an almost impossible task due to the high background radiation in open space. Therefore, for the development of mineral resources, it is necessary to develop fully autonomous and reliable equipment that can be controlled and maintained from the Earth.

As a conclusion, it can be noted that the extraction of minerals in space will be promising in the future, when the Earth's resources will be exhausted, or with the active development of astronautics.

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Аннотация. Многие астероиды богаты полезными ископаемыми. В будущем человечество не сможет ограничиваться ресурсами Земли, так как они не бесконечны. Но как добыть эти ресурсы? Какие проблемы стоят на пути добычи человечеством полезных ископаемых с астероидов. В этой статье я попробую ответить на эти вопросы.

Ключевые слова: Астероиды, добыча полезных ископаемых, разрушительная сила, добыча полезных ископаемых, топливо.

Annotation. Many asteroids are rich in minerals. In the future, humanity will not be able to restrict itself to Earth's resources, since they are not infinite. But how to get these resources? What problems stand in the way of mankind mining minerals from asteroids. In this article I will try to answer these questions.

Keywords: Asteroids, mining, destructive power, extraction of minerals, fuel.

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BREAST CANCER POSITIONING SYSTEM

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The main part

Today the problem of diagnosis of malignant tumors in the human body, namely cancer, is actual. Due to the difficulties associated with the cumbersomeness of the equipment for diagnosing pathology, as well as the time of research, many people do not have the ability to diagnose the disease in a timely manner, thereby creating a risk for their bodies. Modern cancer diagnostic systems include magnetic resonance tomography (MRT). The basis of this method is the use of magnetic radiation of large induction, which allows you to "lumber" the human body and detect the tumor (Fig. 1).

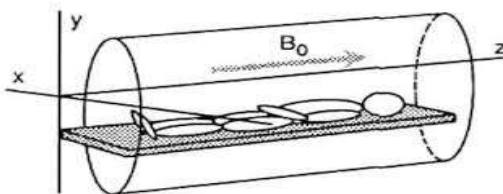


Figure 1 — Magnetic resonance tomography

Modern tomographs have powerful sources of strong magnetic field. These sources include both electromagnets (usually up to 1-3 Tesla, in some cases up to 9.4 Tesla) and permanent magnets (up to 0.7 Tesla). Since the field must be very strong, superconducting electromagnets working in liquid helium are used, and permanent magnets are only suitable for very powerful, neodymium magnets. All this makes the device tomograph very cumbersome, and before scanning, it is necessary to remove all metal objects, check the presence of various foreign objects on the body, such as tattoos, implants, etc. The duration of an MRI scan is usually 20-30 minutes, but it can last longer.

The article [1] describes the method of breast cancer diagnostics using electromagnetic sensors. The described technique is of applied importance in medicine, but the calculations used are implemented for a system that operates on the basis of determining the difference in amplitude absorption between a cancerous tumor and a healthy breast. The use of this approach has a number of drawbacks, including positioning error associated with hormonal changes in the woman's body, which may have a critical role in solving this problem. It is also necessary to take into account that amplitude methods imply the use of some value of EM signal power, which in critical values can also cause malignant tumors.

Thus, it is clear that this technique requires significant improvements. In this paper it is proposed to use a system based on phase methods with the use of microwave sensors of low power. The structure of the location of the sensors is shown in Fig. 2.

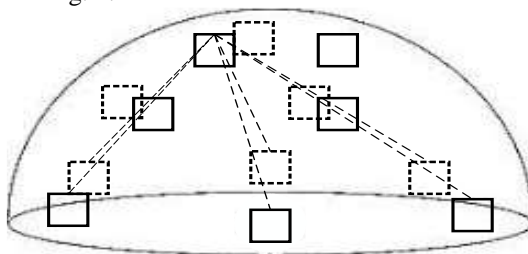


Figure 2 — Sensor arrangement structure

Each sensor works in combination with the others, thus achieving the maximum accuracy of the system. The location of the sensors is described for the breast cancer diagnostic system. The full coverage of the breast area makes it possible to diagnose unequivocally the heterogeneities associated with the occurrence of malignant tumors. The use of low power level will also allow to diagnose tumors by the method described in the article [1], but the disadvantages associated with the use of only amplitude method are eliminated through the use of complex system of accounting of amplitude and phase component. Today, phase systems have the highest resolution when solving problems of object positioning. Its methodology is based on the principle of determining the phase shift of the reflected signal, thus determining the distance with maximum precision.

Conclusion

The use of this system will allow to diagnose the pathology without binding a person to the polyclinic without any harm to the human body, or to carry out the analysis, which requires a lot of time.

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Annotation. This article considers the methods of breast cancer diagnosis by existing methods. The drawbacks of existing systems are considered and described. The technique of definition of a breast cancer on the basis of phase methods is offered.

Keywords: tomography, device, MRT, method, system, location, sensor.

Аннотация. В данной статье рассмотрена методика диагностирования рака молочной железы существующими методами. Рассмотрены и описаны недостатки существующих систем. Предложена методика определения рака молочной железы на основе фазовых методов.

Ключевые слова: томография, устройство, МРТ, метода, система, локализация, сенсор.

SECTION 7: LAW



UDC 340.113.2

MONEY LAUNDERING

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Money laundering is a term used to describe a scheme in which criminals try to disguise the identity, original ownership, and destination of money that they have obtained through criminal conduct. The laundering is done with the intention of making it seem that the proceeds have come from a legitimate source.

Money laundering is the process of concealing the origins of money obtained illegally by passing it through a complex sequence of banking transfers or commercial transactions.

One problem of criminal activities is accounting for the proceeds without raising the suspicion of law enforcement agencies. Considerable time and effort may be put into strategies which enable the safe use of those proceeds without raising unwanted suspicion. Implementing such strategies is generally called money laundering. After money has been laundered it can be used for legitimate purposes. Law enforcement agencies of many jurisdictions have set up sophisticated systems in an effort to detect suspicious transactions or activities, and many have set up international cooperative arrangements to assist each other in these endeavors.

In a number of legal and regulatory systems, the term "money laundering" has become conflated with other forms of financial and business crime, and is sometimes used more generally to include misuse of

the financial system (involving things such as securities, digital currencies, credit cards, and traditional currency), including terrorism financing and evasion of international sanctions. Most anti-money laundering laws openly conflate money laundering (which is concerned with source of funds) with terrorism financing (which is concerned with destination of funds) when regulating the financial system.

Some countries treat obfuscation of sources of money as also constituting money laundering, whether it is intentional or by merely using financial systems or services that do not identify or track sources or destinations. Other countries define money laundering in such a way as to include money from activity that would have been a crime in that country, even if the activity was legal where the actual conduct occurred.

History

Laws against money laundering were created to use against organized crime during the period of Prohibition in the United States during the 1930s. Organized crime received a major boost from Prohibition and a large source of new funds that were obtained from illegal sales of alcohol. The successful prosecution of Al Capone on tax evasion brought in a new emphasis by the state and law enforcement agencies to track and confiscate money, but existing laws against tax evasion could not be used once gangsters started paying their taxes.

In the 1980s, the war on drugs led governments again to turn to money-laundering rules in an attempt to seize proceeds of drug crimes in order to catch the organizers and individuals running drug empires. It also had the benefit from a law enforcement point of view of turning rules of evidence upside-down. Law enforcers normally have to prove an individual is guilty to get a conviction but with money laundering laws money can be confiscated. It is up to the individual to prove that the source of funds is legitimate if they want the funds back. This makes it much easier for law enforcement agencies and provides for much lower burdens of proof.

The September 11 attacks in 2001, which led to the Patriot Act in the U.S. and similar legislation worldwide, led to a new emphasis on money laundering laws to combat terrorism financing. The Group of Seven (G7) nations used the Financial Action Task Force on Money Laundering to put pressure on governments around the world to increase surveillance and monitoring of financial transactions and share this information between countries. Starting in 2002, governments around the world upgraded money laundering laws and surveillance and monitoring systems of financial transactions. Anti-money laundering regulations have become a much larger burden for financial institutions and enforcement has stepped up significantly. During 2011–2015 a number of major banks faced ever-

increasing fines for breaches of money laundering regulations. This included HSBC, which was fined \$1.9 billion in December 2012, and BNP Paribas, which was fined \$8.9 billion in July 2014 by the U.S. government. Many countries introduced or strengthened border controls on the amount of cash that can be carried and introduced central transaction reporting systems where all financial institutions have to report all financial transactions electronically. For example, in 2006, Australia set up the AUSTRAC system and required the reporting of all financial transactions.

Steps in Money Laundering

Money laundering is accomplished in many ways, though most include three common steps, including

1. Obtaining the money or introducing it into the financial system in some way
2. Transferring or concealing the source of the money through complex or multiple transactions
3. Returning the money back into the financial world so that it appears legitimate.

Of these steps, placement of the money into financial institutions is the most difficult. This is because the Bank Secrecy Act of 1970 requires financial institutions to report deposits over \$10,000 in a single day. To circumvent this step then, launderers funnel cash through a legitimate high-cash business, such as a check cashing service, bar, nightclub, or convenience store.

Ways Criminals Avoid Detection

Large scale criminal groups may use complex money laundering techniques in order to avoid detection. However, smaller scale criminals or first time offenders often use simpler methods in their attempt avoid detection. Such money laundering techniques may include:

- Transferring money from bank to bank or from account to account
- Breaking up large amounts into smaller bank deposits
- Purchasing money orders in smaller money amounts
- Breaking the cash into small amounts and purchasing cashier's checks

For example, Sally steals a large amount of cash from her business. She wants the money to go undetected, so instead of making one large deposit into her savings or banking account, she breaks the money up and deposits one small amount each week. This ensures the bank does not look at her transaction suspiciously since it is uncommon for her to deposit large sums of money.

Money Laundering Techniques

There are many forms of money laundering though some are more common and profitable than others. Some of the more popular money laundering techniques include:

Bulk cash smuggling involves literally smuggling cash into another country for deposit into offshore banks or other type of financial institutions that honor client secrecy.

- **Structuring**, also referred to as “smurfing,” is a method in which cash is broken down into smaller amount, which are then used to purchase money orders or other instruments to avoid detection or suspicion.

- **Trade-based laundering** is similar to embezzlement in that invoices are altered to show a higher or lower amount in order to disguise the movement of money.

- **Cash-intensive business** occurs when a business that legitimately deals with large amounts of cash uses its accounts to deposit money obtained from both everyday business proceeds and money obtained through illegal means. Businesses able to claim all of these proceeds as legitimate income include those that provide services rather than goods, such as strip clubs, car washes, parking buildings or lots, and other businesses with low variable costs.

- **Shell companies** and trusts are used to disguise the true owner or agent of a large amount of money.

- **Bank capture** refers to the use of a bank owned by money launderers or criminals, who then move funds through the bank without fear of investigation.

- **Real estate laundering** occurs when someone purchases real estate with money obtained illegally, then sells the property. This makes it seem as if the profits are legitimate.

- **Casino laundering** involves an individual going into a casino with illegally obtained money. The individual purchases chips with the cash, plays for a while, then cashes out the chips, and claims the money as gambling winnings.

Although money laundering is a threat to the good functioning of a financial system, it can also be the Achilles heel of criminal activity. When criminal funds are derived from robbery, extortion, embezzlement or fraud, a money laundering investigation is often the only way to locate the stolen funds and restore them to the victims. Essentially, targeting the money laundering aspect of criminal activity and depriving the criminal group the ill-gotten gains equates to hitting them where it hurts and where they are most vulnerable, for without a usable profit, the criminal activity will cease to continue. However, it will not be possible to stop money laundering without full global cooperation.

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Аннотация. Представлены некоторые факты из истории отмывания денег. Описаны основные меры по борьбе с отмыванием денег. Перечислены способы, с помощью которых преступники могут избежать обнаружения.

Ключевые слова: финансовая система, отмывание денег, преступники, ахиллесова пята, бизнес, казино.

Annotation. Some facts from the history of money laundering are presented. The main measures to combat money laundering are described. The methods by which criminals can avoid detection are listed.

Keywords: financial system, money laundering, criminals, Achilles heel, business, casino.

SECTION 8: NAVAL AND MARINE AFFAIR



UDC 623.8:629.5:681.322

INTRODUCTION OF THREE-DIMENSIONAL LASER SCANNING TECHNOLOGY AT RUSSIAN SHIPBUILDING YARDS

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Every era has its own tasks, and their solution ensures the progress of mankind..

H. Heine.

The main task for the modern Russian Navy is the construction of new warships. By the middle of the two thousandth years large-scale rearmament and strengthening of the fleet with new ships was assumed for 10-15 years. The speed of construction of new large surface ships was extremely low. It is worth noting that the Navy and the naval industry suffered the most in the 1990s. Thus, in parallel with the construction of new ships, it was necessary to restore the entire naval industry as the whole. The main efforts in the naval construction of Russia over the past decade have been aimed at the modernization and restoration of the shipbuilding industry, as well as the development and refinement of advanced weapons systems. This year, the Navy will receive two nuclear and one diesel submarines, will replenish surface forces, and will carry out factory repair of 11 ships and vessels [1]. It is impossible to quickly build a large number of units of the fleet and qualitatively repair it without design organizations and well-equipped, staffed with highly qualified personnel of shipbuilding and ship repair plants. The fleet, ship repair, ship repair plants (SRP) should

have resources for existence and development and it is impossible to achieve the goals without the introduction of new equipment and technologies [2].

In this article I want to reveal the possibilities of three-dimensional laser scanning technology, which can be successfully used in shipyards in the design, construction, repair and modernization of ships.

The essence of the laser scanning process is to determine the spatial coordinates of the points on the surface of the object. This is achieved by means of a laser reflectorless rangefinder by measuring the distance from the instrument to all points to be determined. Presentation of results of laser scanning is an array of laser points reflections from objects within a field of view of the scanner, with five characteristics, namely, spatial coordinates (X, Y, Z), intensity and real color [3, p. 10].

Measurements are made at a very high speed up to 1 million points/sec. The device that implements in practice the above-mentioned measurement technology is called a laser scanner. The result of the scanner is a set of points with calculated three-dimensional coordinates. Such sets of points are called "point clouds" or "scans". Typically, the number of points in a single cloud can range from several hundred thousand to several million. The peculiarity of laser measurements, as well as any measurements, is that in order to obtain a three-dimensional model of an extended or complex object in its geometry, it is required to combine several "scans" performed at different stations into a single coordinate system.

The process of combining individual "scans" into one is called "crosslinking". To do this, the adjacent "scans" must have overlapping zones, in which the so-called control points are selected. Special marks or characteristic points of the measured object are used as control points. The software used for processing the results of laser scanning, the coordinates of the control points on the neighboring "scans" allows you to "sew" them into one "point cloud" with the possibility of subsequent processing for production purposes. If the coordinates of the control points are known in a particular coordinate system, the cross-linked point cloud can be converted to that coordinate system.

The technology experts of the company "NovIT SPb", the specialists of the Russian representative office of Leica Geosystems (OOO "Lake of Geosystems") and "Company G. F. K." tested in 2005 on enterprises FGUP PO "Sevmashpredpriyatie". The staff of the shipyard were performing at the time the largest and most ambitious projects: the construction of the offshore ice-resistant fixed platform (oirfp) "Prirazlomnaya", repair and modernisation of a heavy aviabearing cruiser (TAVKR), project 11430,

better known as "Admiral Gorshkov" [4, p. 13].

According to the results of their work, it can be concluded that the technology of three-dimensional laser scanning is a reliable tool for constructing drawings of complex objects, measuring distances, volumes and areas, modeling new designs and embedding them in existing sizes. The speed of operation allows you to carry out internal and external measurements quickly. The system ensures that the results are accurate enough to build working drawings. The flexibility of the software allows you to solve most of the problems arising from the modernization or direct construction of complex objects.

The feasibility of using the new technology in various applications is based on its unique capabilities. Among the distinctive features of laser scanning, I want to highlight three, in my opinion, the main ones.

First, the technology fully implements the principle of remote sensing, which allows to collect information about the object under study, being at a distance from it. At the same time, we immediately obtain data in the form of coordinates of surface points, which greatly expands the possibilities of further computer processing of the results. This feature can significantly reduce labor costs, improve efficiency and make the work safer.

Secondly, the completeness, details and accuracy of the information obtained by laser scanning can not be compared with any of the previously implemented methods. The density of the defined points can be calculated in fractions of a millimeter, which makes it possible to adequately display the objects of the most complex "non-mathematical" form and almost indefinitely expands the scope of the new technology.

Thirdly, laser scanning is characterized by unsurpassed speed. Information about an object in the form of a point cloud is collected much faster than traditional methods of measurement. Thus, we have a unique opportunity to quickly monitor the processes of both natural and man-made.

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Аннотация. Главной задачей для современного военно-морского флота России является строительство новых боевых кораблей. Основные усилия в военно-морском строительстве России за последнее десятилетие были направлены на модернизацию и восстановление судостроительной промышленности, а также на разработку и доработку перспективных систем вооружения.

Необходимость внедрения новой техники и технологий на судостроительных и судоремонтных заводах на сегодняшний день становится актуальной задачей.

В данной статье раскрыты основы технологии трехмерного лазерного сканирования, и некоторые возможности, которые с успехом можно применить на судостроительных верфях при проектировании, строительстве, ремонте и модернизации судов России.

Ключевые слова: Россия, судостроение, судоремонт, модернизация, трехмерное лазерное сканирование, трехмерная модель.

Annotation. The main task for the modern Russian Navy is the construction of new warships. The main efforts in the naval construction of Russia over the past decade have been aimed at the modernization and restoration of the shipbuilding industry, as well as the development and refinement of advanced weapons systems.

The need for the introduction of new equipment and technologies in shipbuilding and ship repair plants today is becoming an urgent task. This article describes the basics of three-dimensional laser scanning technology, and some of the features that can be successfully used in shipyards in the design, construction, repair and modernization of Russian ships.

Keywords: Russia, shipbuilding, ship repair, modernization, three-dimensional laser scanning, three-dimensional model.

UDC 656.611

DEVELOPMENT OF THE ICEBREAKING FLEET OF RUSSIA AND ITS ECONOMIC EFFECT

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The Northern Sea Route is the shortest sea route between the European part of the Russian Federation and the Far East, including Asian countries (picture 1). The legislation of Russia NSR (The Northern Sea Route) defined that way like historically established national unified communication of the country in the Arctic.

Innovations in Arctic exploration and the marine transport activity in the Arctic Ocean, economic growth in the Russian Arctic regions and prospects of oil and gas extracting companies in sub-polar areas raise a need in ice-class vessels. The Arctic fleet of the Russia which nuclear ice breakers were used for many international projects now nominates a stage of rapid development. In many areas of Far North it caters for supporting life of population, economic activity of the Arctic Regions and export of natural resources [2].



Picture 1 – The Northern sea route

Ruksha V., Golovinsky S., Smirnov A., Nikolaev P., Radionova L., Ivanov A., Peresypkin emphasize the crucial role of nuclear icebreaking fleet in navigation along the Northern sea route to develop the economy of the Arctic of Russia [1]. V.I. Pavlenko, E.K. Glukhareva, S.Yu. Kutsenko underline the important role of the Northern Sea Route (NSR) and nuclear ice breakers for maintenance of navigation in Polar areas. They considered the directions of the nuclear Arctic fleet development in Russia and main types of ice-class marine transport in the Russian Federation and the prospects of the Russian Arctic fleet development until 2040 [2].

The influence of launching the Northern Sea Route may turn out to be comparable in scale of a wide range of industries – from maritime trade and shipbuilding to high technologies related to the production of navigation

equipment [5]. The increase in cargo traffic along the Northern Sea Route to 80 million tons by 2024 is stated in the May decree of Russian President Vladimir Putin (picture 2). At the same time, the Ministry of Environment considers that by 2024 the volume of cargo transportation will be 52 million tons per year. We are talking about the transportation of LNG, oil and condensate, the sale of which is guaranteed at 80–90%. A representative of NOVATEK told RBC that more than half of the NSR cargo traffic can be provided with cargo from the company's projects [3].



Picture 2- Freight volume on the Northern Sea Route.

Source: [https://www.znak.com/2018-03-](https://www.znak.com/2018-03-01/putin_postavil_zadachu_v_poslanii_uvelichit_k_2024_godu_mochnost_sevmorputi_v_10_raz)

01/putin_postavil_zadachu_v_poslanii_uvelichit_k_2024_godu_mochnost_sevmorputi_v_10_raz

Providing a cargo flow of 80 million tons along the Northern Sea Route by 2024 will require more than 100 new vessels. This was stated by Deputy Prime Minister Yury Borisov at a meeting of the maritime board at the government. According to Borisov, icebreakers, gas carriers for LNG transportation, tankers for the transportation of crude oil and gas condensate, as well as auxiliary, rescue and navigation and hydrographic vessels will be required [3].

The aim of research work is to analyze the role of the icebreaking fleet development and possibilities of economic country growth. The **research objectives** are to consider the specifics of modern icebreaking fleet of Russia and its impact on the economy of Russia.

Russia possesses the world's only nuclear icebreaker fleet designed to meet maritime transportation objectives in the Arctic based on advanced nuclear technology application. Currently Rosatomflot (a Rosatom company) operated two nuclear icebreakers with twin-reactor nuclear power plants of 75 thousand h.f. design capacity (the ‘Yamal’, and the ‘50 Let Pobedy’ (Picture. 3), and ones with single-reactor nuclear facilities of approximately 50 thousand h.f. (the ‘Taymyr’, and the ‘Vaygach’). Besides the fleet involves the ice-breaking LASH carrier and container ship the ‘Sevmorput’ with a 40 thousand h.f. power plant, as well as 5 service ships [4].

“Soon the fleet will receive three powerful new generation double-draft LK-60Ya icebreakers built in accordance with the 22220 design. The flagship universal nuclear vessel is already under construction at the Baltic shipyard in St-Petersburg, and in May 2015 the keel was laid for the first serial icebreaker the ‘Sibir’ at the Open Joint Stock Company ‘The Baltic Shipbuilding Plant’ (Baltiyskiy Zavod - Sudostroyeniye) berth. According to the contract, the ships should be due to be completed by 2020” [4, www].



Picture 3-Nuclear icebreaker.

Source: Posatom. <http://www.rosatom.ru/en/rosatom-group/the-nuclear-icebreaker-fleet/>

“The development of Arctic territories and water areas for the purpose of organizing the production of hydrocarbons and metals requires the expansion of the possibilities for transporting goods along the Northern Sea Route. There is a practical interest of large sea carriers to the NSR due to the possibility of reducing the transport arm of the delivery of goods from Asia to Europe and vice versa. With efficient management of cargo flows and the availability of icebreakers, the NSR may be more competitive than traditional logistics routes” [5, www].

The Northern Sea Route is actively used by Russian companies to develop mineral deposits in the Arctic zone (Norilsk Nickel, Yamal LNG, Gazprom Neft, Rosneft, etc.). More than 70% of cargo on the NSR consists of hydrocarbon raw materials and petroleum products. “Large-scale Arctic oil and gas projects are the first bright positive examples of the organization of work on the NSR, which became a powerful impetus, in particular, for the implementation of the program for the development of the nuclear icebreaking fleet” [5, www].



Picture 4 – Icebreaker the ‘Sibir’.
Source: <http://24ri.ru/down/o-311.html>

Based on the presented data, we can conclude that measures of management on the governmental level of the problem of Arctic territory and internal transformation of Arctic fleet in the Russian Federation can promote not only economic efficiency but safety of marine transportation on the ways of the NSR in the polar and sub-polar regions.

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Аннотация. Рассматривается Северный морской путь, как возможность транспортировки важнейших экономических ресурсов. Для увеличения грузопотока, России необходимо развивать флот, причем в 2020 году планируется начать эксплуатировать самый мощный ледокол “Арктика”. Помимо “Арктики” в проекте 22220 предусмотрено еще два ледокола.

С 2015 года на Балтийском заводе строится первый серийный корабль проекта “Сибирь”, в июле 2016 года начато создание третьего атомохода – “Урал”.

В заключении статьи отмечено, что проблема эксплуатации Арктики волнует нашу страну, ведь с решением вопроса возможен экономический подъем и усиление статуса РФ на мировой арене.

Ключевые слова: Арктический флот, арктические территории, Северный морской путь, ледоколы, морские перевозки, экономический рост.

Annotation. The Northern Sea Route is considered as an opportunity to transport the most important economic resources. To increase cargo traffic, Russia needs to develop a fleet, and in 2020 it is planned to start operating the most powerful icebreaker “Arktika”. In addition to the “Arktika” in the project 22220 provides two more icebreakers.

Since 2015, the first serial ship of the “Siberia” project is being built at the Baltiysky Plant, in July 2016, the creation of the third nuclear-powered ship the “Urals” began.

In the conclusion of the article, it is noted that the problem of the exploitation of the Arctic worries our country, because with the solution of the issue, economic growth and strengthening of the status of the Russian Federation on the world stage is possible.

Keywords: Arctic fleet, Arctic territories, the Northern Sea Route, icebreakers, sea transportation, economic growth.

**THE PROBLEM OF DISCRIMINATION AGAINST
WOMEN AT SEA**

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Nowadays a great attention is given to the problem of women's employment. It is well-known fact that it provides support to the family life, the social life and the economic structure of society. At the present time the employment of women has important social changes. Due to the economic growth and the consequent markets expansion massive female employment involves substantial restructuring of both the labor market and social life. Last years it is observed the transition of women from low-skilled professions to high-skilled ones that require high educational background. Having studied other sectors it was noted that the shipping sector still preserves the male dominated culture. In spite of this fact the number of women in the fleet has increased. The available data show that the female employment onboard the ships represents a small percentage of the total employment. It was about 2%. The percentage of the total number of women seafarers vary between 23,3% (Swedish) and 1,2% (Italian) [1]. Different national and international organizations have declared their intention to give equal access to men and women to all sectors of the maritime industry, to provide their greater participation in maritime training at all levels in the maritime industry. However, the real conditions reigning in the seafaring labor market do not favor the employment of women seafarers. So the discrimination against women at sea is studied in the paper.

Due to the lack of officers in the Merchant fleet there is an increasing number of women seafarers. IMO considers that the problem of crew shortage can't be solved by women's employment. Analyzing different sources it may be stated that women are found onboard ships of all specializations, but most of them are employed on cruise and passenger

ships. It occurred due to structural changes in the cruise industry and lack of qualified male seamen. The small percentage of the women seafarers in comparison with their male colleagues makes clear that it is difficult to get a rank of the officer onboard a ship. Also it is reported that women cadets or women mariners encounter difficulties when applying for a job or are discriminated because of their gender. It is observed that even after completion interviewing or passing different tests successfully women can't be sure in applying desired job or shipboard training. A lot of ship owners consider that the time of being women at sea is very short because her main task is to be a mother. So it has no sense to promote them. A thorough study of this problem was made and it was found that the co-existence of men and women was more often onboard a cruise vessel or passenger ship. A lot of men consider that it is good practice to employ women in catering or hotel departments because this work is considered "women's work". On the contrary male seafarers don't want to accept women on board a tanker or other types of ships and to be under their supervision. It is difficult for men to recognize and accept the women in a male dominated environment. Especially it occurs due to such factors as age, nationality and education. They think that it is easy to accept woman as a cadet and behave accordingly than to perform orders given by woman as a master or an officer. To their mind a lot of masculine standards of behavior arise onboard a ship and there are no exceptions in spite of the gender. They can't agree with that fact that sometimes a woman of 30 years old has to give orders to the oldest crew members. So our women encounter these difficulties to promote in their career, especially if one takes into account that, according to the data provided by ITF, 42% of all male seafarers were officers but the corresponding percentage of women seafarers was 7% [5].

Speaking about developing countries we may say that entry to the seafaring profession is even harder as "they have to face triple 'tides' as they navigate the world – as seafarers, as third world migrant workers and as women". It means that in the countries-major supplier of seafarers, we have a very small percentage of women. According to data obtained in 2007, the number of Filipino women seafarers was 6.619, i.e. 3% of the seafarers' total, and only 25 women were ship officers.

As it was mentioned above women seafarers encounter a series of problems which, can be grouped into the categories according to ITF: reproductive health issues, harassment, lack of positive career options/discrimination [5]. Their family commitments were also reported as one of the reasons for failure to reach top career positions, a situation aggravated by the fact that there are few available options to balance family commitments with work [2]. Participants of a research "on the reality and

perspectives of seafarers in Europe” drew attention to the difficulties presented in the shipping sector specifically for women. They said that “it is a profession extremely difficult for a woman to survive in, especially when taking into account her other roles as well”, while one other supported that “women in ships have to prove their worth twice” [5]. It has been noted that very often women have to work harder than their male colleagues, to prove their abilities and to be accepted by them [8].

It was noted that sexual harassment is one of the problems in workplaces, especially in male dominated ones. Ships are good examples of such workplaces where sexual harassment exists. According to these studies there are different types of harassment ranged from sexist comments and behavior and unsolicited verbal advances to physical assault.

These experiences are also linked to the conditions of “residential occupation” [7] and rigid hierarchical environment which are characteristic of the ships. The term of “residential occupation” means that women seafarers have no chance of avoiding their harassers when sailing in the open sea. It was noted that the harasser was an officer occupying a higher rank than the woman seafarer [7]. This confirms that sexual harassment is a reflection of the power relations between individuals involved [8]. Residential occupation means also that women seafarers share the shame enclosed and fixed space with their men colleagues [7]. Every move they make is under the close attention paid by their male colleagues. Very often the incidents are reported but even then, results are not satisfactory for the women seafarers. The fact that IMO requires the shipping industry to address the requirements for separate facilities and accommodation of women seafarers is highly relevant, along with its suggestions to make design modifications mandatory and to guarantee that a core minimum of two female seafarers is employed on any given ship and that the support system available to them is strengthened [4].

In conclusion it may be stated that the problem of discrimination against women exists and it has not been solved yet. We believe that it is necessary to provide legislative support and intensify punishment for the discrimination and harassment. Companies must understand that when they employ women, first of all they get an employee and specialist without paying attention to the gender.

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Аннотация. В статье рассматривается анализ факторов, влияющих на продвижение по службе женщин в морской профессии в контексте международного судоходства, определены факторы принятия женщин в качестве коллег мужчин на борту и условия, негативно влияющие службу женщин в морском флоте.

Ключевые слова: женщины, дискриминация, работа, флот, мужчины

Annotation. The paper studies the analysis of the factors affecting the progress of women in the seafaring profession in the context of International shipping industry, determines the factors of the women's acceptance as men's colleagues onboard and the conditions that affect negatively the women's position in seafaring profession.

Keywords: women, discrimination, work, fleet, men.

UDC 629

ALTERNATIVE METHODS OF CORROSION PROTECTION IN SHIPBUILDING

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In many accidents, the ship structure had been weakened by corrosion. the prevention of corrosion is a major priority for safe shipping. “Corrosion is chemical degradation of solid material by influence from its environment” [1, www]. The definition of corrosion does not apply to plastics and polymers, as they introduced the concept of aging. Alternative methods of corrosion protection in shipbuilding were researched by Dr. Thomas J. Langill, Jan R. Weitzenböck, Stefan Marion, Mann, Darrel, Marion, Stefan, Möhrle, Martin G.

Dr. Thomas J. Langill defined corrosion as the chemical or electrochemical reaction between a material and its environments that produces a deterioration of the material and its properties

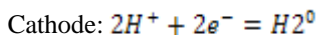
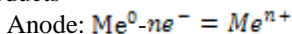
“Today’s coating systems work well and have a sufficient lifetime when they are applied according to the coating producer’s specifications” [3, www].

These minimum levels of protection required to develop innovative approaches to corrosion protection with the main aim of improving the reliability of marine structures. TRIZ stands for Teoriya Resheniya Izobreatatelskikh Zadatch, a acronym that translates to the Theory of Inventive Problem Solving (Mann and Dewulf). TRIZ represents a distillation of the best practices of successful inventors and problem solvers from across all fields of engineering and science.

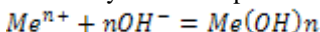
The aim of the article is to indicate different methods for corrosion protection of ships. General specifications of coating systems are stated.

The equation of corrosion:

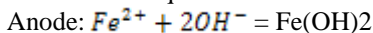
Primary corrosion products



Secondary corrosion products



Consider the equation of corrosion on the example of iron.



Corrosion is classified into two types:

– on the mechanism of the processes:

1) Chemical (occurs in environments where there are no electrolyte solutions.

2) Electrochemical (occurs in environments where electrolyte solution is present).

– by character of corrosion damage:

1) Continuous corrosion (it is also divided into uniform, selective and uneven).

2) Local corrosion (it is divided into point, spots, through, ulcerative, subsurface, etc.)

The corrosion rate is influenced by several factors:

1. The character of the metal and the environment (the smaller the electrode potential of the metal so it is stronger and faster corrodes and the more active the environment in which the metal is, the more corrosion.

2. The state of the metal surface (the more irregularities on the metal, the more places where the electrolyte solution can get, so the corrosion will be faster)

3. The presence of internal stresses in the metal (at internal stress, the phenomenon of electrolytic dissociation occurs, under the action of which the metal begins to corrode faster)

4. The concentration of the oxidant (the greater the concentration of the oxidant the more corrosion)

5. Contact with other metals (safe contact of metals if the difference of their electrode potentials does not exceed 0.25 volts. If the potential difference is greater than 0.25 volts, one of the metals will begin to break down much more actively)

Methods of corrosion control:

1. Rational design. It is necessary to design products from metals so that on it there were as little as possible roughnesses and to avoid unsafe contact of metals with each other.

2. Replacement of destructive metal with non-destructive substances. One of the main competitors for metals is plastic. They are replaced by iron pipes, parts in cars, etc. Plastic as an alternative to iron found itself in shipbuilding, so in April 2018, a ship named "Ivan Antonov" entered the post of the Navy, the main feature of which is a fiberglass non-corrodable hull.

3. Coatings application. "There is no generally valid definition of coating. Coating is often synonymous with painting, i.e. a protective film of thickness usually about 0.2 - 0.5 mm. Coatings or paints are usually sprayed on the metal surface" [1, www]. Coatings can be metallic and organic. Metal coatings are made of zinc, chromium, Nickel, tin, lead, etc. For example, almost the entire body of the car is covered with zinc, which makes it more resistant to corrosion. Organic coatings are various varnishes and paints. As an example, to protect a metal product from corrosion, one can apply a layer of paint. Water will not get on the metal and corrosion will not spread.

4. Chemical coatings. Chemical coatings occur on the metal surface during a chemical reaction. One of the most popular chemical coatings is oxidation(creating a protective oxide film) Oxidation or bluing is done by

heating the metal in an oxygen – containing environment. There is also such a chemical treatment such as nitriding. It is produced during the loading of the metal in the salt bath of nitrate ions.

5. The use of alloys. Alloys of some metals are resistant to corrosion. So the alloy of steel and chromium (13%) is practically not corroded. By adding chromium to the steel , the electrode potential of the alloy increases sharply. Alloy chromium and steel called stainless steel. I also add other metals to iron, such as Nickel, manganese, zinc, etc.

6. VCI (Volatile Corrosion Inhibitor) method

Unlike the protective coating method, the VCI method is an active corrosion protection method, as chemical corrosion processes are actively influenced by inhibitors (fig. 1). “The presence of the VCI inhibits the electrochemical processes which result in corrosion, suppressing either the anodic or cathodic half-reactions. Under certain circumstances, the period of action may extend to two years” [4, www].

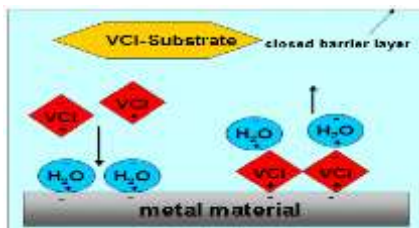


Figure 1 – Mode of action of VCI

The VCI method is primarily used for articles made from carbon steel, stainless steel, cast iron, galvanized steel, nickel, chromium, aluminium and copper. The protective action provided and compatibility issues must be checked with the manufacturer.

7. Electrochemical protection. This protection is the most effective corrosion protection. It is of two types:

1. Tread (Protector is a device of a more active metal than the protected metal). Such protection is actively used in shipbuilding. Protectors are metal blocks made of zinc, magnesium , aluminum, which are welded to the Board. After the active metal is completely consumed, the old blocks are removed and new ones are welded. This method of corrosion protection is the simplest and cheapest among others

2. Cathodic protection. The protected product is connected to a DC cathode. It is used to protect oil pipelines and tanks with various liquids, in the protection of valves and piles, and in shipbuilding (much less often than protective protection). “Cathodic protection impressed are one when current external source of direct current power is connected (or impressed) between

the structure to be protected and the ground bed (anode) and ideal impressed current systems use ground bed material that can discharge large amounts of current and yet still have a long life expectancy” [2, www]. Pieces of an active metal such as magnesium or zinc are placed in contact with the corrosive environment and are electrically connected to the structure to be protected Example: docked Naval Ships [2].

A coating specification could be mutually agreed between builder and owner and coating manufacturer. Inspectors' duties and reporting line should be defined. “The specification should describe: - which coating systems (types of coating, thicknesses and number of coats) to be applied where coating manufacturers accepted for delivery equipment for control of air humidity, temperatures, ventilation coating applicator's duties and application equipment - yard's coating facilities - steel surface treatment - coating application and curing - repair procedures for damages” [1, www].

Another classification of corrosion protection includes the following methods of corrosion:

- Control barrier protection (provided by a protective coating that acts as a barrier between corrosive elements and the metal substrate);
- Cathodic protection (employs protecting one metal by connecting it to another metal that is more anodic, according to the galvanic series);
- Corrosion resistant materials (Materials inherently resistant to corrosion in certain environments) [2].

One obvious solution to the corrosion problem would be to use a different construction material. “Introducing alternative materials like less corrosive steel types or composite materials is a difficult and time consuming process as new designs and production options have to be established and approved” (fig 2.).



Figure 2: Problem hierarchy explorer for selection of materials

Source: <https://triz-journal.com/using-triz-develop-new-corrosion-protection-concepts-shipbuilding-case-study/>

Also, one of the methods of corrosion control is the effect on the corrosive environment: the use of corrosion inhibitors (nitrides, silicates), change the PH of the medium (the greater the PH, the stronger the corrosion), change the oxygen content (in a medium with a high concentration of oxygen, the metal begins to corrode more actively).

In conclusion it should be noted that all mentioned method of corrosion protection are effective ones. The corrosion in shipbuilding is usually controlled by the combination of paints and cathodic protection. Corrosion control plays a key role in new ship design and shipbuilding. Design for maintainability" and "design for affordability" are goals on the new construction side that have been thrown around a lot in recent years. Better corrosion-resistant materials, such as coatings in the tanks and voids should be used. Shipbuilders want more options on the types of materials they can purchase and the freedom to decide how they're going to paint a space.

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Аннотация. Рассмотрены методы борьбы с коррозией, которые применяются в кораблестроении. Методы контроля коррозии охарактеризованы. В заключении отмечено, что контроль коррозии играет важную роль в новом дизайне корабля и судостроении.

Ключевые слова: кораблестроение, коррозия, покрытие, катодная защита, катод постоянного тока.

Annotation. The author consider effective and promising methods of corrosion control which are applied in shipbuilding. The methods of corrosion control are stated. In conclusion it is noted that corrosion controls play a key role in new ship design and shipbuilding.

Keywords: shipbuilding, corrosion, coatings, cathodic protection, DC cathode.

ALGORITHMIZATION OF ENGINEERING DESIGN

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Introduction. Algorithmic modeling along with acting as the general method of science. The implementation of certain algorithms reduces the control processes in different systems, which makes the concept of the algorithm close and Cybernetics.

Algorithms are the object of systematic study of the boundary between mathematics and Informatics of the scientific discipline adjacent to mathematical logic - the theory of algorithms.

The peculiarity of the situation is that it is possible not to rely on the high formalization of this concept in solving practical problems involving the development of algorithms for implementation on a computer, and especially when using information technology in practice. Therefore, it seems appropriate to get acquainted with algorithms and algorithmization based on a meaningful interpretation of the essence of the concept of algorithm and consideration of its basic properties. With this approach, algorithmization more acts as a set of certain practical techniques, special specific skills of rational thinking within the given language means.

The word "algorithm" comes from "algorithmi" - the Latin form of name writing of the great mathematician of the IX century, who formulated the rules for performing arithmetic operations. Initially, algorithms were understood only as the rules of the four arithmetic operations on multivalued numbers.

Algorithmization – methods of drawing up algorithms for the purpose of the solution of applied tasks on a computer [1] and acts as a set of certain practical techniques, special specific skills of rational thinking within the given language means.

An approach to the construction of algorithms based on the application of the information design model was studied by E.H. Tiygu, I.P.Deshko, J. Arifovic E. Polak, A.V. Buravtsev. This approach is called constructive algorithms. Constructive algorithmization uses the principles of conceptual design and conceptual programming. Constructive algorithms use the properties of the conceptual algorithms. Constructive algorithms uses the requirements of the quality standard of the software. The combination of

these scientific directions led to the creation of a new approach. A.A. Shalyto stated the foundations of a technique for algorithmization and programming of problems of logical control. The technique provides an increase in "safety" of software and can be called a state technique or, more precisely, an automaton technique. The corresponding field of programming is called automaton programming [2]. Technology of algorithmization and programming of logic control tasks is called switching technology (SWITCH-technology).

The presence of the algorithm formalizes the process of solving the problem, eliminates the reasoning of the contractor. The use of the algorithm makes it possible to solve the problem formally, mechanically executing the algorithm commands in the specified sequence. The expediency of the actions envisaged by the algorithm is ensured by an accurate analysis on the part of the person who makes up the algorithm.

The algorithm should be composed in such a way that the executor, based on which it is created, can follow the algorithm commands unambiguously and accurately and effectively obtain a certain result

The aim of our article is to consider algorithmization of engineering design.

Research methods are system approach, methods of system analysis, methods of integration and intellectualization, decision support, object-oriented analysis and design.

The present time a formalization of design and construction activity is the actual task in engineering district. By means of modern computational technique it is possible to rise considerably the efficacy of design, however solved tasks must be described by formulations and must be presented in the variety of algorithm [3].

A common way to represent the algorithm is to write it in algorithmic language, which is a system of symbols and rules for uniform and accurate recording of algorithms and their execution. Note that there is a difference between the concepts of "algorithmic language" and "programming languages"; first of all, under the executor in algorithmic language can mean not only a computer, but also a device to work "in the environment." A program written in algorithmic language is not necessarily intended for a computer. The practical implementation of algorithmic language is a separate issue in each case.

While preparing algorithms there is a need to use as an auxiliary one and the same algorithm, which can also be very complex and cumbersome.

In practice, the so-called built-in (or standard) auxiliary algorithms are widely used, i.e. such algorithms that are constantly available to the

contractor. Access to such algorithms is carried out in the same way as to the "normal" auxiliary algorithms.

In the case of drawing up algorithms for working with quantities, one can consider other possible algorithmic designs, for example, a cycle with a parameter or a choice.

These constructions will be considered in detail when getting acquainted with real programming languages.

In the application of schemes of algorithms, in most cases, the transition from algorithms to programming for complex tasks, logic control is a big problem. This is due to the fact that usually the process of algorithmization is almost never completed by what is necessary to create an algorithm in a mathematical sense, which by definition, must be uniquely performed by any computer, and ends with only some "picture", called the algorithm, which to some extent have to think out when programming (for example, to structure the algorithm scheme or introduce unconditional transitions in an unstructured program). In this situation, either the developer must program himself, or the programmer must know all the features of the technological process, or together they must eliminate the inevitable errors of traditional program design during testing [2].

The conceptual model of the intelligent computer-aided design system taking into account the technology of intellectualization can be represented as a set of information intelligent systems.

Each of the intelligent information systems is a tandem of the designing subsystem and expert system, which simplifies and automates decision-making procedures in difficult formalized subject areas, improves the quality and efficiency of decisions. The development of an intelligent information system has not been carried out so far, while the choice of processing methods and the formation of technological documentation on their basis is one of the most important factors taken into account in the design and affecting the quality of the result.

To implement the process of functioning of the information intelligent system at the stage of technological decision-making it is necessary to develop an algorithm – an accurate description of a computational process or any other sequence of actions. Depending on the purpose, initial conditions of the problem, ways of its decision, definition of actions of the performer the developed algorithm can be carried to branching and cyclic, on a way of representation – to the graphic set by means of special graphic symbols.

Results.

The possibility of implementation of the project formation process necessitates the development of an algorithm for this process.

This step can be written conditionally as

$$A = B U C,$$

where A is the operation of intelligent information systems at the stage of adoption of technological solutions; B – routing; C – technological sequence.

The structure of the document "Technological sequence" can be conventionally represented as

$$B = T, \bigcup_{i=1}^n SD_i,$$

where Tp is a technical figure formed in the information intelligent system Di – i -th technological node included in the processing of the project; i is the number of technological nodes in the project, $i = 1...n$; SDi is a graphical scheme (scheme of the processing method) of the i -th technological node [4].

Conclusion.

The presence of the algorithm represents the process of solving the problem. The use of the algorithm makes it possible to solve the problem formally, mechanically executing the algorithm commands consistently. The expediency of the actions envisaged by the algorithm is ensured by an accurate analysis on the part of the person who makes up the algorithm.

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Аннотация. Целью статьи является рассмотрение алгоритмизации проектирования. Наличие алгоритма представляет собой процесс решения задачи. Концептуальная модель интеллектуальной системы автоматизированного проектирования с учетом технологии интеллектуализации представлена в виде совокупности информационных интеллектуальных систем.

Ключевые слова: алгоритмизация, проектирование, алгоритм, интеллектуальные информационные системы, логическое управление.

Annotation. The aim of our article is to consider algorithmization of engineering design. The presence of the algorithm represents the process of solving the problem. The conceptual model of the intelligent computer-aided design system taking into account the technology of intellectualization are represented as a set of information intelligent systems.

Keywords: algorithmization, design, algorithm, intelligent information systems, logic control.

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FLETTNER ROTOR AND TURBOSAIL FROM COUSTEAU

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More and more consumers use environmentally friendly sources of energy in all the «land sectors» of the global economy, and in the navy, diesel engines remain the main propulsion systems, just like a hundred years ago. But if they cannot be abandoned, since ship diesel engines do not have worthy competitors in terms of the cost of fuel costs, then perhaps it is worth giving them the help of forgotten «sailing technologies» to reduce diesel power and the consumption of petroleum products? [3] This idea is already being realized by the developers of «air-engine» projects.

One of these projects is based on the invention of the centenary «age» – a turbosail (also known as the Flettner rotor sail), which uses the Magnus effect. The swirling round object speeds, the air in front of the object moves in the direction of its rotation and stretches along and towards the center. On the side where the surface of the object rotated towards the wind, an area of increased pressure was created, and on the opposite side, a reduced area. As a result, there was a thrust, which moved the vessel, subject to the presence of a side wind. The described physical phenomenon was used by the German engineer Anton Flettner when creating a new type of marine engine. His rotary sail had the appearance of rotating cylindrical wind power towers. On top of the rotors-cylinders Flettner put flat plates for better orientation of air flow. A rotating hollow metal cylinder-rotor that

uses the Magnus effect to create lateral thrust, was later named after its creator, Flettner.

“A turbosail which had a fixed cylinder and a flap with sharp trailing edge that could be positioned at any point around the cylinder. It used boundary layer suction to avoid separation on the cylinder. This is an entirely different principle of operation from the Flettner rotor. It is essentially a conventional wing with a very large thickness ratio. It has more in common with a Griffith airfoil than a Flettner rotor” [1, www].

Unlike a conventional sailing ship, a rotor ship is practically not afraid of bad weather and strong side winds, it can easily go with variable tacks at an angle of 25 to the headwind (for a conventional sail the limit is about 45°) [5]. Two cylindrical rotors (height - 13.1 m, diameter - 1.5 m) make it possible to perfectly balance the ship - it is more stable than a sailboat. The ships were tested both in calm and in a storm, and with deliberate overloading - and no serious flaws were identified. The most advantageous movement of the vessel was the direction of the wind exactly perpendicular to the axis of the vessel, and the direction of movement (forward or backward) was determined by the direction of rotation of the rotors.

The idea of a fundamentally new system that uses wind energy to create a vessel has been introduced by French researcher and inventor Jacques-Yves Cousteau. For the basis he took the Flettner's turbosail (pict. 1). Cousteau's, (actually team of engineers led by L. Malavard and B. Charrier), solution was different then Flettner's. They designed “turbo sail” – hollow cylinder with movable wing-shaped shutter and fans that suck air from the cylinder creating lower pressure on one side. That under-pressure accelerate air flow on one side of the cylinder.



Picture 1 – Flettner's turbosail

System was tested full size in 1983, with the catamaran Moulin à Vent with one “turbo sail”, during Atlantic crossing. After that Alcyone was

built. She sailed a lot, Cousteau's team claim fuel savings of about 35% compared with motor ship on long passages.

The Cousteau design has an aerodynamic profile and acting on the same principle as an airplane wing. In cross section, the pipe has a drop-shaped or egg-shaped form. On its sides there are air grilles through which air is forced through a system of pumps [4]. Air swirls create a pressure difference inside and outside the sail. A vacuum is created on one side of the pipe, and a seal on the other. As a result, a transverse force arises, which causes the vessel to move.

“Practical experience with the ship saw the Cousteau group adopting the vessel as flagship and primary research platform in the 1980s. Computers optimized the functioning of turbosails and engines. To maintain a constant speed, the engines take over automatically when the wind dies down, and they stop completely when the wind is of sufficient strength when blowing in the right direction. A crew of five is required to maintain the ship” [2].

In fact, a turbo sail is a vertically mounted aerodynamic wing: on one side of the air, the flow is slower than on the other, creating a pressure difference and transverse thrust. Likewise, lift is created on the plane. Turbosail is equipped with automatic sensors and mounted on a turntable, which is controlled by a computer. A smart machine has a rotor in view of the wind and sets the air pressure in the system.

Currently, turbosails can be mounted on the deck of a cargo vessel without any difficulty. To control them, there is no need for an operational team: the launch and operation of the turbosails is controlled by a computer with special software installed on it. Rotor sails can save from 30 to 40% of fuel at a speed of 16 knots.

With the current cost of one turbosail \$ 1.15-2.3 million (depending on its maximum possible «traction capacity»), it will pay off by reducing fuel consumption during operation to five years [3]. But the Norsepower company management is «focused» on reducing the price of their products by about 30% by locating production in China.

Now the exact analogs of Flettner's sails are installed as auxiliary propellers on the German cargo ship E-Ship-1. And also their advanced model is used on the yacht «Alcyone», owned by the Jacques-Yves Cousteau foundation. Thus, at present there are two types of propulsion systems for the Turbosail system. The usual rotor sail, invented by Flettner at the beginning of the 20th century, and his modernized version from Jacques-Yves Cousteau. In the first model, the resultant force arises outside the rotating cylinders; in the second, more complex version, electropumps create a difference in air pressure inside the hollow tube. The first turbo sail

is able to move the ship only with side wind. The design feature of the turbosail from Cousteau allows you to get the driving force regardless of the wind direction. Equipped with such propulsion, a ship can even sail against the wind, which is an indisputable advantage both over ordinary sails and over rotary sails. Nowadays, attempts are being made to implement the ideas of Flettner. There are a number of amateur projects. In 2010, the third in history was built after «Buckau» (the first rotor ship developed by Flettner) and «Alcyone» (a ship created by the Cousteau team) ship with rotary sails - a 130-meter German Ro-Lo truck [4] (pict. 2).



Picture 2 – «Alcyone»

Source: <https://ru.wikipedia.org/wiki/Тип60напс>

The propulsion system of the vessel is represented by two pairs of rotating rotors and a hitch from diesel engines in case of calm and to create additional thrust. The rotor sails play the role of auxiliary engines: for a vessel with a displacement of 10.5 thousand tons of four wind power towers on the deck is not enough. However, these devices can save up to 40% of fuel on each flight. To date, «Alcyone» - the only full-fledged ship with this type of propulsion. It is not clear why the system is not used for commercial purposes, in particular on cargo ships, because it allows saving up to 30% of diesel fuel, that is, money.

Conclusion. The rotor ship design was improved by Jacques-Yves Cousteau in order to produce a maximum propelling force in relation to required expenditure of energy. Cousteau's Turbosail conserves energy resources by providing a propulsion force for a ship in response to wind in order to assist or replace other energy consuming propulsion means. With an interest in expanding adoption of the turbosail, it was suggested that tankers and other large vessels would soon install turbosails as a mean to

decrease fuel consumption. The system was intended to power the Calypso II, which has yet to be built

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Аннотация. В данной статье рассматривается безотходный тип движителя судна – Турбопарус. Это изобретение является экологически чистым источником энергии, приводящей судно в движение. Описывается физическое явление, лежащее в основе принципа работы турбопаруса – эффект Магнуса. Указываются особенности данной технологии, её превосходство над аналогами. Рассматриваются характеристики, механизм работы и виды турбопарусов.

Ключевые слова: турбопарус, эффект Магнуса, ротор, судно, ветер, давление.

Annotation. This article discusses the wasteless type of vessel propulsion - Turbosail. This invention is an environmentally friendly source of energy that drives a ship. The physical phenomenon underlying the principle of operation of a turbosail — the Magnus effect — is described. Specifies the features of this technology, its superiority over analogues. The characteristics, the mechanism of work and types of turbosails are considered.

Keywords: turbosail, Magnus effect, rotor, vessel, pressure, wind.

MEMRISTORS AND THEIR POSSIBLE USES**Vladimir Kuznetsov**

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Advances in micro- and nanoelectronics are made mostly due to dynamic growth of modern information technology which constantly demands devices for writing and accessing data to be faster and have more memory while also being able to rewrite data and be independent from energy sources. Use of neural networks with analog architecture opens up new possibilities for creating computing systems that will allow for more optimized instruction processing compared to widespread Von Neumann architecture [6]. In the core of such systems lies the memristor, a two-terminal passive device, the resistance of which changes depending on the value of current flowing through it. Electrical properties of the memristor are determined by history of its operation which is similar to properties of synapse in biological neuron systems. While high cohesion of neurons is essential for efficiency of such systems, which allows for parallel operation, synapse adaptivity is crucial for functioning and learning ability of biological and artificial neural networks. Use of memristors in neural networks has been predicted to increase effectiveness of said systems by increasing the density of the system and cohesion of its elements [6].

Existence of a memristor was first theoretically deduced by an American scientist Leon Chua in 1971. Memristor can be described as an element of electrical circuit having resistance dependent in some way on current flowing through it. After the voltage in the circuit is turned off, memristor's state remains the same which means it "remembers" the last value of its resistance. That is where its name comes from – "memory resistor". The actual prototype of a memristor was made only in 2008 by a team of researchers at Hewlett Packard company led by Stan Williams. During their research they noticed strange and unpredictable behavior of circuit elements at nanoscale, which could not be described by conventional theory. Search for the causes of such phenomenon led them to Chua's theory of memristors, which provided a beautiful concept explaining possible effects if further researched [7].

According to Chua, the four fundamental parameters of electric circuit (charge, current, voltage, flux) can be tied together in six ways [3]. Basic physical laws are valid for two of these relations and for other three there are fundamental circuit elements: resistor, capacitor, inductor. Altogether there is still one position left out, the relation between charge and magnetic flux. That is why Chua offered his memristor theory filling up the vacant position to complete the mathematical symmetry.

Chua positions memristor as the fourth fundamental circuit element, since its function cannot be replicated by any combination of R, L and C elements. There are also opponents of such opinion, the main argument being that the fundamental element must be passive, and memristor claims to be such, but its function cannot be replicated by an equal circuit without some active element forming its hysteresis properties [7].

Chua's theory didn't find any practical use until researchers at Hewlett Packard started experimenting with it. The memristor they studied was composed of a thin layer of material based on TiO_x , placed between two platinum terminals. On one side of the layer there was oxidized alloy (positive ions). Properties of such memristor can be demonstrated using a simple model based on the property of ions to drift when voltage is applied. Equivalent resistance of such a circuit can be presented as the sum of two variable resistors connected in series. One resistor (non-oxidized layer of Ti being the conductor) has low resistance R_{ON} , while the other one (semiconductor TiO_2) has much higher resistance R_{OFF} . Charged ions start drifting when voltage is applied to metal terminals and the border between two layers shifts. If the alternating sinusoidal voltage of specific frequency is applied to terminal of the memristor its volt-ampere characteristic will look like Lissajous curve [1].

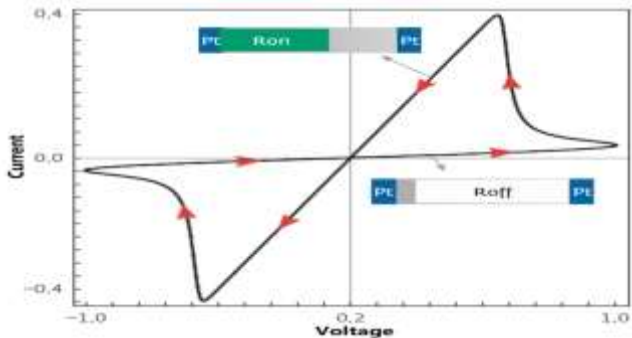


Figure 1 – Volt-ampere characteristic of a memristor

That above mentioned volt-ampere characteristic of a memristor shown on Fig.1 has following unique properties: when periodic bipolar current or voltage is passed through a memristor, its volt-ampere characteristic resembles a hysteresis loop (like a Lissajous curve, irrelevant of starting parameters). It is important to note that hysteresis originates from the memristor and not from the measuring circuit; if the frequency of periodic signal applied to the memristor is increased, its volt-ampere characteristic has a straight line characteristic, the inclination of which is determined by the amplitude of the input signal.

Motion of ions becomes non-linear and shape of volt-ampere characteristic may change due to strong influence of electric field and thermal effects present at nanoscale in real systems. Researches show that memristive effect is prevalent in a wide range of oxides: MgO , TiO_x , ZrO_x , HfO_x , VO_x , NbO_x , TaO_x , CrO_x , MoO_x , WO_x , MnO_x , FeO_x , CoO_x , NiO_x , CuO_x , ZnO_x , AlO_x , GaO_x , SiO_xN_y , GeO_x , SnO_x , BiO_x , SbO_x ; oxides of rare-earth metals: Y, Ce, Sm, Gd, Eu, Pr, Er, Dy and Nd; and in nitrides such as AlN [6].

Properties of a memristor allow for its use as a bipolar switch, RAM element, or as a component of a logic element. When voltage of the opposite polarity is applied to a memristor it either opens or closes the circuit, i.e. memristor goes from state “0” to state “1” and vice versa. Memristor also “remembers” its state, it is able to store that information and it does not require any external power to do so. As for today the achieved speed of memristor changing its state (switching) is 120 picoseconds.

Simplest memristor parameter system is determined by its volt-ampere characteristic. Memristor’s mode of operation in a circuit determines its operating (control) voltages: U_F – “forming” voltage; U_W – settling(recording) voltage; U_E – recovery (erasing) voltage; U_R – reading voltage.

Current flowing through a device corresponds to a control voltage. When reading voltage U_R is applied two values of current should be measured: current while in low resistance state (I_L) and current while in high resistance state (I_H). Ratio between them (equal to ratio between conductivities in these two states) determines hysteresis properties of the device (difference between states). It is desirable to eliminate the forming voltage. Settling (recording) and recovery(erasing) voltages should not exceed the supply voltage. Reading voltage should be about half of the supply voltage.

There are several applications of memristors:

1. Nano-scale nature.

The main objective in the electronic chip design is to move computing beyond the physical and fiscal limits of conventional silicon chips. Increases in chip performance were largely achieved due to making transistors smaller and putting more of them into a single chip. But there is also a downside to such an approach. By increasing the density of transistors in a chip we also increase its heat output which leads to overheating issues. By using memristors in hybrid chips it is possible to achieve more functionality and computing power engaging less elements which is very desirable by chip manufacturers. It would make chips faster, cheaper and more versatile.

Memristors could also make chips more power-efficient. They were not observed earlier because their effect relies upon atomic-scale movements, and it was not until tech-process reached nano-scale that memristive effects started having noticeable impact. Data can be written to a memristor as the value of its resistance uses close-to-zero energy. Once written, data stays written even when the power is shut down.

2. Replacement of flash memory.

One of the potential uses of a memristor is a powerful replacement for conventional flash memory that is used in applications requiring fast data access. Unfortunately, memristor memory can only be rewritten around 10,000 times which makes it less reliable compared to flash memory. It is, nevertheless, possible to improve memristor durability in the future.

3. Replacement for D-RAM.

Conventional D-RAM is unable to keep its data once the voltage is turned off. Once the computer is turned on, slow power consuming boot-up process is required to rewrite the data.

4. Brain-like systems.

Use of memristors may one day provide the opportunity to create brain-like systems functioning just like their biological counterpart. This can be used to significantly improve facial recognition and biometric systems in general, greatly improving safety of personal information. These pattern-matching capabilities could one day provide us with computers capable of making decisions just like a real human.

We can conclude that the complex electrical response of synapses and their ability to alter their response in accordance with the frequency and strength of the signals is similar to the response a memristor would produce. [6].

Nanotechnology is fast emerging, and nanoscale devices automatically bring in the memristive functions. Thus, memristors might revolutionize the 21st century as radically as the transistor in the 20th century.

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Аннотация. В статье рассмотрены вольт-амперные характеристики мемристора и его способность изменять сопротивление в зависимости от протекающего через него тока; проанализированы различные научные подходы к определению и применению мемристоров. Перечислены преимущества мемристора как более быстрого устройства хранения и обработки данных следующего поколения в сравнении с существующими процессорами; определены негативные факторы, влияющие на потенциал использования мемристоров на практике. На основании проведенного исследования предложены пути использования мемристоров в морском применении.

Ключевые слова: Мемристор, электромагнитный, резистор, радиоинженерия, электроинженерия.

Annotation. The article covers volt-ampere characteristics of memristor and its capability to alter its resistance with respect to the current flowing through it; various scientific approaches towards defining and finding application for memristors are analyzed. The advantages of memristor as a faster data storage and processing device of the next generation in comparison to the existing processors are listed; the negative factors influencing the potential use of memristors in practice are defined. On the grounds of the study made the ways of using memristors in marine application are suggested.

Keywords: Memristor, electromagnetic, resistor, radio engineering, electrical engineering.

DRY CARGO VESSEL CATEGORY

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1. Introduction

According to the State program of the Russian Federation "Development of shipbuilding for 2013 - 2030" the shipbuilding industry has important goals and objectives, including:

- achieve a fundamental improvement of the strategic competitive position of the shipbuilding industry of Russia in the world;
- ensuring the possibility of full satisfaction of the needs of the state and domestic business in modern shipbuilding products;
- the creation of advanced scientific and technological potential and technology necessary for the creation of prospective marine and river ships;
- strengthening and development of scientific, design and production potential of the
- ensuring implementation of the state defense order and the current state armament program;
- development of personnel potential of the shipbuilding industry and its consolidation in the organizations of the industry;
- ensuring the efficiency of the industry and the investment attractiveness of the domestic shipbuilding industry, including the achievement of the level of advanced countries in the quality of shipbuilding products.

2. Main part. Shipping plants welcomed the modern, high quality 8000 dwt general dry cargo vessels to their commercially-managed fleet, now in vessels with 5-19k dwt, and with vessels in the 6800-8500 dwt size bracket. They shared views of excellence in ship management, aligned with quality, modern tonnage provision, and a mutual understanding based on co-operation, integrity, humility and professionalism, will result in an exceptional end product [1].

Both bulk & MPP shipping sectors continue to face challenging markets. Every market cycle has its own trials and tribulations, and this one is certainly no different. Yet they also harbour opportunities for those who are patient, passionate and remain flexible to new trading patterns.

The object of this work is to consider general -purpose dry cargo vessel features (pict. 1), which help to deliver goods from various regions and places of production of the Russian Federation, including for export (so the state traditionally exports wood, having its significant resources); to analyze the requirements for the choice of material for the manufacture of construction , to consider welding modes to obtain high-quality welds.



Picture. 1 – Dry cargo vessel

General-purpose dry cargo vessels are the most common type and are designed for the delivery of general cargo, as well as oversized and large-capacity.

They are equipped with cranes and arrows for loading and unloading. Goods can be packed in a variety of ways – in boxes, in bales, in barrels, etc.

Steel grade

For the manufacture of the bulwark assembly is applicable low-alloy steel of high strength grade 09G2S [7].

Chemical composition (content of elements) are C - 0,09%, Mn > 2%, Si – до 1%, Mb – 0,08%, Cu – 0,35%, Cr – 0,2%, the rest – Fe.

Mechanical property:

Tensile strength - Q2 400mpa

Yield strength - Q2 360mpa

Elongation – δ2 21%

Impact strength at 40°C – $a_2 = \frac{49J}{cm^2}$

Hull steel should be strong, corrosion-resistant, plastic, well welded, well machined (cutting, straightening, bending), should work normally at low ambient temperatures and be resistant to cracking [3-5].

Based on the mechanical properties and chemical composition of the steel provides all the technical requirements for the material of construction.

Welding mode

In order to obtain high-quality welded joints, it is necessary to comply with certain welding modes, which are understood as a set of basic characteristics of the welding process, ensuring the production of seams of

specified sizes, shapes and quality. In manual welding, these characteristics are the diameter and grade of the electrodes, the strength of the welding current, its gender and polarity; arc voltage; the number of passes (layers in the seam) and the position of the seam in space [8].

The strength of the welding current depends on the thickness of the weld metal, the diameter of the electrode and the strength of the weld in space and is calculated by the formula:

$I_{\text{wel.}} = K \cdot d_{\text{el.}}$, where $I_{\text{wel.}}$ – welding current strengt, A; D_{el} – electrode diameter mm, K – coefficient depending on the electrode diameter.

In shipbuilding, partial automation of production is used. This can be automated production lines for the production of standard parts and assemblies, cleaning lines and primer sheet and profile material. The equipment with CPU on separate operations is applied as well [8-10].

Table 1. Data for the development of parts marking programme on the parts-marking machines with program control.

№ part	Part outline	coordinates, mm		Notes
		x	y	
1	A	0	0	
	B	0	1400	
	C	3500	1400	
	D	3500	0	
2	E	3700	1400	
	F	3800	1400	
	K	4100	0	
	X	3700	0	
3	L	0	1700	
	M	0	2000	
	N	1400	2000	
	P	1400	1900	
4	R	1450	2000	
	S	1450	1950	
	T	3500	2000	
	U	3500	1950	
5	P ₁	1450	1900	
	S	1450	1950	
	U	3500	1950	
	W	3500	1900	

Economic issue.

Design weight according to drawing – 490kg. The calculation of the value of the metal 1 t c/c steel – 50000 R; $0,49 \times 50000 = 24500$ R. The calculation of the cost of electricity– $24500 \times 0,15 = 3675$ R. Calculation of the cost of welding consumables – $24500 \times 0,1 = 2450$ R. Labor expenditures – 500 R. Section Assembly time – 20 h; $3 \times 20 \times 500 = 3000$

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Аннотация. Автор описывает особенности сухогрузов, которые помогают доставлять груз из различных районов и мест добычи РФ, в том числе и для отправки на экспорт (так государство традиционно экспортирует лес, обладая значительными его ресурсами); анализирует требования к выбору материала для изготовления конструкции, рассматривает режимы сварки для получения качественных сварных соединений.

Ключевые слова: сухогруз, сварка, прочность шва, марка стали.

Annotation. The author describes the features of general-purpose dry cargo vessels, which help to deliver cargo from various regions and places of production of the Russian Federation, including for export (as the state traditionally exports timber, having significant resources); analyzes the requirements for the choice of material for the manufacture of construction, considers welding modes for obtaining high-quality welded joints.

Keywords: dry cargo ship, welding, seam strength, steel grade.

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FACTORS INFLUENCING THE EFFICIENCY OF NAVIGATION

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The efficiency of navigation depends on many factors such as: the training of qualified personnel (officers, ratings), the use of new technologies and the quality of cargo transportation. Each factor accumulates a certain percentage of quality and their sum shows the general efficiency of navigation.

Navigational safety is the main condition for the solution of any navigational task, and the general task of navigation is summarized as

following: "to carry out the voyage from one point to another using the safest and the most favorable route." The safest and most favorable route means that the ship's arrival at the port of destination is carried out at a fixed time with low fuel consumption and without risk of encountering navigational hazards, other ships and dangerous weather conditions.

ISM Code states the Company should ensure that the master is properly qualified for command; that each ship is manned with qualified, certificated and medically fit seafarers in accordance with national and international requirements. The Company should establish in the safety management system that the master has the overriding authority and the responsibility to make decisions with respect to safety and pollution prevention and to request the Company's assistance as may be necessary[5]. Compliance with ISM Code will reduce the number of accidents at sea. The absence of ISM certification means that shipping company is outsider which can't confirm service quality and compliance with the safety standards. So slogan "No code – no trade" exists.

Despite the development of navigation equipment and severe requirements for navigators and ship owners both from part of IMO and national departments, the navigation accident rate remains very high. At least a half of ships' wrecks occur due to grounding or collisions, which are closely connected with the activity of persons keeping the navigational watch.

Detailed investigations of the accidents have shown that the reason of the most of sea disasters is due to incorrect or delayed actions of ship's personnel. "The human factor" causes 70-80% of accidents and disasters. We may recollect the most famous accidents at sea. The influence of the human factor should be taken into account while manoeuvring a ship and in case of emergency situations. According to the safe navigation the "human factor" means human capabilities in receiving and processing information as well as making a decision in different conditions. The problem of reducing accidents at sea, minimizing the risk in navigation will remain while vessels put to sea.

Fitting of the ships with up-to-date equipment and ability to use it correctly for long-term service of equipment without breakdowns plays an important role in the efficiency of navigation. All the ship's equipment requires maintenance at regular intervals for avoiding problems during the voyage. Special attention should be given to normal aging. The term normal aging denotes changes in the initial forms, sizes and structure of materials in the result of physical or chemical phenomena. Normal physical wear arises during the operational process from friction, corrosion and different deformations. Accelerated wear is the result of heavy service of the vessel,

violations of the engineering instructions (undue and negligent ship maintenance). Improper maintenance causes a lot of problems both for crew and shipowner. For avoiding of these problems we must remember about such concepts as ship maintenance and ship repair. The term ship maintenance includes a complex of works carried out by ship's crew during the voyage and at anchorages without removal from service.

Ship repair is a complex of works carried out by Ship-Repair yards.

Nowadays sea transport plays an important role in production process, international and internal trade, agriculture, transportation of passengers and luggage, boating. The problem of shipping efficiency is solved by two ways such as: 1) the construction of new vessels and modernization of the obsolete fleet in order to provide new technical means which will help to ensure safe navigation and avoid pollution, 2) the training of navigators which provides safe operation of the ship using Pilot Directions during the voyage. Special attention should be given to the transportation of goods. It is considered that transportation is performed properly if:

- the goods are delivered in time;
- the quantity and quality of cargo didn't change;
- there was no need for additional expenses.

So it is concluded that the efficiency of navigation depends on many factors. The most important one is human factor and it requires special attention.

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Аннотация. В статье описан ряд факторов, которые влияют на качество судоходства. В современном мире, где действует система «производитель-транспорт-потребитель» очень важно не нарушать эту систему, так как малейшие изменения в ней могут повлечь за собой

большие финансовые потери. Поэтому важно знать и уметь анализировать проблемы в этой цепи.

Ключевые слова: навигационная безопасность, эффективность, проблемы, суда.

Annotation. The article describes the number of factors which affect the efficiency of navigation. In the modern world, where the system "producer-transport-consumer" exists, it is very important not to violate this system because the slightest changes can cause financial losses. Therefore, it is important to know and analyze problems of this chain.

Keywords: navigation safety, efficiency, problems, ships.

UDC 62

WHAT YOU MUST KNOW AND FOR WHAT YOU MUST PREPARE TO START WORKING AS AN ELECTRICAL ENGINEER

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It's no secret that studying at the University prepares future electricians only for about 20%. These 20% are very important but there are still 80%, and I will try to reveal what they include.

About 10% is an additional view of Internet sources in this specialty.

About 20% is the training on board a ship in the position of at least a machine cadet. This allows you to get, at least, the visual information about what is located where and how it looks like. This is quite an important part of the future work. If this did not happen before coming on board as an ETO, then in the future it will be a big problem and a lot of stress at the first contract.

The remaining 50% are luck, matching your personality type with your future profession, perseverance, ability to manage free time, the desire to make money, and a lot of tenacity. All this will help to cope with the huge flow of information in the absence of Internet and without somebody's help.

Those who are on board for the first time know nothing about their profession.

The purpose of this report is to familiarize the novice specialist with the main points which are worth paying attention to so that to understand everything in the first contract as quickly and efficiently as possible.

1. You have already had the ETO working documents in your hands and you are faced with the choice of vessel's typw for the first contract. Often this happens by chance (acquaintances, successfully sent resumes, etc.). Here you need to understand that you should not be afraid to get on a big ship because the stress of getting on an unfamiliar ship pursues even electricians with sea experience, so do not be afraid. All you need to understand that in this profession the fear should only be present when working with electricity and not before getting on the ship or when learning new information.

The main criteria of ship choosing should be:

- Preferred navigation region (when crossing large seas or oceans there is no mobile network or Internet).

- Year of construction of the vessel on which you will work. If the ship is more than 20-25 years old you should be prepared for the fact that there will be enough work and you will have no free time at all. If it is possible, choose a vessel with the year of construction as close as possible to 2019. Another problem when working on ships being built before 2000 is the frequent passing of register checks and it is better for you to know what it means for ETO to prepare the vessel for the register check as late as possible.

- Salary. Try to keep the salary as high as possible and do not be afraid of this. With a high salary you will realize that your work is paid adequately and this is the main incentive for any work.

2. Before coming on board be sure to learn the duties of an ETO by heart, so it will be easier to get used to the ship because, for example, during the ships maneuvers you have to be in the engine room, you do not have to repair the mobile phone of the sailor, you have to repair the ship's phone, there are batteries in the boats and they need to be monitored, etc. Your knowledge will help you to understand the situation on the ship better and not to waste your time.

3. Do not hope that when you get on board the ship the person whom you substitute will tell you how everything works, where pay attention to, etc. Maximum what you should hope are the words: «Here everything works normally, here it doesn't work, I don't know what's up, this one did not work before me» ATTENTION: This did not work before me - the most dangerous thing when you take your responsibility on board.

4. Here you are on the ship unpacking your suitcases, sitting in the cabin and thinking what to do next. Do not waste the time, go to the engine room, check out the crew and start investigating your territory of responsibility. Do not be afraid to test every equipment in the Engine room! Believe me, you'd better look it by yourself, than you will be down by the Chief Engineer when it fails then.

5. Be sure to find out and better rewrite a separate list of those spare parts that you have in stock, because ordering of spare parts is also your responsibility. And in case of failure of something you should know what you have in stock and what is not.

6. Describe the tool that is available and if, as you think, you have something missing – then immediately write it in the ship's monthly application for supply. Do not wait, except you no one will do it.

7. If the ship is old it is very important to treat all electrical equipment very carefully, because old plastic, for example, turns into a very fragile material (it is crumbling). You will not have the opportunity to replace or glue the detail that you break due to your negligence.

8. Do not waste your free time in vain. I don't tell that you do not need to relax, but for the first time it is better to forget about movies and computer games. In your free time it is better to study further how these or those mechanisms work according to the schemes that are attached to them. If you do not know how to read the schemes, then eliminate this point before anyone else from the crew learns about it. With the knowledge and ability to read electrical circuits, repair work from dancing with a tambourine turns into a quick and meaningful process. Realize that the Engineer can advise something to the Engineer, the Navigator – to the Navigator, the boatswain can advise the sailor. No one will advise you anything. Your knowledge is your best adviser.

9. It is very important to understand that your primary responsibility is to know how to operate this or that ship equipment correctly in order to prevent breakage and increase the period of uninterrupted operation. Do not neglect to check the insulation resistance of mechanisms or the replacement of filters, lubrication in bearings, etc.

10. Just define what register-based mechanisms are on board the ship. These are the main units and devices that must be constantly in good condition such as desalination plant, ballast drainage pump, fire pump, or GMDSS equipment. The safety of the vessel and crew members depends on them. If you see that one of these mechanisms can fail, then maintaining it in working order should be your primary and urgent task as well as its repair

11. A very important point. Always try to be present when any equipment is being repaired, especially in the engine room, even if the

repair is not included in your area of responsibility. About 80 percent of breakdowns on the ship occur due to negligent attitude on the part of the crew. Then you look for a breakdown.

12. Never be in a hurry. All equipment on the ship costs a lot of money and it is not sold at the stall on the market. Always work carefully and if you have any doubts, it is better to sit and think, no matter how long it may take. For example, it is better to eliminate the error in the wiring diagram before switching on than think how to fix the burned pump afterwards.

You may encounter many more nuances in the work of an ETO. You need to understand that the experience is your best assistant in the future, but it also needs to be earned, and it is not earned on the University bench, and then sleepless nights while working on the ship.

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Аннотация. В Керченском морском технологическом университете ведется подготовка специалистов по широкому перечню направлений, связанных с работой в структурах морского флота. Все студенты морского факультета университета должны проходить плавательную практику на морском судне. В статье рассматриваются те проблемные вопросы, с которыми обычно сталкивается курсант, впервые попав на судно в качестве кадета машинного отделения, и предлагаются пути облегчения акклиматизации курсанта при прохождении практики на морском судне. Целью данной статьи является познакомить будущего специалиста с теми моментами, на которые необходимо обратить внимание, чтобы в первом рейсе понять все как можно быстрее и эффективнее.

Ключевые слова: будущий специалист электрик, специальность, обучение на борту судна, зона ответственности, район плавания, обязанности.

Annotation. At the Kerch Maritime Technological University specialists are being trained in a wide list of areas related to work in the structures of the navy. All students of the Marine Faculty of the University

must undergo the training on board ships. The article discusses the problematic issues that a cadet usually encounters when he first comes on the ship as a cadet of the Engine Room and suggested ways to facilitate the acclimatization of a cadet while training on a seagoing ship. The purpose of this article is to familiarize the novice specialist with the main points which are worth paying attention to so that to understand everything in the first contract as quickly and efficiently as possible.

Keywords: Future electrician, speciality, training on board ship, area of responsibility, region of navigation, duties.

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HAZARD OF ELECTRICAL SHOCK ON SHIP

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On modern ships the entire ship's crew, not only electricians, perform the maintenance of electrical equipment and various electrical devices. Therefore, when working on a vessel, electrical injury is possible during the operation of electrical equipment directly both for electrician and other personnel while working. To improve safety at sea, it is important that each crew member, regardless of his specialty should be well-known in electrical safety issues.

Electric current flowing through the human body can cause external and internal damage.

Electric injuries cause internal and external electric shocks. The latter are extremely dangerous, as they affect the human body as a whole, affecting the heart, lungs and nervous system.

The main causes of accidents from electric shock are touching or approaching into dangerous distance to non-insulated open parts of electrical equipment, the appearance of voltage on non-current-carrying metal parts as a result of insulation breakdown, damage to grounding and disconnecting devices or step voltage on the surface of the earth in the area of current spreading caused by reducing the insulation resistance of current-

carrying parts. The force of the current passing through a person is a determining factor of the electric shock.

The frequency of the alternating current significantly affects the result of the electric shock. The most dangerous is the current industrial frequency of 40- 60 Hz. With frequency increasing to 450-500 Hz the danger of injury is somewhat reduced even with an increase in the of amperage. High frequency currents (above 200 kHz) do not represent a danger of electric shock but they can cause severe burns. These frequencies aren't also dangerous to human life, but the electromagnetic fields they create can have a harmful effect on a person.

The amount of damage to a person caused by electric current depends on the current path through his body, i.e. from the position of the points of entry and exit. The result of the damage will be determined by the current passing through the vital organs of the person - heart, lungs, brain where the most dangerous is the path of the current along the line from arms to legs.

The impact of current on a person also depends on the electrical resistance of his body. This resistance varies over a wide range (from hundreds to million Ohms) depending on a number of factors of the psychophysical state, the isolation of a person relative to the earth, the state of the environment, etc. The result of an electric shock depends largely on the time it flows through the human body. The longer a person is subject to current, the greater the injury from electrical shock. The longer the exposure to current, the higher the temperature of afflicted part of the body which leads to a decrease in the resistance of the upper protective layer of the skin and, accordingly, an increase in the amperage to a dangerous value that can cause damage to the body.

On ships, the possibility of electric shock increases due to the fact that the staff works in damp, cramped rooms, in conditions of rolling, roll and trim. High-risk areas include rooms with significant moisture, conductive dust, high temperature and the possibility of simultaneous contact of a person with the metal case of electrical equipment and metal objects that are connected to the ship's hull. This includes boiler rooms, galley, tiller compartments with a relative humidity of more than 75%.

The most dangerous are the rooms that have a special dampness or chemical active environment and, in addition, two of the listed conditions of increased danger. This group includes propeller tunnels, cofferdams, tanks, cisterns and laundries, in which the relative humidity is close to 100%.

Protective measures against electric shock

- live parts must be inaccessible;
- good quality insulation;

- all electrical equipment and components of electrical installations must be grounded;
- safe and high quality automatic protective blocking of current-carrying parts;
- portable power consumers are powered by supply only with low voltage;
- scheduled inspections and repairs of electrical wiring and electrical equipment are necessary;
- organization of training events;
- installation of warning signs and posters while working;
- monitoring the condition of the insulation;
- wiring should be easily recognizable and, depending on the conductor, marked with a certain color
- Work performed with full voltage removal are carried out on de-energized sections or electrical installations, to which the supply of voltage from other electrical equipment that is under voltage is excluded. All preventive measures, necessary repairs of buttons, magnetic starters, rheostats, automatic switches, air switches and the replacement of fusible inserts for various currents are included in this category
- Work performed during partial stress relief is carried out in a de-energized section, but adjacent areas are under voltage. Technical and organizational measures are taken to prevent people from coming into contact with live areas: fencing of workplaces, imposing portable groundings, hanging a poster “Work here”.
- To prevent the supply of voltage to the place of work, mechanical locks are installed on the switching devices, isolating the gaskets between the contacts, and the fuses are removed. On the handles of switching equipment, with the help of which voltage can be supplied to the place of work, a sign “Do not switch on - people at work” is hung out.
- Working under voltage should be in a headdress and in clothes with sleeves, buttoned at the hands, work in dielectric gloves and stand on a dielectric mat or be in dielectric galoshes, use electrical tools with insulated handles, while not touching other current-carrying parts, bulkheads and persons standing nearby on an insulated deck, and not to use hacksaws, files and metal measuring instruments for work.
- All work performed in the order of the current operation, recorded in the form of electrical, indicating the content and location of their conduct and the name of the artist. The magazine is checked daily by an electrician.

Providing first aid to victims of electrical current

If the victim is in contact with live parts, you must quickly release him from the action of electric current. Touching a person under current is dangerous. Therefore, you need to quickly disable the part of the electrical device or machine, which afflicts the victim. To release the victim from the wire, you should use dry clothes, a dry board or any other object that does not conduct electrical current, while avoiding contact with metal objects and exposed parts of the body.

To determine the condition of the victim, it is necessary to put him on his back on a hard surface, check breathing, check pulse on the radial artery at the wrist or carotid artery on neck, determine the width of the pupil on the eyes.

If the victim has lost consciousness, but at the same time sustained breathing and pulse persist, it is necessary to lay it flat and flat on the bedding, unbutton the belt and clothes, provide fresh air, and let off ammonia. In cases where breathing is very rare and convulsive or there are no signs of life, artificial respiration and heart massage should be performed. If the victim fainted but soon regained conscious he should be conveniently laid on the bedding and covered with some clothes on top and continuously watched for breath and pulse.

In all cases of electric shock, calling a doctor is obligatory regardless of the victim's condition.

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Аннотация. На современных судах весь экипаж судна, а не только электрики, выполняет техническое обслуживание электрооборудования и различных электрических устройств. Поэтому при работе на судне возможна электрическая травма непосредственно как для электрика, так и для другого персонала. В данной статье рассматриваются опасные ситуации, связанные с угрозой поражения током. Статья также дает советы, как избежать этих опасных ситуаций. Статья знакомит со стандартными мерами защиты от поражения электрическим током.

Ключевые слова: обслуживание электрического оборудования, электрический ток, электрические травмы, опасность поражения электрическим током, приборы безопасности, правила безопасности.

Annotation. On modern ships the entire ship's crew, not only electricians, perform the maintenance of electrical equipment and various electrical devices. Therefore, when working on a vessel, electrical injury is possible during the operation of electrical equipment directly both for electrician and other personnel while working. This paper deals with hazard situations connected with threatening of shock hazard. The article also gives advices how to avoid these dangerous situations. It familiarizes with standard protective measures against electric shock.

Keywords: Maintenance of electrical equipment, electric current, electric injuries, hazard of electric shock, safety devices, safety rules.

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THE LATEST TECHNOLOGY TO FIGHT FIRE

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Introduction. Fire extinguishing methods consist in taking measures to stop the access of combustible material to the fire, isolate the fire from air, and cool the combustible substance. And in this work we will consider the most unusual and effective ways to extinguish fires [3, 1].

1. Dry water fire extinguishing system. The absence of hydrogen in the structure of the fluorinated ketone molecule has endowed the substance with special properties that are successfully used to eliminate the sources of ignition:

- Zero conductivity;
- Boiling point + 49 ° C;
- Substances and materials do not get wet.

Extinguishing with dry water occurs according to the principle of temperature reduction (70% of the substance's action) and inhibition of the chemical reaction of the combustion process (30% of the quenching effect).

High efficiency - the ignition source is neutralized, due to the high level of evaporation, for 10-15 seconds;

Safety for humans confirmed by clinical trials. The installation can be switched on when people are still in the room.

Convenience of operation - dry water can be used as an extinguishing agent in already installed gas fire extinguishing installations with minimal equipment upgrades. In addition, the damage to the cylinders with dry water and even its spill will not cause unpleasant consequences. "Water" just evaporate, leaving no trace.

Environmental safety - the decomposition of a substance occurs in 3-5 days, without damaging the ozone layer.

Considering the high efficiency demonstrated by dry water (the fire extinguishing of the class A fire center takes only 10 seconds), the dimensions of the installation required to control the room are much smaller, and the number of cylinders is much less. In addition, much smaller technical requirements are imposed on the pipeline. The operating pressure is only 25 bar, instead of 250 to 300 bar required for a gas system. This greatly simplifies and reduces the cost of both installation and further maintenance.

2. Mist fire extinguishing technology. Fire extinguishing with water mist or water mist, as this method is also called, is increasingly attracting the attention of specialists, developing and finding new objects for use. Having proven himself as a means of extinguishing fires on ships, he took a firm stand on the protection of ground objects [2].

Fire extinguishing with water mist has its specificity different from traditional water extinguishing, as using a small amount of water in a short time we get an impressive result with minimal losses and damage.

Special equipment, supplying water under high pressure, contributes to the formation of a cloud of fine mist with droplets less than 150 microns and a high cooling effect. Filling the entire volume of the room blocks the flow of oxygen, significantly reduces the temperature in the fire zone, reducing the burning rate to a critical one.

Water fog does not dissipate immediately, which prevents the possibility of re-ignition, but due to its natural characteristics it also has the function of smoke suppression.

These properties make the method simply indispensable in places of evacuation of people with long passages and strong smoke, it does not pose a danger to life, it is environmentally friendly and can be used to detect the source of ignition without delaying time.

Even with a false alarm, the damage is minimal, since the system has a small amount of water.

Water mist extinguishing systems can be modular to protect small areas and automatic. This is a complete complex equipment that does not require long installation.

Like any fire extinguishing method has its drawbacks: off-scale spray holes, sometimes additional equipment - water treatment system, unheated premises, restrictions on the use of some objects. To maintain system uptime, maintenance is key.

Fire extinguishing with water mist is a fairly new method, therefore, the choice of the specialists responsible for the installation and further operation of the complex requires an especially careful approach.

3. *Sound fire extinguisher*. We know about extinguishing fires using foam, powder, gas and water fire extinguishers, but perhaps in a short time it will be enough for us to simply bring the sub-buffer closer to the fire and it will go out [4].

An alternative and rather radical way to extinguish flaming objects is possible, for this you can take as a basis the construction of a fire extinguisher, but not fill it with any substance.

The technology is based on the process by which sound waves are propagated by atmospheric oxygen: the sound stream at a low frequency is able to repel oxygen molecules. According to the "fire triangle", the fire needs an oxidizing oxygen, but it is possible with music to remove the fire supply. Indeed, with sounds ranging from 30 to 60 Hertz, oxygen ceases to flow into the flame and it dies out.

The fire extinguisher consists of an amplifier and a tube. It acts as a collimator or straightens a beam of sound waves that come from a source and transforms it into parallel rays, so that it is better to direct them to the focus point.

The advantage of the presented solution is not only the relative compactness of the installation, but also the absence of water, foam, gas and other types of fire extinguisher filler, which can cause additional damage. True, the effectiveness of such a system does not seem to be suitable for extinguishing something larger than a burning frying pan or an object of similar size.

Conclusion. Modern unusual fire extinguishing methods were dismantled. The main advantage of the research is that more effective ways to fight the fire have been created. It can not but rejoice that the low cost of fire extinguishing systems and their compactness is provided for.

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Аннотация. Объектами данного исследования являются технологии пожаротушения. Эти технологии предназначены для наиболее эффективного осуществления пожаротушения, и также рассматриваются пути снижения стоимости существующих систем пожаротушения. Мы рассматриваем преимущества и недостатки применения этих технологий.

Ключевые слова: огонь, туман, высокая эффективность, система пожаротушения, технологии.

Annotation. The objects of this research are fire extinguishing technologies. These technologies are designed to carry out fire extinguishing in the most efficient way and cost reductions of existing fire extinguishing systems are envisaged. We will also consider the advantages and disadvantages of these technologies applying.

Keywords: Fire, mist, high efficiency, extinguishing system, technologies.

UDC 656.611

SHIP RECYCLING CONVENTION

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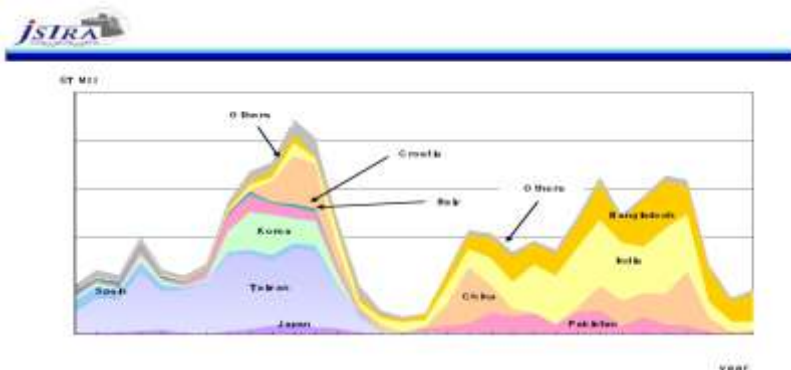
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Introduction. The IMO New Convention on Ship Recycling covers all stages (from Construction to Recycling of Ship Shipbuilders. Properly handled, ship recycling is, without question, a "green" industry IMO's role in the recycling of ships, the terminology used to refer to ship scrapping, was first raised at the 44th MEPC session in March 2000 following which a correspondence group was established to research this issue and provide information about current ship recycling practices and suggestions on the role of IMO [3].

The aim of our article is to describe the main points of Convention on Ship Recycling, analyze the ultimate responsibility and its compliance.

Main part. Ship recycling convention is aimed at ensuring that ships, when being recycled after reaching the operation end, do not pose any unnecessary risks to human health, safety and to the environment. It intends to address all ship recycling questions, “including the fact that ships sold for scrapping may contain environmentally hazardous substances such as asbestos, heavy metals, hydrocarbons, ozone-depleting substances and others. It also addresses concerns raised about the working and environmental conditions at many of the world's ship recycling locations” [3, www].

An appendix to the Convention provides a list of hazardous materials the installation or use of which is prohibited or restricted in shipyards, ship repair yards, and ships of Parties to the Convention. Requirements of Ship recycling convention are presented in the picture 1.



Picture 1 – Requirements of Ship recycling convention

Source: <https://ru.scribd.com/document/24799880/Ship-Recycling-Convention>

Compliance with the applicable requirements of IMO documents, specifically with regard to the inventory of hazardous materials, is a prerequisite:

IMO SR/CONF/45, Hong Kong International Convention for the Safe and Environmentally Sound Recycling of Ships, in particular with the following Regulations:

- Regulation 4 – Controls of ship's hazardous materials
- Regulation 5 – Inventory of Hazardous Materials
- Regulation 10 – Surveys

IMO Resolution MEPC.269(68), 2015 Guidelines for the Development of the Inventory of Hazardous Materials [4].

These are following materials:

- Asbestos X 0.1%4 A-2
- Polychlorinated Biphenyls (PCBs) X 50 mg/kg5 A-3
- Ozone Depleting Substances* CFCs, Halons, Other fully halogenated CFCs, Carbon Tetrachloride, Trichloroethane (Methyl Chloroform), Hydrochlorofluorocarbons (HCFCs), Hydrobromofluorocarbons, Methyl Bromide, Bromochloromethane, Anti-fouling systems containing organotin compounds as a biocide, 2,500 mg total tin/kg7

The Hong Kong Convention allows new installations containing hydrochlorofluorocarbons (HCFCs) until 1 January 2020. The product contacting HCFC should be listed in the Inventory [4].

In the process of recycling ships, nothing goes to waste. The materials are almost entirely reused (table 1).

Table 1. Reused materials and their further use

Reused materials	Materials' further use
Steel	To be reprocessed to become reinforcing rods for use in the construction industry
Ships' generators	To be reused ashore.
Batteries	find their application in the local economy
Hydrocarbons on board	become reclaimed oil products to be used as fuel in rolling mills or brick kilns
Light fittings	find further use on land.

Furthermore, new steel production from recycled steel requires only one third of the energy used for steel production from raw materials.

IMO's treaty environmentally-sound ship recycling and for safe has received another boost. Japan has become the 10th country to be a Party to the Hong Kong_Convention (pict. 2). The Convention deals with the design, construction, maintenance and operation of ships, and preparation for ship recycling in order to provide safe and environmentally sound recycling.

Ships are required to carry an Inventory of Hazardous Materials, specific to each ship under the treaty. Ship recycling yards are required to provide a "Ship Recycling Plan", which is specific to each ship to be recycled, defining "the manner in which each ship will be recycled, depending on its particulars and its inventory" [1, www].



Picture 2 – Ship Recycling Japan accedes to ship recycling convention

Although the principle of ship recycling may be sound, the working practices and environmental standards in the yards often leave much to be desired. While ultimate responsibility for conditions in the yards has to lie with the countries in which they are situated, other stakeholders must be encouraged to contribute towards minimising potential problems in the yards.

In conclusion it should be noted that recycling makes a positive contribution to the global conservation of energy and resources and, in the process, employs a large, if predominantly unskilled, workforce. All materials used in the construction of a ship should not be potentially hazardous to human health or the environment. Successive owners of the ship would maintain the accuracy of the Green Passport.

The IMO should develop, as a high priority, a new way of ships recycling with a view to providing legally binding and globally applicable ship recycling requirements for international shipping and recycling facilities.

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Аннотация. В статье рассмотрены основные положения Конвенции по утилизации судов, проанализирована ответственность и ее соблюдение. Представлены требования документов ИМО, в частности, в отношении перечня опасных материалов.

Ключевые слова: судостроители, утилизация судов, безопасное и экологически безопасное, опасные материалы, повторное использование, глобальная экономия энергии.

Annotation. The article describes the main points of Convention on Ship Recycling, analyzes the ultimate responsibility and its compliance. Adherences with the applicable requirements of IMO documents, specifically with regard to the inventory of hazardous materials are presented.

Keywords: shipbuilders, ship recycling, safe and environmentally sound, Hazardous Materials, Reused, global conservation of energy.

UDC 556

RISK OF LOSS OF STABILITY DURING VESSEL OPERATION

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*"When dealing with water, first resort to experience,
and then to reasoning." Leonardo da Vinci*

Relevance

This theme is relevant in the global shipping industry, as well as the majority wreck of vessels due to the loss of stability, due to not knowing what affects it and how to deal with it.

The goal is to show the importance of the concept of stability and how to deal with it.

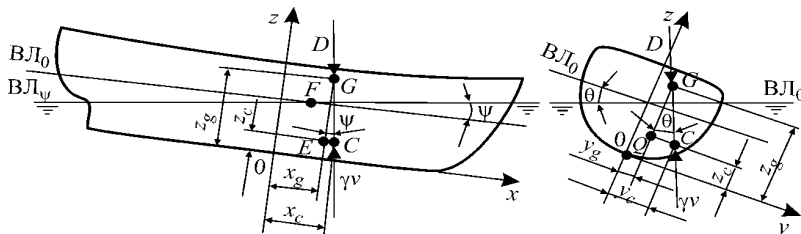
Strategy:

- To examine the concept of stability and risk assessment.
- To determine the causes of loss of stability.

The loss of stability of the vessel means the death of herself and very often - the entire crew.

Unlike other nautical qualities, the reduction of stability to dangerous limits in a visible way does not manifest itself. The forces acting on a ship and its stability largely depends on the geometrical dimensions of the ship, the shape and her contours and the position of the center of gravity. How can even a comparatively small vessel resist the sea, leaning now to one side, then another one, without overturning?

The deviation of the vessel from the equilibrium position in the transverse plane is called roll, in the longitudinal plane – trim.



Stability is the ability of a ship to counteract forces that deflect her from a state of equilibrium, and return to her original position after the termination of these forces. This is one of the main nautical qualities of the vessel, the preservation and maintenance of which is one of the main tasks of the crew.

The stability of the vessel is adversely affected by the influence of the free surface of the liquid in double bottom tanks, tanks, as well as shock waves, wind gust, changing of course, loading or unloading the cargo, the direction of the waves and icing of the vessel.

To save the life of the vessel can not only know the concept of stability and the factors affecting it, but you can also resort to risk assessment.

Risk assessment is the process of identifying hazards and assessing the risk from such hazards.

To assess the risk, we must:

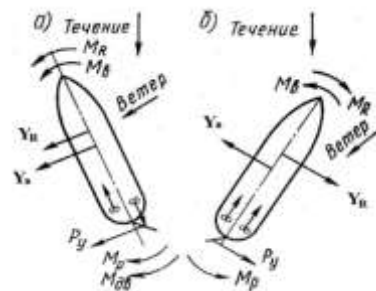
1. Identify the problem.
2. Gather expert measures.
3. Identify the hazard.
4. Determine the probability of advantage.
5. Evaluate the effects
6. Calculate the degree of the risk
7. Develop the response.
8. Evaluate the risk.
9. Estimate the cost.
10. Analyze the cost-benefit ratio.

The risk is calculated by the formula:

where

H_t – current metacentric height

H_k – critical metacentric height



In consequence of our research among 20 cadets of specialty of Navigation, only 8 know how to calculate the risk of loss of stability of the vessel, and it is only 40%.

Conclusion

Stability is one of the most important nautical qualities and crew members must be able to manage it. To avoid the loss of ships completely impossible, but you can reduce this percentage. Various procedures will help with this, such as exercises while swimming in ice, briefings, exercises to combat stability, advanced training of the crew, as well as the concept of “risk assessment” and the ability to use it.

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Аннотация. Рассматриваются основные особенности устойчивости судна в различных ситуациях. Отмечается, что потери судов избежать полностью невозможно, но сократить их процент вполне реально.

Ключевые слова: устойчивость, потеря судов, брифинги, оценка рисков.

Annotation. The author describes the stability of the vessel. It is noted that to avoid the loss of ships completely impossible, but you can reduce this percentage.

Keywords: stability, the loss of ships, briefings, risk assessment.

UDC 627.7

IMPLEMENTATION OF THE NAVY SIMULATOR IN THE EDUCATIONAL PROCESS OF FSBEI HE “KERCH STATE MARITIME TECHNOLOGICAL UNIVERSITY”

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The motivation of the research is in using the Navy Simulator for specialty of Navigation, it has become possible to work out the duties of a watch attendant not only in theory but also in practice by performing certain exercises and performing tasks satisfying the competence of STCW.

The goal is training of competences on the simulator.

The objectives are development of competences K6, K7, K8, K9, K10, K13, K22 (table 1).

These conventions are mandatory when carrying out the watch of navigation.

Methods and Materials are practical use of the simulator, STCW Code, practice.

This Navy Simulator completely copies the ship's bridge down to the instruments, as well as simulates weather conditions, ship breakdowns. It is great opportunity to train your future duties as a master.

Table 1. The objectives of competences.

K-6. Keeping a safe navigation watch	Collision regulations	Profound knowledge of the content, application and objectives of the International Regulations for Preventing Collisions at Sea, 1972. Amended	Collision Avoidance
	The principles of carrying the watch	Deep knowledge of the principles of carrying a navigational watch	Organization of service on ships Prevention of pondering Navigation and Flight
	Bridge Resource Management	Knowledge of bridge resource management principles, including allocation, assign men and priority of a resource; effective communication; assessment of the situation and the role of the leader; obtaining and maintaining knowledge of the situation	Organization of service on ships Maritime Security Management Socio-psychological technology team management
	Using establish end traffic paths	The use of established paths of vessels in accordance with the general provisions on the establishment of routes of vessels	Geography of waterways Collision Avoidance
	Use of navigation equipment to carry the watch	Use of navigation equipment to carry the watch	Technical means of navigation
	Knowledge of techniques for pilotage	Knowledge of navigation methods used to ensure safe navigation in reduced visibility	Navigation and Flight Collision Avoidance
	The use of messages in accordance with the general principles of	Knowledge of the principles of carrying the watch while sailing in the VTS operation zones	Organization of service on ships Collision Avoidance

	ship reporting systems and VTS procedures		
K-7 Using radar and ARPA to ensure safety of navigation			IMO Model Course 1.07
K-8 ECDIS Use for Safety of Navigation			IMO Model Course 1.27
K-9 Emergency Response		Precautionary measures for the protection and safety of passengers in emergency situations	Shipping safety
		The first actions after a collision or grounding; initial damage assessment and durability control	Shipping safety
		A proper understanding of the procedures to be followed when rescuing people in distress; measures taken in cases of accidents occurring in the port	Shipping safety
K-10 Action upon receipt of a distress call.		Knowledge of the content of the IAMSAR Manual	Shipping safety Organization of service on ships
K-13 Maneuvering and steering		The effect of displacement, speed, trimming and water under the keel on the circulation diameter and stopping distance; the influence of wind and current on the management of the vessel; maneuver and procedures for saving man overboard; an increase in precipitation from vessel speed, shallow water and similar effects; proper anchoring and mooring procedures	Maneuvering and steering
K-22 Leadership and Team work Application		Knowledge of ship management personnel	Socio-psychological technology team management IMO model course 1.39

In practice, the cadets of Navigation perform specified exercises to work out the competencies of the STCW. These exercises allow to prepare future specialists to perform their immediate responsibilities for maneuvering the vessel, managing the bridge's resources, making decisions in emergency situations, acting when receiving a distress signal, and showing leadership skills when working in a group.

Research results According to our survey of 230 cadets of specialty of Navigation (from 1 st year cadets till 4thyear cadets), just 16% of cadets have being trained on this Navy Simulator, and all these 16% received good result while checking the competencies of STCW.

Conclusion

According to our survey and practice, we can make a conclusion that this simulator can perform all mentioned competences (K6, K7, K8, K9, K10, K13, K22). There is also a great prospect for preparing cadets of specialty of Navigation for swimming practice on merchant ships. The simulator is relevant and fully commissioned.

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Аннотация. Целью исследования является обучение компетенция с помощью тренажера, который представляет большие перспективы для подготовки к плаванию на торговых судах курсантов специальности “Навигация”.

Ключевые слова: курсанты, навигация, тренажер, компетенции, военно-морской тренажер.

Annotation. The goal if the research is training of competences by means of the simulator which presents a great prospect for preparing cadets of specialty of Navigation for swimming practice on merchant ships.

Keywords: cadets, Navigation, simulator, competences, Navy Simulator, STCW.

SECTION 8: HISTORY



UDC 930.85/910

HISTORICAL FACTS ABOUT LONDON BRIDGES

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The city of London boasts a wealth of culture and history. This is why it is such a heavily visited city, with over 17 million people flocking to London in 2014 alone, according to the BBC. Some history facts about London Bridges are represented in this article. They are very popular in the whole world due to their historical importance.

The aim of this research work is to consider the locations of bridges over the River Thames, and to highlight their historical, architectural, or other merits and to describe their use. Tasks of this research are as following:

1. to make a theoretical analysis of London, Waterloo, Westminster, Tower Bridge, Millennium, Cannon Street Railway and Vauxhall Bridges because of their architectural, historical, or aesthetic qualities.
2. to highlight their historical, architectural, or other merits and to describe their use;
3. to compare their ages and heights;
4. to make up the diagrams of these comparisons.

More than 100 bridges span the River Thames from beginning to end. Each London Bridge has a unique history.

London Bridge has rather simple and somewhat austere in appearance. The old London Bridge was an example of a multi-purpose inhabited bridge, which housed commercial establishments, houses with often very impressive size, a chapel, various craft workshops and warehouses. Before it was destroyed in 1823, it existed for more than six centuries (picture 1). On the place where the London Bridge stood, there were several generations of wooden bridges, the first of which was built in the days of Roman rule. The first stone bridge of London was built between 1176 and 1209 by Peter, chaplain of St. Mary's Church. It crossed the Thames from Southwark to the city on the other side. Until 1739 it was the only bridge in London. The bridge was stone flooring, resting on the supports of elm driven into the river bottom. It is known that its length was 285 meters, width-4.6 meters, and height-18.5 meters, and that it had 20 arches (picture 2).



Picture 1 – The old London bridge



Picture 2 – The first stone bridge of London

Old London Bridge had a great influence on the development of London as a city. Being the only crossing over the Thames, the bridge was the reason that the greatest density of buildings was in the immediate density on its Northern shore. On the South shore, the buildings were less dense and seemed to fan away from the bridge along the river. The bridge also played an important symbolic and political role in the life of the city. Before it was again damaged by fire in 1725, the heads of executed traitors were exhibited at its southern end, and it served as the main site of historical events such as the return of Charles II, who arrived in London to reclaim his father's throne, during the Restoration of the Stewart dynasty in 1660 [4].

Modern London Bridge is not functioning very long time. “In 1832 it was rebuilt as Victorian stone arch and then later in 1971 it was rebuilt with modern material and hence it’s called “Modern Bridge” that was opened for public in 17 March 1973” [2, www]. There is a rhyme called “London Bridge is falling down”, which show you a complete description of the built and rebuilt of this historical bridge. This rhyme also gives information about historical collapses of the bridge.

The design and construction process of the modern bridge of London was monitored by a famous architecture. This great bridge project is one of the projects of the Michael Leeming (pictures 3, 4).



Picture 3 – Modern London Bridge



Picture 4 – Bridge lights at night

Waterloo Bridge is one of the many magnificent bridges built to go across the river Thames. Pedestrian and traffic, it is between Bleckfriarskim and Gangerfordskim bridges of London. Its history is rather interesting.

It was built on the site of the bridge of the same name in 1817 and named after the defeat in 1815 of Napoleon (picture 5). In the 1920s the authorities of London has decided to destroy the existing bridge and replace it with the project architect sir Gil Gilbert Scott.

This time the bridge turned out not only beautiful but also very functional. Beginning in 1942, the building was completed in 1945 - just three years - despite the serious difficulties of the war period. It is symbolic that the modern Waterloo bridge was opened in 1945 with a triumphal victory over the regime of the invader Hitler. Modern Waterloo bridge remains a strict symbol of the British capital (picture 6).



Picture 5 – Waterloo Bridge, June, 1817



Picture 6 – Modern Waterloo Bridge

Currently *Westminster Bridge* is the oldest one of central London. In the early 1700s, there really wasn't much choice if you wanted to cross the river. For the previous 600 years, you could opt between crossing at London Bridge, or at Kingston Bridge (picture 7).



Picture 7 – Old London Bridge on the 1632 oil painting "View of London Bridge" by Claude de Jongh

When Westminster Bridge was proposed to in 1664, the Corporation of London, the watermen (who ferried people across the river all day), and other people with vested interests, all opposed it.

One of their arguments was that if the watermen lost their jobs, there'd be fewer readily available seamen for the navy if England went to war [3].

The modern Westminster Bridge opened on Queen Victoria's 43rd birthday, 24 May 1862. Westminster Bridge was painted green in 1970 to match the seats in the House of Commons, the part of the Palace of Westminster closest to the bridge. In addition, with Westminster Bridge London Eye is perfectly visible from where you can see London and its surroundings.



Picture 8 – Six of Westminster Bridge's seven spans.

Tower Bridge, one of the London's most famous landmarks, is a suspension bridge on River Thames. It has two towers, in Victorian Gothic style, that are connected with two walkways. Base of each tower holds machines that lift two parts of the bridge so bridge can allow passing of river traffic beneath it. Tower Bridge is located close to the Tower of London from which it got its name [1].

Construction began in 1886 and lasted until 1894 (picture 9). Victorian Gothic style is used to esthetically integrate Tower Bridge with nearby Tower of London. Prince and Princess of Wales officially opened the bridge

on 30th of June 1894. The bridge connected Horselydown Lane, today Tower Bridge Road, with Iron Gate, today Tower Bridge Approach.

Tower Bridge is still in function and is still a major crossing of the Thames (Picture 10).



Picture 9 – Building a bridge.



Picture 10 – Modern Tower Bridge

Daily, some 40,000 people cross it in both directions. While it was controlled manually from the beginning, in 2000, a computer controls system was installed so bascules could be raised around 3 times a day [1].

Millennium Bridge is the newest bridge of central London.

This bridge has a peculiar structure. It is a suspension bridge. The Millennium Bridge was the result of a 1996 competition held by Southwark Council in conjunction with the Financial Times and the Royal Institute of British Architects. The Millennium Bridge officially opened by the Queen on 10 June 2000. Its official title is the London Millennium Footbridge. Instead, it'll probably always be called the Wobbly Bridge.

Built using lateral suspension, an engineering innovation allowing suspension bridges to be built without tall supporting columns, the Thames' newest crossing was hit by a phenomenon called Synchronous Lateral Excitation when loads of people flooded over its shiny new deck.

Around 80,000 people crossed the bridge on its opening day, with around 2,000 on the bridge at any one time (pictures 11, 12).



Picture 11 – Millennium Bridge



Picture 12 – A view from St Paul's Cathedral.

The construction of *Cannon Street Railway Bridge* was started in 1863 and lasted until 1866. This bridge is listed as «London Bridges». The railway station is located on the north bank of the River Thames (picture 13). The bridge connects the station with the southern bank of the river.

Originally the bridge was called the Alexandra Bridge (in honor of the wife of Edward Prince of Wales).



Picture 13 – Cannon Street Railway Bridge

Vauxhall Bridge was built in 1816 (its construction lasted seven years) as the first iron bridge over the Thames. The bridge was called in honor of the Prince Regent George, but was soon renamed Vauxhall (picture 14). In 1968, Vauxhall became the first bridge, which has been an allocated special bus lane. The new bridge soon became a major transport artery and today carries across the Thames. Originally built with tram tracks, New Vauxhall Bridge was the first in central London to carry trams (picture 15).



Picture 14 – Old Bridge Vauxhall 1835 Picture 15 – New Vauxhall Bridge.

To sum up a theoretical analysis of all Bridges it should be stated that the oldest Bridge in London is Westminster Bridge (diagram 1), the highest one is London Bridge (diagram 2).

Conclusion. When the Romans came to Britain, they built a city on both sides of the river Thames (the River Thames), and two banks communicated with each other by means of a bridge. Today there are more than 30 bridges across the Thames in London.

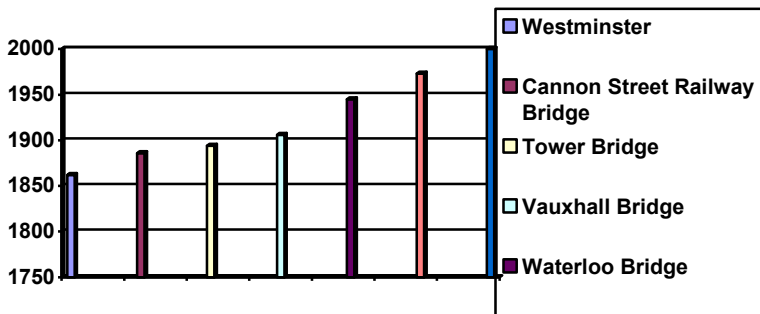


Diagram 1 – Comparing the heights of bridges.

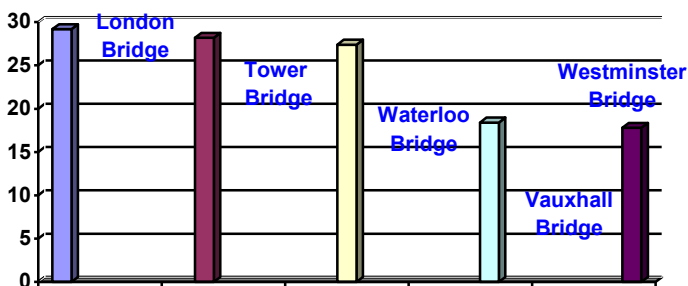


Diagram 2 – Comparing the ages.

Some are hundreds of years old, others are relatively new, but they are not just a means of crossing from one Bank to another, and serve as a real decoration, pride, unusual history and attraction of London and the whole of Britain.

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Аннотация. Цель данной исследовательской работы – рассмотреть расположение мостов через Темзу, выделить их исторические, архитектурные или иные достоинства, описать их использование.

Для подведения итогов теоретического анализа всех мостов автором составлены диаграммы сравнения возраста и высоты.

Ключевые слова: история, Лондонский мост, Мост Ватерлоо, Вестминстерский мост, Тауэрский мост, Мост Тысячелетия, железнодорожный мост Кэннон-стрит, Воксхолл-Бридж.

Annotation. The aim of this research work is to consider the locations of bridges over the River Thames, and to highlight their historical, architectural, or other merits and to describe their use.

To sum up a theoretical analysis of all bridges the author made up the diagrams of the age and height comparison.

Keywords: history, London Bridge, Waterloo Bridge, Westminster Bridge, Tower Bridge Bridge, Millennium Bridge, Cannon Street Railway Bridge, Vauxhall Bridge.

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FORMATION OF MATHEMATICS AS A SCIENCE AND ITS ROLE IN HUMAN LIFE

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Mathematics is a tool for learning the world. Why is mathematics directly related to our world? Why does it describe so well what is happening in the universe?

During the daily bustle, we are not always able to appreciate all that is happening in the world around us. If you stop the frantic rhythm of life for even a minute, you can see the beauty of the world around us. It is full of amazing phenomena, objects, secrets and mysteries. Many great discoveries have been made in the history of mankind. All these discoveries are somehow connected with mathematics. Mathematics is the queen of sciences [1], on which all others rest. She plays a very big role in our life.

Without knowledge of mathematics, all modern life would be impossible. We would not have good houses, because builders should be able to measure, count and construct. Our clothes would be very coarse, since they need to be well tailored, and for this purpose we must measure everything. There would be no railways, no ships, no planes, no big industry. There would be no radio, television, cinema, telephone and thousands of other things that are part of our civilization. It is thanks to mathematics that computing computers have appeared which greatly simplify human life. But how did it all begin? How did the math, and who invented it?

Even in the Stone Age, people needed to be able to count at least at the simplest level. They needed to share food between the tribe, exchange goods, count animals. But at that time there was no arithmetic. What did people do? They replaced the numbers with serifs, chopsticks, and fingers. In this way they could count something. But over time, life became more complicated, and new needs and responsibilities appeared. For example, in order to successfully engage in agriculture and successfully grow a particular culture, arithmetic knowledge was needed. Without certain calculations, it was difficult to determine when to sow the fields, began watering, when to wait for offspring from animals, and so on.

Life went on as usual, everything changed, people needed some other signs besides fingers. The numbers became more and more, it was difficult to keep them in my head, it was necessary to somehow identify and write them down. So the numbers appeared. Moreover, different countries invented their own. The first were the Egyptians, then the Greeks and the Romans. The first written figures, of which we have reliable evidence, appeared in Egypt and Mesopotamia about 5,000 years ago. Although these two cultures were very far from each other, their numerical systems are very similar.

After several centuries, the ancient Mayan people came up with a record of any numbers, using only three signs: a point, a line and an oval, and they were written on clay tablets. The next step was the numbers of knots, which were tied on a string. On the thread tied as many knots as required. But it was inconvenient to store fragile tablets and knotted threads. This continued until the ancient Indians invented their own sign for each digit. A little later, the Arabs simplified these icons; they became more like modern figures.

Gradually the numbers and operations on them developed. One of the first significant discoveries is the idea of the number itself, as well as the invention of the main four actions that are now familiar to everyone - multiplication, division, addition and subtraction. The first geometrical

achievements are the simplest concepts, such as a straight line and a circle. Based on this, answering the question where the mathematics appeared, we can say that it originated in Babylon, and then in Egypt. In Babylon, studies were constantly developed in which units and dozens were used. It was the Babylonian scientists who invented the degrees, the calculus systems were developed. In Egypt, the numbers were designated in the form of hieroglyphs. Until the seventeenth century, mathematics was considered a science that studies numbers, geometric shapes, quantities. It was used in commerce, astronomy, architecture, and during excavations [2].

Starting from the 18th century, mathematics began its rapid development. The twentieth century was a period of intensive development for mathematics, a breakthrough into new areas. In the first half of the 20th century, technology was developed: aviation, electrical engineering, radio engineering, etc.

The emergence of new technology was associated with the creation of complex mathematical models and the introduction of new requirements for mathematics [3]. Mathematics has always been important for a person, because it surrounds him constantly. In the modern world, mathematics is a must. It is thanks to the math we get a lot of new facts and move on. But we need mathematics not only for solving problems and designing new models.

M.I. Kalinin wrote that if you wanted to participate in a big life, you should know mathematics; it would be of great help to in future work. After all, the truth is, wherever you look, it's a solid math! Unfortunately, not everyone pays attention to this and believes that mathematics will be useful only at school and in higher educational institutions. But such people are very mistaken.

Even the usual trip to the store requires knowledge of mathematics. A person must calculate the number of products that he needs and how much he will spend on it. This is not the only example of the use of mathematics in everyday life.

As you have noticed, mathematics has been surrounding people in various fields of activity for hundreds of years, if it was in medicine, animal husbandry, or anything else. Making a conclusion, we can say that the life of a modern person is impossible without this science, whether you like it or not, but you will encounter mathematics in any of its manifestations, whether it is payment in a store or a simple task at school. Therefore, the profession of a teacher of mathematics is also necessary, since mathematics is necessary for the development of a child.

Thus, Mathematics allows you to develop some important mental qualities, improves the abilities of abstract thinking, the ability to concentrate, trains memory and enhances the speed of thinking and much

more [4]. This once again confirms the importance of mathematics in our life, and even more so its presence around us.

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Аннотация. В данной статье рассмотрено становление математики как науки, история её развития. Проанализировано появление чисел, их значения и использование. В статье подчеркнута роль и значение математики в жизни современного человека.
Ключевые слова: математика, цифры, современная, повседневная жизнь, развитие, открытия.

Annotation. This article describes the development of mathematics as a science, its history of development. It also tells about the appearance of numbers, their development, meaning and use. The article discusses the importance of mathematics in the life of man, its role and importance.

Keywords: Mathematics, numbers, modern, daily life, development, discoveries.

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THE NAMES OF THE HEROES OF THE CRIMEAN OFFENSIVE IN 1944 ON THE MODERN MAP OF SEVASTOPOL

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The grim years of the Great Patriotic War fade, but the memory of the defenders of our homeland who died on the battlefield, will remain forever.

The memory of the defenders of the Fatherland, who died during the Great Patriotic War, was immortalized in memorials and plaques installed on the buildings where they lived, studied and worked. In honor of heroes who gave their lives for freedom and independence of the Motherland the streets of villages and towns were named.

Now, in the year of the 74th anniversary of the Victory in the Great Patriotic War, an occasion to remember those who saved us in May 1945 becomes even more urgent (fig.1).



fig.1

Everywhere on the earth there are small rivers and lakes, low hills, small towns, villages and streets that can hardly be found on a map. Nevertheless, they may be of a particular historical interest.

Map of any locality in Russian Federation includes streets and squares named in honor of the war heroes. How often, time after time, walking along a familiar street, do we think of a person, whose name this street bears? What do we know about this personality, and why is there such an honor to name the street after this person? Of course, few people think about it. But there are people whose names are given to thousands of streets, these people being less well known. Each of these names has its own, often heroic, history.

Harsh and severe test for the residents of Sevastopol and the Black Sea Fleet sailors became the Great Patriotic War of 1941-1945. It was Sevastopol that one of the first cities in the USSR in June 22, 1941 in 3 hours and 15 minutes was subjected to Nazi air raid!

On the days of the defense of the city residents showed military and labor heroism. Marine plant workers were repairing the ships under the enemy attack, were creating military equipment in the night and day, and equipped two armored trains! In the mine workings (galleries), on the banks of the Sevastopol Bay, special underground facilities were created: #1 – for the production of weapons and ammunition, #2 – for clothes, shoes and uniforms sewing. Right under the ground there were running dispensaries, dining room, clubs, schools, nurseries and kindergarten, and then a hospital and a bakery (fig.2).



fig.2

May 5, 1944, at 12 a.m. 2nd Guards Army under the command of Lieutenant General Zakharov started an offensive with Mekenzievy mountains to liberate the Northern Quarter of Sevastopol.

May 9, in the evening Sevastopol was completely liberated.

May 10, at 1:00 o'clock in the morning Moscow with 24 volleys from 342 guns saluted the liberators of the city.

May 12, at Cape of Chersonese the remnants of the Nazi troops in the Crimea were defeated.

Now in this peaceful steppeland there stands an obelisk of 25 meters high embellished with a depiction of the Victory Order and an inscription carved on the stone:

“Erected to commemorate the Rout of the crimean group of Hitlerite troops on Cape of Chersonese on the 12th of May 1944. Eternal Glory to the heroes who liberated the Crimea from nazy invaders”.

Who were those heroes who's names were given to the streets and places of Sevastopol? Lets recollect them!

Georgiy Fiodorovich Zakharov (1897-1957) (fig.8)

was born on April 23 (May 5), 1897 in the village of Shilovo Saratov region in the family of a poor peasant. Russian.



fig.8

In military service since 1915. Graduated from the Chistopolsk school of ensigns in 1916. During the First World War he fought on the Western Front, in the rank of second lieutenant, was in command of a half-company.

In February, 1944 the Second Guards Army headed by Zakharov relocated to the area of the Perekop Isthmus and in April-May took part in the Crimean strategic operation, in which, on the 9th of May in cooperation with other troops of the 4th Ukrainian Front and the

forces of the Black Sea Fleet liberated Sevastopol.

The Second Guards Army in 34 hours broke through the heavily fortified enemy at the Perekop. A month later, they were the first to come out to the Northern Quarter of Sevastopol. The onset of advanced mobile detachments allowed to move from the Chatyrylyk river in the north of the Crimea to the Black Sea coast in 14 hours.

The second Guards Army Fighting had completed the liberation of the Northern Quarter of Sevastopol. But General Zakharov insisted that his army marched into the center of the city.

On December 22, 1954 the square was renamed as the Northern square, and on May 5, 1975 – as the Square of General Zakharov.

Yakov Aleksandrovich Romanov (1925-1944) (fig.3) was born on October 23, 1925 in the village of Semibalki (now Azov district of Rostov region) in a peasant family. Russian. Has got incomplete secondary education.



fig.3

The Guards Rifle Regiment shooter, the Komsomol member, Guard Red Army soldier Yakov Romanov was in the first group of soldiers who crossed the Northern bay on May 9, 1944 on the boat and landed in the center of the city of Sevastopol.

In heavy street fighting, reflecting the enemy counterattacks, the brave warrior- guardsman killed dozens of Nazis. In the same battle he died a hero's death.

Exactly at 6:00 on May 9, 1944 Comrade Romanov with five fellows-volunteers in a boat under heavy enemy fire floated across the bay from the Northern Quarter of the city of Sevastopol. After landing in the city center (on the south shore of the bay), the group of brave men, fighting and beating strong counterattacks, moved forward.

In this battle, Yakov destroyed 29 German soldiers with grenades, killed one soldier with a knife, and then was killed.

For his merit beyond the call of duty, for courage and bravery in the fight against the German invaders, he deserved the award as the title of the Hero of the Soviet Union.

The high school in his native village, where his bust was installed, and the street in the Nakhimov district of Sevastopol, where a memorial plaque is, were named in honor of Yakov Romanov (fig.4).



fig.4

Rodionov Aleksey Pavlovich (1898-1965)

(fig.5) was born on March 30, 1898 in the city of Yelets, Oryol province, in a poor working-class family. He finished junior secondary school. A year before the October Revolution, he was drafted into the imperial army. In 1918 Rodionov volunteered for the Red Army.

In the spring of 1944 the Colonel Rodionov's Division as the part of the 63rd Infantry Corps was advancing to the north of the Crimea. During three days the Division was fiercely fighting against the enemy. His soldiers were the first who broke into Simferopol. On April 13, 1944 the city was liberated from the



fig.5

Nazis.

After Balaklava had been liberated, Rodionov's soldiers rushed to Sevastopol – the last outpost of the Nazis in the Crimea. Their path laid across Sapun-Mountain. On May 7, 1944 during the assault of Sapun-Mountain Rodionov himself was at the forefront, and skillfully directed the actions of his soldiers. Terrible battle lasted nine hours. By the evening the enemy could not resist the onslaught of our soldiers. Sapun-Mountain was taken. When the Mountain ridge position was occupied, soldiers of the 77th Division hoisted the red flag.

On May 9, Rodionov's Division repulsed several enemy counterattacks. The Division was the first Soviet Army unit that entered the city of Russian glory. After the futility of further resistance had been realized, the enemy started negotiations for capitulation.

On May 12, 1944 the remnants of the Nazi troops at Cape of Chersonese surrendered. Crimean operation completed.

Rodionov name was given to streets in Sevastopol and Simferopol. His high relief was installed. in the Victory Square in Yelets.



fig.6

Mikhail Yakovlevich Dzigunsky (1921-1944)

(fig.6).

Mikhail Dzigunsky was born on May 15, 1921 in the village of Tsibulev of the Lipovetsky county of Kiev province in Ukraine in a peasant family. Mikhail received incomplete secondary education, and then worked at Tsibulev sugar factory. In April, 1940 Dzigunsky was called up for service in the Workers' and Peasants' Red Army.

On May 7, 1944 during the Sapun-Mountain assault Dzigunsky and his platoon were the first to brake into the enemy shelter trenches and in the ensuing battle personally destroyed 20 enemy soldiers and officers. When the fire of the German machine gun had slowed up the platoon offensive, Dzigunsky got close to the machine gun and covered it with his body by sacrificing his own life. The platoon thereby managed to go on the offensive. Dzigunsky was buried in the cemetery of the village Dergachi in Sevastopol.

In honor of Mikhail Dzigunsky streets in Sevastopol and Tsibulev were named. His heroic deed is reflected in the Diorama of "The Sapun-Mountain Assault" in Sevastopol, where we can see lieutenant Dzigunsky closing the pill-box embrasure with his body



fig.7

(fig.7).



fig.8

Kondrat Semenovitch Melnik (March 12 (25), 1900- May 3, 1971) (fig.8) – Soviet military commander, Lieutenant-General, participated in the Civil and the Great Patriotic War.

Army troops under his command successfully operated in the fighting in the North Caucasus and in the liberation of Crimea. Later the army to end the war defended coast of Crimea.

General Melnik street is in the Nakhimov district of Sevastopol, on Vorontsovaya mountain. On May 6, 1974 the street was named after General Melnik in commemoration of the 30th anniversary of Sevastopol liberation from Nazi invaders.

Evgenia Filippovna Deriugina (fig.9) (October 26, 1923-May 7, 1944)

Evgenia was born in Simferopol. She graduated from the Railway High School number 98 and studied at Sevastopol Shipyard college. Besides, she educated herself through nursing courses. The first battle for the girl was near Odessa. She went to the exploration into the enemy's rear. Then she participated in the defense of Sevastopol, at the positions near Balaklava.

When in May 1944, Soviet troops began the liberation of Sevastopol, the most violent and bloody fights broke out on the outskirts of the city – on Sapun-Mountain. Its assault lasted nine hours. Sevastopol

defenders fought hard for each trench shelter, for each projection, showing unprecedented bravery examples and courage.

Evgenia was barely eighteen when the Great Patriotic War broke out. The student-girl wore military uniform. She was baptized by fire near Odessa. At the front the girl received the first wound and was sent with a military ship to Sevastopol. However, not in the character of Evgenia was to stay in the hospital for a long time. As soon as she learned that her medical team had arrived from Odessa and had taken up positions near Balaklava, she ran away to take part in combat operations. From that moment the



fig.9

heroic defense 250 days' period started for the girl. In the spring of 1944 together with the 83rd Marine Brigade shock battalion Evgenia Deriugina was involved in battles near Balaklava. Only from May 3 to May 7, they managed to save the lives of 80 wounded.

Evgenia was mortally wounded. Marines buried Evgenia Deriugina in Balaklava (later at the request of her parents, she was reburied in Simferopol).

In Sevastopol, not only the street was named after Evgenia Deriugina. The Secondary Medical School bears the name of Zhenya Deriugina. In the lobby of the School there is a bust of the legendary defender of Sevastopol.

Although we can determine this terrible war as a thing of the distant past, but the memory of our homeland defenders is alive! It lives in our hearts. Working on this paper, we have come to strong belief that the younger generation should know the heroes of the Great Patriotic War, the military exploits of our compatriots.

For the world history hardly knows so many heroic deeds accomplished by one city in such a short period of time! The defence of Sevastopol in 1941-1942 and the Crimean Offensive in 1944-1945 will endure through ages of human history as witnesses of Russian Military Glory.

This work makes us think that generation of people thought not only about their personal lives, but also about the fate of Russia, about the motherland. We believe that we, the present generation, should not forget the heroes of our country, who sacrificed their lives for the sake of our homeland, our future, the future of our country.

As long as we remember the PAST – we have the FUTURE!

Let's cherish the memory of all those heroic people!



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Аннотация. Настоящая публикация посвящена участникам Великой Отечественной войны, проявившим отвагу и героизм в Крымской наступательной операции 1944г., в честь которых названы улицы города Севастополь. Цель данного исследования заключается в том, чтобы на основе анализа документальных и архивных источников, поисковых материалов, изучить жизнь и подвиг наших земляков – героев Великой Отечественной войны, чьими именами названы улицы нашего города: Георгий Федорович Захаров, Яков Александрович Романов, Родионов Алексей Павлович, Михаил Яковлевич Дзигунский, Кондрат Семенович Мельник, Евгения Филипповна Дерюгина.

Ключевые слова: Великая Отечественная Война, Крымская наступательная операция, май 1944 года, Георгий Федорович Захаров, Яков Александрович Романов, Родионов Алексей Павлович, Михаил Яковлевич Дзигунский, Кондрат Семенович Мельник, Кондрат Семенович Мельник, Евгения Филипповна Дерюгина.

Annotation. This publication is dedicated to the participants of the Great Patriotic War, who showed courage and heroism in the 1944 Crimean offensive operation, in the honor of whom the streets of the city of Sevastopol were named. The purpose of this study is to analyze the life and exploits of our countrymen, heroes of the Great Patriotic War, whose names the streets of our city bear based on the analysis of documentary and archival sources, search materials: Yakov Aleksandrovich Romanov, Rodionov Alexey Pavlovich, Mikhail Yakovlevich Dzigunsky, Kondrat Semenovich Melnik, Evgenia Filippovna Deryugina.

Keywords: The Great Patriotic War, Crimean offensive, may 1944, Georgiy Fiodorovich Zakharov, Yakov Aleksandrovich Romanov, Rodionov Aleksey Pavlovich, Mikhail Yakovlevich Dzigunsky, Kondrat Semenovich Melnik, Evgenia Filippovna Deriugina.

HEROIC DEED NEAR ASHAG-DZHAMIN: CRIMEA, 1944

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Unfortunately some facts of our history are getting out of mind and heart of post-war generations. People do not take interest in them anymore. This year we will celebrate the 75th anniversary of the liberation of the Crimea from Nazi invaders. In connection with the event, I would like to tell you about a mass grave located in the central Crimea in which eight heroes of the Soviet Union rest in peace.

It was April 1944. After breaking through the enemy's fortifications on the Perekop isthmus, the 4th Ukrainian Front command formed reconnaissance detachments out of various mobile units. Their task was to collect information about the movement of the enemy [1]. A detachment consisting of six fighters of the 3rd Guards Motor and Engineering battalion and three of the 91st motorized rifle one of the 19th tank corps conducted reconnaissance along the road between Evpatoria and Simferopol [3].

On April 13, 1944, the tank of the reconnaissance group was sent to the village of Ashag-Dzhamin in the Saki region in the Crimea. The scouts met two teenagers Peter Boyko and Seyt-Veli Seitmemetov, who told them about the fascists. The commander of the group sergeant Nikolai Poddubny decided to explore the situation in the village. As it turned out just in time, because an execution was being prepared in Ashag-Dzhamin. The Nazis drove the residents of the village to the school and were going to blow up the building [3].

At the entrance to the village, the scouts were met by artillery and machine-gun fire of Romanian units. The tank gun was wrecked by a direct hit. The tank was left without weapons. Romanians rushed to it. At the same time, the scouts started shooting with machine guns and rifles. Romanians lay down and the tank got the opportunity to leave. All enemy's fire from the heights and from the village was directed to the scouts and soon they were surrounded by a Romanian battalion.

The commander of the Romanian battalion shouted them to surrender. N.I. Poddubny, the head of the reconnaissance team, replied: "The army which has beaten the Romanians does not surrender to them!" He ordered

the soldiers to fire. The battle lasted for about two hours. "Soviet fighters ran out of ammunition, and Romanian soldiers approached the scouts intending to capture them. Nikolai Poddubny raised the fighters to the attack and killed the Romanian officer with the butt of his automatic rifle" [2]. The Romanians were several times as many as the Soviet soldiers. The scouts were captured. In the battle 13 Romanian soldiers were killed, 1 officer and 9 more Romanian soldiers were wounded.

The Soviet soldiers were brought to the village. During interrogation they were cruelly tortured but said nothing. Many of them had their arms and ribs broken. Their bodies were cut all over with bayonets. Even being bound and battered the scouts resisted. Ivan Timoshenko rushed and hit the head of a Nazi officer, immediately bullets pierced the warrior. Despite all tortures no one became a traitor.

On April 13, the prisoners were dragged to execution. Exhausted scouts found the strength to rise for the last time. And a German soldier who was a translator still persuaded Magomet Abdulmanapov to betray his comrades, "They are Russians, and you are a Muslim ...". The junior sergeant replied, "They are my brothers. We are the children of the same Motherland!" Then followed the automatic gun fire" [3].

These are the names of nine fighters:

1) sergeant Nikolai Ivanovich Poddubny, born in 1923, Ukrainian, communist. He went to the front in 1941 and was awarded with the Order of the Patriotic War of the II degree, the Order of the Red Star and the medal "For the Defense of Stalingrad".

2) sergeant Abdumanapov Mikhail Mamedovich (Magomed-Zagid), born in 1925, Avar, a Komsomol member. He went to the front in 1943.

3) private Veligin Petr Vladimirovich, born in 1922, Ukrainian, member of the CPSU (b). He went to the front in 1942, awarded with the Order of the Patriotic War II degree, the medal "For the Defense of Stalingrad".

4) private Zadorozhny Mikhail Alekseevich, born in 1923, Ukrainian, non-partisan. He went to the front in 1941, awarded with the medal "For the Defense of Stalingrad".

5) private Zakharchenko Grigory Nikiforovich, born in 1922, Ukrainian, non-partisan. He went to the front in 1941. He was awarded with the medal "For the Defense of Stalingrad".

6) private Ivanov Peter Artemyevich, born in 1909, Russian, non-partisan. He went to the front in 1942.

7) private Simonenko Alexander Fedorovich, born in 1912, Russian, non-partisan. He went to the front in 1942.

8) private Timoshenko Ivan Terentievich, born in 1909, Ukrainian, communist, participant of the western campaign to Belarus (1939) and the Finnish campaign (1940). He went to the front in 1941, awarded the medal "For the Defense of Stalingrad".

9) private Ershov Vasily Alexandrovich, born in 1920, Russian, non-partisan. He went to the front in 1941 [4].

When the Romanians left the place of execution, the locals came to bury the Red Army soldiers. And they found a crippled, but still alive fighter. He was a 24-year-old Vasily Yershov. He had 10 gunshots and 7 stab wounds, both arms and leg were broken. A local resident Lyubov Gapkova sheltered him in her house. The same boys Peter Boyko and Seyt-Veli Seytmemetov, and later medical assistants Olga Sobko, Nina Kolesnikova, Klavdiya Afanasyev, Yefrosinya Sosedenko, Nadezhda Bereziuk, Evdokia Razumova, Ustinya Dolibozhko, Raya Gritsenko cared for the wounded. When Russian units liberated the village, he was sent to a hospital. Vasily Ershov survived. After the war, he worked in one of the collective farms of the Yaroslavl region until his death in 1971.

On May 16, 1944 by decree the reconnaissance group was awarded with the title Hero of the Soviet Union.

After the war, the local people renamed the village into Geroyskoye and commemorated the heroes by the obelisk with the inscription on a pedestal: "Eternal glory to the Heroes of the Soviet Union". Eight of nine heroes' names were engraved, as V.A. Ershov was lucky to survive. In 1982 the monument was rebuilt. A T-34-85 tank, a black marble slab with the names of the dead heroes, pylons with their figures were installed. In June 2014 in memory of the fellow countryman, a charitable found from Samara restored this memorial complex.

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Аннотация. В статье описан трагический и героический эпизод в истории освобождения Крыма от фашистских оккупантов, когда 13 апреля 1944 года в селе Ашага-Джамин Сакского района девять советских разведчиков вступили в бой с превосходящими силами противника, и ценой своих жизней спасли жителей деревни. В честь совершенного подвига был воздвигнут мемориальный комплекс в селе Геройском (бывший Ашага-Джамин) Сакского района.

Ключевые слова: ВОВ, Ашага-Джамин, Герой Советского Союза.

Annotation. The article describes a tragic and heroic episode in the history of the Crimea liberation from fascists when on April 13, 1944 nine Soviet scouts fought against superior enemy forces and rescued local people with their lives. To commemorate the heroes the village was renamed into Geroyskoye and the obelisk was put up.

Key words: Great Patriotic War, Ashaga-Jamin, Hero of the Soviet Union.

SECTION 10: PSYCHOLOGY AND PEDAGOGY



UDC 15 9.944.3

FOOD HABITS AND HEALTH ATTITUDE OF UNIVERSITY STUDENTS

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Introduction

Nutrition is the main component of human life. Often, in order to assess a person's condition, one should identify what kind of food he eats and understand his nutritional psychology. Food psychology includes nutritional decisions that have a direct impact on overall health. People do not always think about it, and especially students who need a lot of energy and strength.

When young people start studying at university, they often live away from home for the first time in their lives and are completely independent. This newfound freedom has its pros and cons. Now young people are responsible for their health and well-being.

In order to be healthy and perform their studies well, students need to eat healthy foods, get enough sleep and exercise. In addition, the student must plan the purchase of food and prepare meals. Students must eat healthy foods in order to achieve academic excellence, ensure their physical development and prevent chronic diseases.

Studies have shown that students can learn better when they eat well, and healthy eating was associated with higher grades, better memory and alertness, and faster processing of information [1, 2, 3, 4].

The purpose of this work: to examine Tomsk Polytechnic University first-year students' eating habits.

The research method

The authors studied the eating habits of first-year students (Tomsk Polytechnic University) using the survey method.

The survey involved 50 students as respondents, they answered the following questions:

- 1) How many meals a day do you usually have?
- 2) Do you eat fast food? And for what reason?
- 3) Could you evaluate your health status?

According to all the survey results, it was found that:

- 73% of respondents answered that they have 3 meals a day,
- 20% of respondents answered that they have 2 meals a day,
- 5% of respondents answered that they have 1 meal a day,
- 2% of respondents answered that they have irregular eating habits
- 96% of students eat fast food and 4% do not eat.

To the question regarding the health status assessment **90%** of the surveyed students answered positively.

All respondents noted that fast food is harmful to health. However, to the question: “Why do you eat fast food?” **87%** of respondents indicated that they do not have enough time to prepare a healthy meal, because of their intensive studies at the university.

In addition, students noted the following reasons:

- a) the presence of laziness, since it is easier for them to buy ready-made and inexpensive product instead of cooking;
- b) lack of funds for the purchase of quality food

Consequences

Thus, according to the survey authors found that first-year students (Tomsk Polytechnic University) do not follow a healthy diet, their diet is influenced by the rhythm of students' life. Many students do not think about kind of food they eat and how it will affect their physical and psychological health, they could face an increased risk of chronic diseases, including cancer, heart disease and diabetes. If students incorporate lifelong healthy habits like eating nutritious food from an early age, they may be able to reduce and prevent the health-care costs and deaths from poor-nutrition-related chronic disease.

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Аннотация. Данная работа посвящена изучению привычек питания студентов первого курса (Томский политехнический университет). Авторы исследовали пищевые привычки студентов-первокурсников с помощью метода опроса. По данным опроса авторов установлено, что студенты первого курса не следуют здоровому рациону питания, на их рацион влияет ритм жизни студентов.

Ключевые слова: пищевая психология, здоровое питание, пищевые привычки.

Annotation. This work is devoted to the study first-year students' eating habits (Tomsk Polytechnic University). The authors examined the eating habits of first-year students using the survey method. According to the survey authors found that first-year students do not follow a healthy diet, their diet is influenced by the rhythm of their students' life.

Keywords: food psychology, healthy food, eating habits.

UDC 377.8

THE PROBLEM OF TEACHING A FOREIGN LANGUAGE IN A NON-LINGUISTIC UNIVERSITY

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The question about problems of human communication attracts the attention of researchers of various scientific disciplines, such as: pedagogy, psychology, sociology.

In teaching a foreign language the problem of teaching communication is associated primarily with the formation of language, speech, phonetic, grammatical and lexical skills and creative skills in various types of speech activity: reading, writing, speaking and listening. Therefore, the teaching

method and communication system must be optimal for the teacher and the student to work together.

Foreign language proficiency is compulsory for a specialist of any profile. A modern specialist should be ready to establish intercultural scientific relations, participate in international conferences, study foreign experience in a certain field of science, as well as implement business and partner contacts. In connection with the foregoing, at the present stage of development of science, culture and technology, the problem of teaching a foreign language in non-linguistic universities is particularly relevant. Since the possession of a foreign language (English) is an essential condition for the successful and competitive work of the future specialist on the labor market [3].

According to the discipline “foreign language” standard in a non-linguistic university, foreign language teaching should be communicative-oriented and professionally-oriented. The main purpose of teaching foreign languages is formation, improvement and development of personality capable for achieving the necessary level of communicative competence. The education is also aimed on the development of the cognitive independence of future specialists based on the formation of linguistic and professional orientations in the process of working with special literature.

The student is said to have linguistic competence if he has an idea about the system of the studied language and can use this system in practice using all the morphological and syntactic units in his speech. However, in practice, students enrolled in a technical college do not have basic foreign language knowledge, skills and abilities. Unfortunately, this tendency is typical for all institutes and universities that provide training for bachelors and masters in non-language areas. Without a solid base of formed language skills and abilities, about which we talked above, it is impossible to develop speaking skills, terminological base, the ability to read fluently and other communicative, linguistic and intercultural competences [1].

However, the goal of a non-linguistic university should not include teaching a basic level of a foreign language. This task should be solved at school, therefore continuity and consistency in the reform of general and vocational education is so important.

Another problem when teaching a foreign language at a higher educational institution is the insufficient amount of hours devoted to this discipline. Therefore, self-study work of students plays an important role in the development of the language being studied. For such kind of work the obligatory hours in the course program are given. The classroom hours allocated in the basic cycle for teaching a foreign language are used in the first two years of study and are spent mainly on “pulling up” the language

level of the majority of students. For most of them the question of learning a professional foreign language is generally not worth it. Such a number of hours is clearly not enough for the development of all those competencies that are required from a modern engineer of the European level. Often, the problem of classroom hours lack is solved by the so-called variable component, which involves conducting practical classes in the professional foreign language by teachers in specialized departments. Such classes, as a rule, are devoted to the consideration of problems directly related to the profile of training, and involve a discussion of these problems at a higher, professional level.

Based on the above, as one of the solutions of this problem, is that a large amount of educational material on a foreign language is submitted for independent work of a student that he must perform outside the classroom. Another problem is the lack of motivation of students to master a foreign language. Motivation, as we know, is directly related to the effectiveness of training [2]. Any cognitive process is based on the desire to learn a foreign language culture. Low motivation to learn a foreign language is largely based on the negative experience of teaching it at the level of secondary education. Students entering a university often do not see the sphere of application of a foreign language in their future profession, since they simply do not yet imagine their professional future. Low motivation to learn a foreign language is also appeared due to its limited use in educational, industrial, and also in real life conditions. And in such situation there is a wide field of activity for the university and chairs of foreign languages in the sphere of establishing international educational and research contacts, joint international projects, academic exchanges, etc.

Summing up, we conclude that in non-linguistic universities a foreign language takes a somewhat separate position in the system of other training courses, since when studying many students sometimes come across a new language and speech material. Learning foreign language communication in a non-linguistic university is associated with a number of limitations among which are the unfavorable time-frequency characteristics of classes and the fact that communication is mainly educational. In the absence of the need to communicate on the language being studied, that is, when mastering a language outside the language environment, "communication" is reduced to understanding and reproducing some typical, situationally determined language cliches. Communication on a foreign language is significantly inferior to communication on the native. As a result the lack of active oral practice, sufficient individualization and differentiation of education is the main obstacle to the effective mastery of foreign language reality. Unfortunately, in a non-linguistic university learning a foreign language is

sometimes viewed as the accumulation of a certain amount of knowledge and the formation of skills, that is, there is no idea of the language as a complex, constantly evolving, multi-level system. Nonetheless the difficulties of learning a foreign language in non-linguistic universities are associated with the specific features of it as a subject that is difficult to study in the conditions of the university.

Learning a foreign language requires the expenditure of enormous energy as well as daily, systematic, motivated work. Therefore, only a personal interest in mastering a foreign language can effectively contribute to the formation of motivation for a given subject.

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Аннотация. В статье рассматриваются основные проблемы преподавания иностранного языка в неязыковых вузах. Также рассматривается вопрос мотивации студентов, которая, как известно, напрямую связана с эффективностью обучения.

Ключевые слова: проблемы, задачи, методы, принципы мотивация, процесс обучения, иностранный язык, неязыковой вуз.

Anotation. The article discusses the main problems of teaching a foreign language in non-linguistic university and the motivation, which is directly related to the efficiency of learning.

Keywords: aims, problems, methods, principles, motivation, learning, foreign language, non-linguistic institution.

**INTERACTIVE METHODS
IN TEACHING ENGLISH LANGUAGE**

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In the contemporary higher education system, the issue of increasing the quality of English language professional training is vital. It can result from the efficient use of interactive methods in teaching English language.

Under the modern learning conditions, the process of English study is viewed as an interaction among a teacher and students, targeting to transfer common knowledge, skills, and values to the students. There can be only three forms of such interaction:

1. Passive methods;
2. Active methods;
3. Interactive methods.

A passive method of instruction is a form of interaction between the teacher and students with the teacher being the center of the lesson while the learner remains to be a passive listener. It is considered to be the most inefficient method of learning English.

An active approach is a form of a teacher-student interaction equally involving both a teacher and students. In this form of learning, students are not passive listeners anymore but they are active participants in the learning process. Because of these advantages, a lot of teachers choose this method of instruction during English classes.

Active and interactive approaches have a lot in common. In general, an interactive method can be considered as a modern version of active methods. In contrast to the passive approach, active learning is focused on a closer relationship between learners and a teacher, and students are more active in the learning process. The main difference between active and interactive approach is that, in contrast to active approach, interactive learning involves students' interaction not only with the teacher but with each other as well.

Among a large number of interactive methods, the most efficient are the following [1, 2, 3]:

1. Creative tasks;
2. Games (role-plays, imitations, business and development games);
3. Use of human resources (excursions, inviting experts);
4. Social Projects;
5. Use of new material (interactive lectures, video-audio materials, student in the role of a "teacher", Socratic dialogue, asking questions);
6. Solving tasks (associative maps, brain storming, case analysis).
7. Case study method: the study method that is a training by solving specific cases. The essence of this method is a collective analysis of a situation, finding a solution and a public defense of said solution. In the process of reviewing the cases, students gain the skills of teamwork, independent modelling of the solution, independent reasoning and defending their opinion.

8. Training: a teaching method that aims at developing skills and knowledge in any field by performing sequential tasks, activities or games. This method allows the teacher to give the participants missing information and allows students to form skills of professional and appropriate behavior in the performance of professional tasks.

Practice proves that using the above-mentioned interactive methods helps to achieve the results in modern English language learning, because students are equally involved in the cognitive process, each individual contributes to the teaching process, and students exchange information and ideas.

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Аннотация. Основная стратегия современного образования должна быть сосредоточена на самообучении, экспериментальной и практической подготовке студента, в ходе которой они выбирают свою собственную траекторию обучения, работают в удобном ритме и используют инициативу наряду с гибкими программами обучения. В этой статье обобщены наиболее популярные интерактивные методы обучения английскому языку, которые стимулируют интерес студентов к этому предмету, способствуют эффективному усвоению

учебного материала, обеспечивают высокую мотивацию, командный дух и свободу выражения и, что самое важное, способствуют развитию сложных компетенций. будущих профессионалов.

Ключевые слова: метод обучения, интерактивный метод, профессиональная компетенция, игры, проекты, кейсы.

Annotation. The main strategy of modern education should focus on the student's self-learning, experimental, and practical training, during which they select their own course of action, work in a comfortable rhythm, and use initiative as well as flexible training programs. This paper summarizes the most popular interactive methods of English language training, which encourage student interest in this subject, promote the efficient acquisition of training material, provide high motivation, team spirit and freedom of expression, and, most importantly, contribute to the complex competences of future professionals.

Keywords: Teaching method; Interactive method; Professional competence, Games, Project, Cases.

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ROLE OF SOCIAL ENVIRONMENT IN PERSONALITY DEVELOPMENT

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A distinctive feature of social change within the regional dimension is the reassessment of values, changes in social norms, as well as the crisis of social ideals. Humanization of education is inextricably linked with the ideas about the orientation of the learning process to self-development of the individual, the priorities of human values, to optimize the interaction of the individual and society.

Improvement of training and continuous professional development of specialists is associated with a conscious ascent of the individual to a high level of professionalism, which is possible in the possession of certain competencies. Competencies (personal qualities and skills) affect the success of a person. They are the key to person's promising future. These competencies are universal [3].

Among universal competences, adaptability plays a special role (the ability to overcome the language barrier, to respond effectively to any changes in the working environment, to adapt to new conditions, readiness to change, readiness to learn). We consider the development of a person with universal competences in the context of noogenesis (ancient

Greek:νοῦς=mind +γένεσις= origin, becoming) is the emergence and evolution of intelligence) and this process reflects the following realities: the development of personality in the global social environment; modeling of motivations through secondary needs (acquired) [4]. "A new understanding of the term "noogenesis" as an evolution of the intellect was proposed by A.L. Eryomin. A hypothesis based on recapitulation theory links the evolution of the human brain to the development of human civilization. All of the people living on this planet have undoubtedly inherited the amazing cultural treasures of the past, be it production, social and intellectual ones.

Developmental psychologists such as Kazmierz Dabrowski and Erich Fromm emphasize the role of the social environment in personality development. The problem of human potencial is considered by B.G. Yudin, V.J. Kelly, N.N. Avdeeva, G.B. Stepanova. Social development of the person as an individual process of human development in terms of society, social contacts, social groups and communication was researched by V.I. Bobneva, E.V. Shorokhova. To understand behaviors and the possibly of treating undesired behaviors the researcher used theoretical perspectives including learning, language, cognitive, social, moral, and personality development.

The study of the process of assigning personal values in the educational space of the university is particularly vital problem in the situation of social change. The relevance of this study is determined by the existing social and educational need for specialists who are able to respond effectively to any changes in the global social environment, adapt to new conditions, ready to change and learn and search for pedagogical conditions and means to implement this need.

Mankind is the material carrier of the displayed objective reality arising in the course of interaction of persons, groups of people and mankind as a whole with the outside world [1].

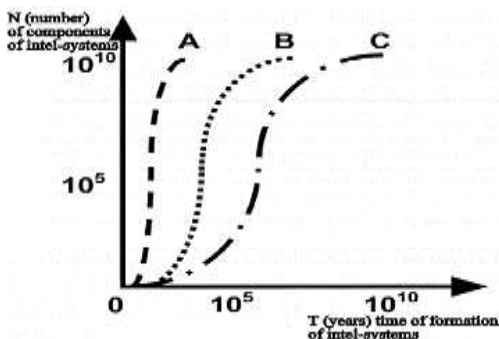
Social development of the student's personality is the assimilation, processing and implementation of social experience in the process of communication and interaction in a social environment. As a result of socialization and education of the individual there is a formation of existential competencies (personal strategies, social competencies, goal-setting), which belong to the universal competencies.

The social environment is one of a person in his/her social life, manifestation, originality of the public relations. The surrounding social reality, in which the development and formation of personality takes place, is an objective condition for the formation of personality, which determines human inclinations – thinking and speech.

The life position of a person is formed by the totality of all social influences on a person, and first of all by the system of public education. Formation and development of personality in the social environment is one of a system of specific social characteristics of the individual. In the process of the social environment, a person integrates the social relations of the environment and forms his attitude to the outside world, acting as the subject and the result of social relations.

Therefore, the social environment is a double-edged sword: On the one hand, the very values we assume are dictated to us by the norms of society. On the other, our ideas and plans for successfully assuming these values are internalized with regard to our impressions of the people we look up to [6]. It is important to realize that a person may have a high developmental potential, yet fail to transcend the influences of the social environment and achieve true autonomy, self-actualization.

Individuals in the social environment can be considered in the context of noogenesis, as intellectual potential of the individual and the ability to interact in society are developed. Noogenesis represents a set of natural, interconnected, characterized by a certain temporal sequence of structural and functional transformations of the entire hierarchy and set of interacting among themselves on the basic structures and processes ranging from the formation and separation of the rational system to the present (the phylogenesis of the nervous systems of organisms; the evolution of humanity as autonomous intelligent systems) or death (in the course of ontogenesis of the human brain)" (see picture 1).



Picture 1 – Iteration of the number of components in intellectual systems.

A – number of neurons in the brain during individual development (ontogenesis),

B – number of people (evolution of populations of humanity),

C – number of neurons in the nervous systems of organisms during evolution (phylogenesis).

The environmental and inherited influences on individuals' development in the social environment, also known as, nature and nurture both play key roles in the shaping of developmental processes. Nature refers to inherited or biological traits such as, abilities. Nurture refers to environmental influences that play a role in shaping persons' behaviors, such as methods of childrearing and other products of society. "We could get closer to understanding the most profound patterns and laws of the Universe if these kinds of research were given enough attention" [5].

Societal influences are believed to play a significant role on the environmental impacts of development. The way we have been socialized or conditioned is a response to environmental stimuli.

It is in the process of activity that the humanistic values are formed as social interaction is a dynamic, changing sequence of social actions between individuals or groups. The task of the teacher is to design the individual development of each student, taking into account specific physiological and psychological characteristics.

In the course of socialization, the following social qualities, properties, actions and skills are formed, where students become capable participants of social interaction: communication skills; moral qualities; will qualities (perseverance, self-control, initiative and independence).

The conditions for effective personal development in the social environment are as follows:

- revival of the imperative "harmonious development of personality" , but in a new round of history – an organic combination of noospheric view, special knowledge and effective professional activity;

- diagnostics of inclinations and abilities, theoretical development and practical creation of conditions for their manifestation and development (psychological diagnostic tests);

- the use of positive factors in the development of personal qualities (motivation for success, overcoming failures), modeling of motivations through secondary needs – the conscious absence of anything that causes the urge to action. Primary needs are genetic, and secondary needs are developed in the course of learning and gaining life experience [7];

- organization of educational activities of students aimed at the formation of special abilities.

Thus, individuals in the social environment can be considered in the context of noogenesis, when not only a person with universal competencies is formed, but the intellectual potential of the individual and the ability to interact in society is developed.

It is possible to change the social environment. It is only by actively modifying our environments that we can achieve our highest potentials.

Due to prioritizing self development, we naturally begin to surround ourselves with exceptional people – fantastic teachers, skilled and dependable co-workers, and loving friends, family. “Not only do we grow more rapidly on an individual level, but our collective accomplishments become increasingly valuable to society as a whole. Aligning our individual goals with the needs of the planet and the people around us is the inevitable progression of personality development” [6, www].

The basis of person’s development in the social environment must be considered on the interactions between psychological, biological, and social aspects of development. Influences from both inherited and environmental elements are equally important to the construction of growth and development. However, certain behaviors and growth patterns are believed to result from greater attributes of environmental and inherited influences.

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Аннотация. Рассмотрены условия эффективного развития личности социальной среде. Отмечено, что исследование процесса присвоения ценностей личности в условиях образовательного пространства вуза представляется особенно актуальной проблемой в ситуации социальных перемен. Автор приходит к заключению, что личности в социальной среде возможно рассматривать в контексте ноогенеза, когда развивается интеллектуальный потенциал личности и способность к взаимодействиям в социуме.

Ключевые слова: социальная среда, ноогенез, общечеловеческие ценности, профессионализм, социальная среда, социализации.

Annotation. Conditions of effective development of personality in social environment are considered. It is noted that the study of the process of assigning personal values in the educational space of the university is particularly relevant problem in the situation of social change. The author comes to the conclusion that individuals in the social environment can be considered in the context of noogenesis, when the intellectual potential of the individual and the ability to interact in society are developed.

Keywords: social environment, noogenesis, universal values, professionalism, social environment, socialization.

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RELEVANCE OF TECHING THE ENGLISH LANGUAGE AT SCHOOLS

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Nowadays, according to the 2005 Education Act, a foreign language is studied at schools since the second grade, whereas previously a foreign language was taught only since the fifth grade, after the transition to the Middle School. At the same time, if the school is not a highly specialized

and can give the choice to study several foreign languages, parents are given the right to choose the language specialty. The most popular language chosen by parents is English, because from the XVI century English has become the international language.

English is chosen because of its popularity and worldwide prevalence. According to Forbes, English is spoken by almost one and half billion people, which is a quarter of the entire population of the Earth. More than 70% of the population in North America speaks English which is essential for those people who wish to get an education abroad. Also, the higher education in United States provides you with an international diploma which can help to find a job in any country, including Russia.

As it's been mentioned above, teaching foreign language is usually started in Primary School and in some private kindergartens it can begin even earlier. A famous scientist Glenn Doman has proved that it's better to start learning a foreign language at the time of the brain growth period (about three -four years). Also, the researchers found that children whose parents teach the child a second language from an early age, or who grew up in a bilingual family, show higher level of mental abilities, because studying languages develops horizons, helps in better understanding the native language by teaching and learning different dialects of countries which also speak it. For example, US English, you can be easily recognized from the classic British English for frequent cuts, changed rules, different pronunciation of the syllables. Even more striking differences we can see within the Australian dialect of the English language. Sometimes it can be difficult to understand for those who are not acquainted with language peculiarities of any particular country. For example, Australians do not say the usual "afternoon", they say "arvo" instead.

Thanks to close trade cooperation between the English-speaking countries and Russia, the popularity of the English language constantly grows because "only with a help of effective communication so many events are able to appear in society" [1, p. 12]. It grows accordingly to the demand for qualified personnel, who would be able to teach children English well enough to let the child express himself freely by the end of the school. In addition, the demand for English teachers is growing also because every year more and more children tend to take the state exam on this subject, and by 2020 the English exam will be one of the principal, together with the Russian language and Mathematics. Another reason why the demand for English teachers constantly grows is that the government tends to complicate the task for the state exam every year. However in some regions of the country many schools are not able to provide a high-quality English education. Therefore many parents have to hire tutors for their

children. According to the recent survey the price of tuition has risen by 15% since January 2015. This figure is a fundamental indicator of the relevance of studying English since the early age. If the English language is taught in school on a sufficient level, parents do not have to spend thousands on a tutor for their child. In addition to this, making English language a mandatory subject can also provide many unemployed translators with working places in schools.

Thus, by analyzing all of the above arguments, it is easy to conclude that the studying and teaching English language becomes more popular every year. The basic argument for this conclusion is that the Russian labor market does not have enough qualified English teachers. Therefore studying and later getting a profession in this specialty will help a young teacher to find a good job both in private and in public schools.

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Аннотация. данная статья посвящена актуальности преподавания английского языка в школах. Также рассматриваются причины и потенциал изучения иностранных языков с раннего возраста. Государственный экзамен ставит школам задачи, для выполнения которых требуется квалифицированный персонал, способных вывести учащихся на соответствующий уровень знания иностранного языка. В статье приведены аргументы, почему преподавание английского языка сейчас актуально, и почему потребность в учителях с каждым годом возрастает.

Ключевые слова: английский язык, педагогика, школа, преподавание в школе.

Annotation. The article is dedicated to reference of teaching English language at schools. Also the purposes and the potential of studying foreign languages from the early age are considered. The State exam sets such goals to schools that could be achieved only by qualified specialists who can bring the students to the sufficient level of English language skills. The article sets out arguments for reference of teaching English language and for the growing demand for English teachers.

Keywords: English language, pedagogy, school, school teaching.

**PSYCHOLOGICAL ADAPTATION AND EMOTIONAL
STABILITY AS INDICATORS OF PROFESSIONAL SELF –
DETERMINATION**

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The study of the features of future engineer's professional and communicative competence formation allowed to identify fundamentally important positions for us. Professional and communicative competence is one of the key competences necessary for a future specialist to successfully carry out professional activities. Professional and communicative competence of the future engineer can be understood as a part of the general professional competence of the specialist, which allows to form a new engineering thinking. It is such an integrative characteristic of the individual, which requires constant development, improvement, and awareness of its importance allows the future specialist to take an active position, other people, society to achieve success in the implementation of their own professional potential. The purposefulness of this process is given by the tasks and types of professional training of the student at the university (within the framework of Federal state educational standards of higher education), the implementation of which ensures the success of the professional functions of the future specialist.

The formation of professional and communicative competence of the future engineer is a consequence of the optimal organization of two interrelated processes: the educational process in the university and self-development, self-organization of subjects of education, the integration unity of which provides the success of professional adaptation and professional development of the university graduate. Professional adaptation is a condition of stability and harmony of professional self-determination of the person.

The challenges that arise during the transition process require young people to be as resilient as possible. Different life situations can act as a cause of emotional instability, as well as a stimulus for resilience in a changing social environment.

Viability and psychological adaptation are an important condition determining the stability and harmony of professional self-determination of

the future specialist [2]. The problem of professional and personal self-determination, stability was considered by K.A. Abulkhanova-Slavskaya, A.A. Bodalev, L.I. Bozhovich, M.R. Ginzburg, A.A. Derkach, E.F. Zeer, L.I. Kataeva, E.A. Klimov, N.V. Kuzmina, A.K. Markova, S.L. Rubinstein.

D.A. Leontiev noted that resilience characterizes the measure of the ability of the individual to withstand a stressful situation, while maintaining internal balance and success of the activity. G.N. Kameneva, S.I. Kudinov, S.M. Hammad, and others characterize "adaptability as a socially determined ability of the individual" [1, p. 6]. A.A. Rean defines "adaptation as an active process that includes changing the social environment and changing itself" [4, c. 10].

Analysis of scientific literature and researches in the field of professional self-determination shows that the problem of emotional stability and indicators of professional self-determination of students was not the subject of special research.

The purpose of this study is to analyze the dynamics and relationship of indicators of professional self – determination: psychological adaptation, emotional stability and cognitive ability as the features of future engineer's professional and communicative competence formation in the process of professionalization in high school. Professional adaptation is considered as a condition of stability and harmony of professional self-determination.

The relevance and importance of the study of indicators of resilience is obvious, because it characterizes the degree of resilience of the individual's ability to withstand stress, while maintaining internal balance and success. Students who have a high level of resilience, have the following qualities: high adaptability, self-confidence, motivation for success, overcoming failures, the desire to achieve even in a difficult transition period.

Methods. In an empirical research we used the technique of viability diagnostics (S. Muddy and D.A. Leontiev) to examine indicators of psychological adaptation and emotional stability as the features of future engineer's professional and communicative competence formation [5]. In an empirical research to study the indicators of socio-psychological adaptation of the individual, we used the technique of viability diagnosing (S. Maddi in the adaptation of D. A. Leontiev) [5]; to research a type of thinking and cognitive abilities we used Shane Frederick cognitive ability test [6]. The sample of the study was 50 people. Students of the third (n = 25) and fourth (n = 25) courses of "Physics" department of Sevastopol State University took part in the research. Characterizing the sample of the study, it should be noted that the main professionally-oriented personality choices are formed during the period of professionalization at the student age.

Psychological adaptation and emotional stability is a system of beliefs, about the relationship with the world [3, 5]. This disposition includes three components: involvement, control, risk taking. "The severity of these components and resilience prevents the formation of internal stress in stressful situations with the help of persistent coping with stress and their perception as less significant. Test scales include: involvement, control, risk taking» [5, www]:

- Involvement
- Control
- Risk adaptation.

Involvement is the conviction that participation gives the maximum chance for something interesting and useful for the individual. A person with a high level of involvement enjoys his own activities.

Control is a conviction that the result of what is happening depends on the struggle. A person with a high level of control is sure that he chooses his own activity.

Risk adaptation is a person's conviction that everything that happens to him/her contributes to his/her development at the expense of certain knowledge gained from experience. A person acts at own risk. The idea of personal development through acquired knowledge, skills and experience is in the basis of risk adaptation.

The results of the study and their discussion.

Students were asked to answer 45 question test on the methods for diagnostics of survival (S. Muddy in D.A. Leontiev’s adaptation).

The levels of resilience were determined in accordance with the standards proposed in the methodology. The norms of the test of viability are given in table 1.

Table 1. Norms of the test of viability in points.

Indicators	High level	Average level	Low level
Involvement	42 and more	34-41	Less than 34
Control	33 and more	25-32	Less than 25
Risk adaptation	16 and more	12-15	Less than 12

The average values and standard deviations of viability are presented in table 2.

Table 2. The average values and standard deviations of viability

Respondents	n	M	δ	m
Students	50	83.18	2.82	0.81

Note: n -number, M - the arithmetic average meaning, δ - standard deviation, m - average value error.

The ratio of the rate “involvement”, “control”, “risk adaptation” indicators are represented in the figures 1-3 (red – Norm, blue – tested indicator).

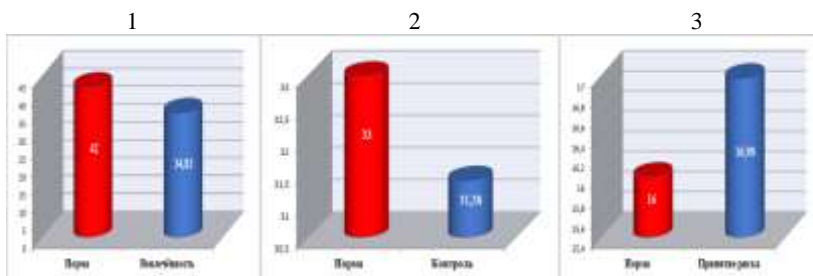


Figure 1 – "Involvement" indicator Figure 2 – "Control" indicator.
Figure 3 – "Risk adaptation" indicator.

Source: constructed by the authors on the basis of statistics data.

General indicator of emotional stability and professional self-determination is determined by the sum of the indicators of each subscale (involvement, control, risk adaptation): 90 or more points – high level, 72-89 points – average level, at least 72 points – a low level.

Based on the results of the study, the average level was determined in indicators: involvement and control, high level – risk acceptance (table 3). Therefore, most of the students are able to take risks, the basis of risk is the idea of personal development through the acquired knowledge, experience and skills.

To research a type of thinking and cognitive abilities we conducted Shane Frederick cognitive ability test. Cognitive reflection test (CRT) includes three questions. Each of these questions has two answers: one intuitive and one correct. Intuitive answers first come to mind. Frederick found that people with low test results prefer intuition. They're impulsive. Conversely, those who answered two or three questions correctly

preferred willpower to give up the momentary fulfillment of desire, and are rewarded for it later. They have cognitive abilities.

Table 3. – General results of diagnostic study on the test

Indicators	Average point	Level
Involvement	34.82	Average
Control	31.38	Average
Risk adaptation	16.98	High
General point	83.18	Average

Source: constructed by the authors on the basis of statistics data.

Tasks are formulated in such a way that push the reader to an intuitive rash decision, but some people, despite the instant desire to give the wrong answer, notice the trick and begin to analyze the solution of the problem in more detail — from this moment analytical thinking comes into action. Economist Shane Frederick calls the ability to "notice a trick" cognitive reflection. If you answered intuitively (and at the same time satisfied with the answer), it does not mean that you are stupid, just the analytical part of thinking responsible for the "mathematics" did not have time to get involved in the work. When re-reading tasks the brain is already beginning to act more intensively. But unlike IQ-test CRT is designed to identify different features of the person.

The average students' CRT as a percentage is presented in the figure 4.

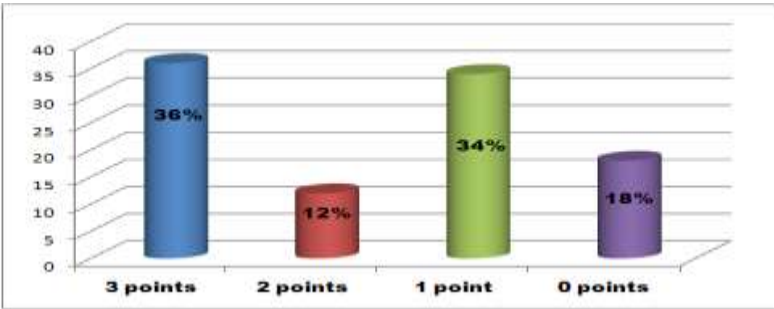


Figure 4 – The average students' CRT as a percentage

Thus, the presented results of the study of indicators state that students in many adaptive components demonstrate a good or optimal level of adaptive capacity. Based on the results of the analysis of these

characteristics mentioned method of diagnosis, determined the manifestation of tested components, which significantly reduces the stress phenomenon in different situations.

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Аннотация. Выделены особенности процесса формирования профессионально-коммуникативной компетентности будущего инженера. Обоснована актуальность выбора данной темы и приведены показатели профессионально коммуникативной компетентности. Профессиональная адаптация рассматривается как условие устойчивости и гармоничности профессионального самоопределения личности.

Ключевые слова: профессионально-коммуникативная компетентность, самоопределение, устойчивость.

Annotation. The features of the process of formation of professional and communicative competence of the future engineer are highlighted. The relevance of the choice of this topic and the indicators of professional communicative competence. Professional adaptation is considered as a condition of stability and harmony of professional self-determination.

Keywords: professional-communicative competence, self-determination, stability.

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CREATIVE COMPONENT IN THE TEACHING OF PHYSICS

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Creative items are not just music, art and drama. Physics is also a huge resource for creativity and expansion of the picture of the world.

Physics is a science, one of the tasks of which is to shape the outlook of not only the younger generation, but also a completely adult person. It is designed to show the possibility of knowing and explaining the world in all its diversity, to play a crucial role in the formation of the natural science picture of being. After all, the latter is extremely important in the conditions of accelerating progress.

Today, misconceptions about the nature of events and things are carefully masked, overgrown with pseudo-scientific terminology, adherents of alternative science struggle to reputable scientists, offering miraculous discoveries at a reasonable price to everyone [1, p.64].

If we look at the situation in detail, we have to admit: at least the school physics course has ceased to be something understandable for young people. Discipline in the capable hands of the compilers of textbooks, standards and exam assignments has evolved from a means of knowledge into an annoying burden on the path to the results of the exams.

The first thing that catches your eye when you study any textbook on physics for schools and colleges is the systematic abuse of mathematics. The explanation of the physical picture of a phenomenon new to students at the end is reduced to problems where there are many known and several

unknowns. Quick drawing - and now we have an equation or a system of equations that is poorly consistent with life.

Seriously, it creates the feeling that physics has become an appendage to a huge, overgrown, apparatus of mathematics.

But all these formulas and equations are intended only to quantitatively reflect processes, not even processes — models, for the diversity of the surrounding world does not allow this or that system to be completely isolated.

I dare to paraphrase the famous Feynman - if you cannot explain the basic principles of quantum physics to a ninth-grader without formulas, then you are a charlatan [2, p.273].

The basis of the physical picture of the world is always an understanding and description in the familiar language of everything that happens and is accessible to the mind. Let us recall Newton: at first he understood how and from what objects fall (according to the legend, apples), and then he consolidated his understanding with the formula. First, the image – then the equation. First fantasy, then variables. A textbook on physics should resort to mathematics as a spicy seasoning for dishes. Just a little overdone – and everything is already impossible.

Examinations in physics also contribute to the compromise of discipline in the eyes of girls and boys. You know, if I were in their position, after passing the exams, I would never want to listen to physics anymore. There is only one thing behind the formulas and dry terms - to formally check how young people have the ability to solve equations and forget about it.

Thus, the school physics turns into courses of alternative mathematics for passing an exam from typical tasks. And yet, no systematic attempts at creative search and, more importantly, no influence on the worldview occur, the framework is set up such that it is hardly more difficult to break out of them than in the kitchen to detect the Higgs boson with a teaspoon.

The slender, beautiful in its complexity world, does not carry young people away simply because they do not see it behind the mathematical apparatus and in frenzy of exhausting preparation for the formal exam.

There must be a way out. We must begin with ourselves, trying with all our might to show physics the way it should be - by organizing practical circles, reading popular lectures. If circumstances allow and there is no need to ensure a high score for reporting on the results of the exams, simply start two programs.

The tendency of decrease in interest of pupils to a subject is noticed. One of the reasons for this state of affairs is called American physicists: “Everyone agrees that physics is one of the most interesting sciences. At the

same time, many physics textbooks can't be called interesting. In such textbooks everything that follows the program is stated. It usually explains the benefits of physics and how important it is to study it, but it is very rare to understand why it is interesting to study physics. But this side of the issue also deserves attention. ”

I believe that an important factor in learning, as a means of educating the individual, is the organization of the learning process. Therefore, it is necessary to influence the feelings of the child, on his need-motivational sphere, in order to induce a desire to self-educate certain qualities and personality traits.

Creating an atmosphere in the classroom in which students feel the need for training sessions perceives new knowledge with interest [3, p.21].

Goals:

Increasing student interest in the subject;

Creating a psychologically comfortable state of students in the classroom, which increases the effectiveness of classes, promotes students' understanding of the study material and helps them not to experience difficulties in studying physics.

According to many researchers, problem-based learning is aimed at achieving the above-mentioned goals, which forms an interest in learning, develops the student's initiative in cognition, promotes an understanding of the inner essence of phenomena and processes, forms the ability to see the problem, etc.

At the heart of problem-based learning lies the creative component, namely, the principle of "discovery." The goal of problem-based learning is the assimilation not only of the fundamentals of physics, but also the assimilation of the very process of obtaining knowledge and scientific facts, where cognitive and creative abilities are used [4, p.17]. Problem learning begins with the creation of a problem situation. The problem situation suggests the appearance of a discrepancy between the knowledge that students have learned and the phenomena that need to be explained [5, p.326].

So, physics is an important component in the development of students' worldview. In addition, physics is inseparable from creativity.

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Аннотация. В данной статье рассматривается творческая составляющая преподавания физики и вопрос о том, как увлечь учащихся физикой. Физика — это наука, одной из задач которой является формирование мировоззрения не только подрастающего поколения, но и вполне взрослой личности. Она призвана показать возможность познания и объяснения мира во всём его многообразии, сыграть решающую роль в формировании естественнонаучной картины мира.

Ключевые слова: Творческая составляющая, уравнение, физика, математический аппарат, культура, искусство, мировоззрение.

Annotation. In this article discusses the creative component of teaching physics and the question of how to entice students with physics. Physics is a science, one of the tasks of which is to shape the outlook of not only the younger generation, but also a completely adult person. It is designed to show the possibility of knowing and explaining the world in all its diversity, to play a crucial role in the formation of the natural science picture of the world.

Keywords: creative component, equation, physics, mathematical apparatus, culture, art, worldview.

UDC 371.38

BROAD-MINDED AS THE GENERAL CULTURAL COMPETENCE OF THE STUDENT-PHYSICS

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Progress in our world does not stand still, and with it, and man has no right to lag behind. The life of each of us encourages to equip themselves with knowledge.

To live, you need to have a special education, but still need to have a General education. You need to be able to understand everything that is happening around, and for this you need the ability to think and understand, you need a certain breadth of horizons [1].

Outlook is the amount of knowledge of a person, the range of his interests and ideas about life, the range of its perception, the breadth of vision of the world and the depth of his understanding. (dictionary).

Without a broad Outlook, a person can not reach a proper understanding of any phenomenon, which means — he can not be a good specialist. For example, to be a specialist physicist you need to know and chemistry, and mathematics, and the history of these Sciences, and physiology. The desire to comprehend the depth of their specialty puts the need for knowledge of other fields of science in front of man. To be a good specialist, you need to have a broad Outlook of knowledge. After all, as the German scientist and publicist Georg Lichtenberg said, if a person does not understand anything except chemistry, then he does not understand chemistry enough.

The decrease in the level of general culture and narrowing the horizons of students reduces their competitiveness in the labor market, and on the scale of society reduces the quality of human capital in the modern information society [2].

In the concept of horizons laid the desire to increase the range of visibility. It is a broad Outlook that a modern professional needs for intellectual solvency in both humanitarian and technical spheres [2].

Even in the Renaissance (aka Renaissance) the question of comprehensive development was widely studied. Humanists created their ideal of man and called him "universal man". "Universal man" embodied the basic principles of Renaissance humanism, which considered man the center of the universe, unlimited in the ability to develop. "Universal man" sought to cover all knowledge, developed his abilities as fully as possible, improved in physical development, in social achievements and in the arts. [4].

Vladislav Stolyarov, a specialist in the field of logic and methodology of scientific research, the theory of dialectics, philosophical and sociological problems, in his book "Philosophy of human physicality" highlighted the prerequisites and prerequisites for a broad Outlook:

- A person has a variety of interests, Hobbies, as well as knowledge, abilities (intellectual, artistic, physical, etc.)

- The ability to creatively and effectively (successfully) apply this knowledge and ability to set and solve problems, perform certain functions, i.e. creative achievements in a particular activity.

- Compliance with the rules and principles of aesthetics, the laws of beauty, as well as moral rules, moral norms.

- Ability to clearly plan and organize their actions [5].

And before the student-physicist are also the following tasks:

- look closely at the surrounding life and think about it;

- learn, know and understand it;

- be able to act in it.

Thus, a survey was conducted aimed to survey the breadth of Outlook among 1-4 year physics students Sevgi, who were asked 12 questions of various categories of knowledge. The survey results showed that 17% of respondents have a low level of knowledge. 39% - average and 44% - high levels of knowledge.

It can be concluded that physics students have a sufficient level of knowledge, but we must not forget that a person should always remain open to new knowledge.

And so, comprehensive (universal) human development is the formation of such multilateral interests, Hobbies, knowledge, abilities that allow you to actively participate, achieve certain successes, understand their meaning and importance, effectively perform functions related to the main (fundamental) activities. Therefore, the presence of such interests, Hobbies, knowledge, abilities is necessary for every person, regardless of what profession he is going to choose or has already chosen, in what field he is going to work or already work [5].

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Аннотация. В статье рассматриваются понятие всесторонне развитого человека и широкого кругозора у людей.

Ключевые слова: кругозор, гуманизм, развитие, «универсальный человек», учебно-познавательная деятельность.

Annotation. The article considers the concept of a fully developed person and a broad outlook in people.

Keywords: outlook, humanism, development, "universal man", educational and cognitive activity.

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ON THE QUESTION OF CULTURE FORMATION OF INTERETHNIC COMMUNICATION IN COLLEGE

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The effectiveness of social communication depends on mutual understanding, and communication is considered not only as the transferring knowledges, but also as an interaction of the parties with different objectives. One of the obstacles to the interethnic relations stabilization in Crimea is the lack of a positive image of ethnic relations in the public consciousness.

Today, the question of the formation of a culture of interethnic communication is becoming increasingly important. The development of culture by a person involves the development of its methods of practical activity. Communication is a significant factor in the social determination of individual behavior. A person learns not only the cultural experience content, but also the methods of cultural behavior, cultural ways of thinking [1].

Modern system of professional education should eliminate the negative manifestations of social communication and create conditions for the formation of those value orientations, preferable for the individual and society. Culture is the achievement of harmony that gives the individual a social stability and active involvement in social life and professional activities, as well as personal psychological comfort [3].

Innovative activity in the implementation of new approaches to education in modern conditions is associated with the conceptual development of substantive, organizational and structural directions of professional education (E.V. Bondarevskaya, V.I. Zagvyazinsky, V.A. Slastenin, etc.), including the development of various approaches to the formation of a culture of interethnic communication.

The questions of professional education were considered by A.S. Belkin, E.F. Zeer, I.A. Zimnyaya, V.V. Serikov, A.V. Khutorskoy. Basic culture as the harmonious combination of feelings, emotions, knowledge-beliefs and actions of behavior in society are examined by O.S. Gazman.

The purpose of this article is to substantiate the importance and necessity of culture of interethnic communication forming in the educational process of Sevastopol Pedagogical College named after P.K. Minkov, and to define the tasks of cross-cultural education. Students of many nationalities study at the college: Crimean Tatars (about 20%), Ukrainians, Chechens, Kazan Tatars, etc. Therefore, this problem is urgent for our educational institution.

The purpose of culture is a person; the essence of culture is manifested in the process of person's self-development and the realization of his/her creative potential in practice. Communication is an important factor in the social determination of individual behavior and is a special interpersonal interaction of people as members of society, representatives of certain social groups and cultures. Ethnic consciousness testifies to the awareness of the members of the ethnic group of their special unity and difference from the members of other similar ones.

The personality culture includes knowledge, skills, needs, value orientations and is manifested in the nature of its communication and creative activity. The culture of interethnic communication is a harmony of culture of knowledge, feelings and communication, creative action, tolerant attitude to the culture of other nations.

International communication is considered as the relationship when people of different ethnic communities and different religious views exchange experiences, advice, feelings, thoughts and spiritual values.

The culture of interethnic communication is stated to be a system of moral ideas and guidelines, activities, ways and forms of behavior which is

directed to interaction, mutual influence, mutual understanding between people of different nationalities. Communication between members belonging to different ethnic groups can also be considered a challenge as it brings in more general intergroup controversies. Ethnicity affects both verbal and nonverbal communication at different intensity levels [4].

There are many reasons for emerging interethnic conflicts caused by the low level interethnic competence and connected with psychological peculiarities of perception of other cultures and religions. Bringing up, education, sociocultural environment and religion play a certain role in this process [5].

Intercultural communication involves not only interpersonal communication of different cultures, but also cultural contacts. In the process of interpersonal communication of representatives of different cultures there is an enrichment of national consciousness.

Education in the pedagogical college, providing a mechanism for the translation of ethnic heritage, is designed to provide:

- focus on the ability to maintain and develop a dialogue of cultures;
- integration process;
- the basis for understanding and communicating with other cultures.

In the educational process of the pedagogical college the problem of cross-cultural education, the formation of a culture of interethnic relations, education of interethnic tolerance should be solved taking into account that the process of intercultural communication begins with the awareness of the existing cultural differences between different people; the main purpose of communication is to overcome intercultural differences.

Objectives of cross-cultural education are following:

1. The study of people's pedagogical knowledge of different nations, excluding the imposition of certain values, interethnic intolerance.
2. Application of the general humanistic position as the basis of socio-pedagogical design in the educational space of the college.
3. Organization of the atmosphere of an educational institution on the basis of trust, joint activities and creativity.

The results should be following;

1. Identification of common spiritual origins of different ethnic groups, manifestation of the spirituality of the ethnic group, humanistic values in the dialogue of cultures.
2. Understanding the relationship of national spiritual cultures, the formation of the ability to think analytically, comparing the categories of private and general, the relationship of national and international.

3. Creation of conditions for self-determination, self-realization; promotion of personal development; actualization of human motivational resources.

Solving the problems of cross-cultural education contributes to the settlement of ethnic conflicts, which are socio-cultural in nature due to differences in language, customs, religion and peculiarities of mentality in the conflict of ethnic communities, as well as the removal of inter-ethnic tensions, accompanied by inter-religious tension.

Thus, it can be concluded that in the conditions of intensive migration and interaction of cultures, the modern education system is designed to create all conditions for the formation of the future professional, capable of active life in a multinational multicultural environment.

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Аннотация. Проанализированы основные особенности компетентностного подхода к развитию культуры личности. Определены задачи кросс-культурного образования. В заключении отмечено, что решение задач кросс-культурного образования способствует урегулированию этнических конфликтов.

Ключевые слова: колледж, культура личности, межнациональное общение, коммуникация, этнический конфликт, кросс-культурный.

Annotation. The article analyses the main features of competence-based approach to the development of the personality culture. The tasks of cross-cultural education are defined. In conclusion, it is noted that solving the problems of cross-cultural education contributes to the ethnic conflicts regulation.

Keywords: college, personality culture, interethnic communication, ethnic conflict, cross-cultural.

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DEFINITIONAL CRITERION OF FUTURE NAVIGATORS' COMMUNICATION COMPETENCE

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The main ways of improvement of formation of readiness of future navigators to cross-cultural communication are in using modern principles of foreign language teaching (principles of an intercultural approach). The principles of foreign language teaching are intercultural principle, target principle, the principle of meaning [1].

Although the terms "communication skill" and "communication competence" are used interchangeably in some treatments, it is useful to make a distinction between the two.

Regarding the overarching distinction, then, between "skill" and "competence," the approach here is to identify "skills" as specific behaviors and behavioral abilities and "competence" as the perceptions or evaluations of those behaviors and abilities [4].

One of the new topical areas in the methodology of teaching foreign languages both in Russia and abroad has become professionally oriented training [2, 3]. In the sphere of our scientific interest is the training of communication of students of navigation faculties. In connection with the development of scientific and technological progress and socio-economic changes in the country is constantly expanding the scope of communicative navigators: now they solve not only traditional issues (when dealing with the pilot, agent, etc.), they have to conduct radiotelephone negotiations of a medical nature, etc. For this reason, the content of training English language necessary to make appropriate adjustments.

In addition, English language proficiency requirements of the navigator are also increasing, as the safety of the crew, vessel and cargo often depends on it. In this regard, it becomes obvious why a number of researchers are turning to the issues of teaching English.

Communicative competence is a term which refers to a language user's grammatical knowledge of syntax, morphology, phonology and the like, as well as social knowledge about how and when to use utterances appropriately. The term was coined by Dell Hymes in 1966, reacting against the perceived inadequacy of Noam Chomsky's (1965) distinction between

competence and performance. As much as there has already been much debate about linguistic competence and communicative competence in the second and foreign language teaching literature, the outcome has always been the consideration of communicative competence as a superior model of language following Hymes' opposition to Chomsky's linguistic competence. In psychological terms, communication is usually defined as the interaction of two or more people, consisting in the exchange of information between them cognitive or affect-evaluative nature.

The Navigator should be a real diplomat in conducting professional conversations with authorities in foreign ports, when not only communication skills are required, but also Maritime ethics, etiquette and customs of the port knowledge. The officer of the watch shall, on entering the stand watch, "obtain information concerning the implementation of local and port regulations, means of communication with the shore and the port in case of accidents or assistance" (Charter of the service). The international Convention on the training, certification and Watchkeeping of seafarers) requires sufficient knowledge of the English language to enable "a commanding officer to use maps and other navigational AIDS, to understand meteorological information and communications concerning the safety and operation of the vessel, to communicate with other vessels and shore stations, and to perform the duties of a commanding officer in a multilingual crew, including the ability to use and understand "Standard navigation dictionary-Phrase Book" .

Thus communicative competence of future navigator is the ability to carry out speech activities for the implementation of professional tasks, for example conducting professional conversations with authorities in foreign ports, obtaining information concerning the implementation of local and port regulations, means of communication with the shore and the port in case of accidents or assistance, using maps and other navigational AIDS for understanding meteorological information and communications concerning the safety and operation of the vessel, to communicate with other vessels and shore stations, and to perform the duties of a commanding officer in a multilingual crew.

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Аннотация. Определено понятие «коммуникативная компетенция будущих штурманов», проанализированы основные показатели коммуникативной компетенции в рамках профессиональных обязанностей штурманов.

Ключевые слова: коммуникативная компетентность, штурман, коммуникативные умения, иностранный язык.

Annotation. The concept of "communicative competence of future navigators" is defined, the main indicators of communicative competence in the framework of professional duties of navigators are analyzed.

Keywords: communicative competence, navigator, communicative skills, foreign language.

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**SPECIFICITY OF JUNIOR ADOLESCENTS RELATIONSHIPS IN
THE CONDITIONS OF THE TEMPORARY CHILDREN'S
COLLECTIVE (ON THE EXAMPLE OF THE INTERNATIONAL
CHILDREN CAMP "ARTEK")**

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The relevance of this topic is significant, because through the influence of the temporary children's collective on the child, we can change it for the better. In the camp, the adolescent's influence is weakened by the

influence of family, class, company of friends, etc., here he can manifest himself in other way, reveal his creative, leadership, sports abilities. Become more self-confident. The practical part is based on the formation of a temporary children's collective of younger teenagers having a rest at the International Children's Center "Artek", where we had the opportunity to observe the formation of a temporary group of teenagers in the camp. This allowed us to consider it as a kind of model of the community of children and adults, where not only the features were clearly manifested, but also the general patterns characteristic for the processes of interaction, communication of children in collectives, the process of the unification of public opinion, joint experiences, sentiments.

The purpose of this study is: to study the specifics of relationships among younger adolescents in the conditions of a temporary children's collective.

The social situation of the development of the younger adolescent is that he is included in the new system of relations and, compared with the younger schoolchild, the teenager should establish relations not with one but with many teachers, and the need for interaction with the same is also manifested. Leading kind of activity is the intimate-personal communication. Personal new formation is the ability to identify, personal self-determination. Younger teenagers are the special age group for which learning activity stops to be leading. Significance is acquired by relationships with children of the same age and adults. This leads to a reassessment of values associated with the change of leading activity [1].

Adolescence is traditionally called transitional, difficult, critical. L.S. Vygotsky thought that the psychological nature of the crisis lies in the emergence of self-consciousness. This gives rise to the desire for self-affirmation, self-expression, self-education. The main stimulus of any activity organized by a tutor is its effectiveness [8]. Changes in the personal sphere make it possible to call the adolescent period as a second birth of a person. Along with a sense of adulthood, the adolescent shows a desire for independence, critical thinking, a tendency to reflect, the formation of introspection, the desire for communication, the evaluation of comradesly and friendly relations as personal achievements. Such a significant situation for a teenager may be a temporary children's collective.

The temporary children's collective is a specially created social space, the prototype of the system of social relations, where the skills of life in society are formed, universal values are valid, the accumulated national traditions and positive experience of the upbringing of the younger generation are maintained [3].

The theory of the collective occupied one of the prominent places in the national pedagogy and psychology. A large number of scientific research, dissertations, books, articles, essays, etc. have been devoted to the collective as a dominant, the core of the socialist type of culture, way of life, ethics and upbringing. Widely known are the names of Russian teachers and psychologists who have made a significant contribution to the theory of the collective and the practice of educating the individual in the team: P.P. Blonsky, O.S. Gazman, I.P. Ivanov, M.B. Koval, T.E. Konnikova, N.K. Krupskaya, P.N. Lepeshinsky, A.N. Lutoshkin, A.S. Makarenko, A.V. Mudrik, L.I. Novikova, A.V. Petrovsky, K.D. Radina, V.N. Soroka-Rosinsky, V.A. Sukhomlinsky, L.I. Umansky, S.T. Shatsky.

To study the characteristics of the relationship of younger adolescents in the conditions of the temporary children's collective, the sociometry method was used. Twenty subjects participated in the study, of which 10 were girls and 10 boys aged 12-13 years, who rested in the 8th shift "Artek collects friends".

Proceeding from the sociometry conducted, we can trace the mutual relations of the children, the children quickly became friends, active interaction and communication was traced already on the fourth day of the shift, the organizational period was successful, the children quickly got used to the atmosphere and rules of the camp. Organizational moments were carried out by all. The guys respected and obeyed their counselors, the conflicts during the shift were, but not significant, with the help of the leaders were resolved quickly. The profile showed itself at a high level, the interest in the field of DJing was in every child, everyone claimed that when they arrive home, they will continue to develop themselves in this area. In the profile competitions, the team spirit and spirit of rivalry was noticeable. The guys from our group participating in the DJ-Battle, showed themselves as talented, DJs who are able to get the audience.

During the shift a lot of detachment, camp and camp events took place, where we also took an active part, almost always took first place. Since the children were active, the camp received permits for their personal achievements, there were a lot of creative guys in the group, with the help of the leaders, showing creativity, and all their creative abilities, we quickly prepared to participate in the events.

To study the dynamics of the relationship in the group, a graph was compiled that displays indices of sociometry: the index of cohesion (as the main indicator of cohesion in the group, a favorable social and psychological climate), the isolation index (the indicator of the number of outsiders in the group), and the number of micro groups (figure 1).

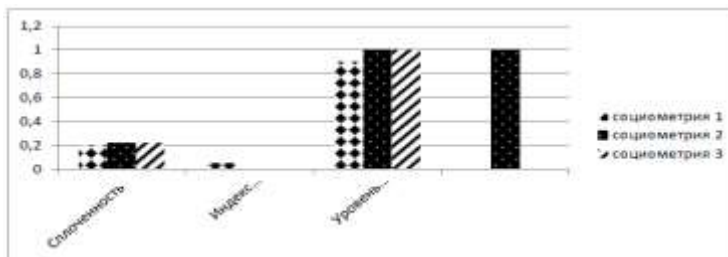


Figure 1 – Dynamics of relations in the group according to indices on the method of sociometry

As we can see in picture 1 the level of cohesion remains practically unchanged during the camp shift, there are no outsiders at the end of the shift, and the index of well-being becomes higher, especially at stages 2 and 3.

It is interesting that the groups appear during the main stage and completely disappear at the last stage - which confirms the positive trend of development of the temporary children's collective.

Based on the data of the three sociometrics, we can say that all the goals and tasks set by the teachers at the beginning of the shift are fulfilled, we managed to create a friendly, active detachment. Children who behaved quickly at the beginning of the shift became more confident in themselves, many claimed that it was here that they found real friends. Many of the guys learned how to allocate their time correctly. The camp becomes a place of actualization of the resources of personal development [9].

In conclusion we should say that the temporary children's collective makes influence on children positively, helps to realize their potential, adds self-confidence, and promotes the acquisition of new skills.

The most important thing is that the situation of communication with children of the same age, which is created in a temporary children's team, constant joint activity - all this allows to include any teenager in the circle of communication and can become a positive experience that can be used in the future.

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Аннотация. В статье рассмотрена динамика взаимоотношений во временном детском коллективе, выделены основные психологические особенности взаимоотношений подростков на разных этапах развития временного детского коллектива.

Ключевые слова: подростки, временный детский коллектив, метод социометрии, сплоченность, изолированные, лидеры, совместная деятельность.

Annotation. The article is devoted to dynamics of relations in a temporary children's group of teenagers. Also is considered, the basic psychological features of relations of teenagers at different stages of development of time children's group.

Keywords: teenagers, temporary children's group, sociometry method, group cohesion, outsiders, leaders.

FORMING COMMUNICATIVE COMPETENCES IN ENGLISH OF CADETS OF MARINE ENGINEERING DEPARTMENT BY MEANS OF PROBLEM-BASED LEARNING METHOD

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Introduction

According to the requirements, which are put forward to the content, learning methodology and final results of implementing degree programs in the field of technic and technology contained in the regulations of socio-professional organizations for accreditation of degree programs in Russia and abroad, two types of competencies are traditionally distinguished in the structure of modern engineer's competences [1–3]. They are professional competences connected to the sphere of engineering activity in its broad sense (the so-called hard skills) and key competences (the so-called soft skills). Nowadays among the most efficient techniques for developing communicative competences which are considered to be key competences problem-based learning is considered to be rather successful.

Overview

These two types of competences are closely connected and supplement each other. Key competences refer to skills which are critical for an efficient professional activity, including such as professional interaction in English, teamwork skills, ability to think creatively and realize innovative ideas, ability to organize the process of autonomous learning with regards to personal features and life long learning ability.

Some scholars and practitioners forming education development strategy for future engineers in the modern world agree that having possessing key competences is one of the decisive factors which determine success of the specialist's work in conditions when it is needed to respond to the challenges of time and to changes in socio-economic situation in the world promptly and adequately [4-6].

Nowadays the present high school accords high priority to introducing innovative methods into teaching process for successful forming of communicative competences in English. A proper combination of traditional and innovative teaching methods helps develop cognitive interests and creativity of cadets, their readiness for practical work. Within the context of the modern world which has been changing rapidly where competitive pressure is increasing with each passing day, lack of practical

experience and skills of marine engineering cadets may be a serious and crucial barrier to their employment and/or promotion. Consequently, modern teaching methods aimed at developing particular practical skills are gaining popularity. Implementation of various modern teaching techniques improves the process of mastering the material, teaches cadets to cogitate and employ in practice the knowledge received at the workshops. This article considers problem-based learning method which enhances understanding of study material and assists in applying what they have learned.

This method is getting popular in the west. Problem-based learning method (PBL) is viewed as a successful innovative learning method which promotes self-directed learning. In this method learning process is student-centered rather than teacher-centered, as the student plays a more active and decisive part trying to solve a practical task. PBL teaches cadets to comprehend broadly and deeply the language material introduced and practiced at the workshops. A number of attempts was made to give a definition to a notion “problem-based learning”. Howard Barrows who pioneered PBL at McMaster University in Canada gives a definition in terms of concrete attributes peculiar for this method. Among the latter such characteristics of PBL as personality-oriented nature, organization of the learning process around the problem and focus on work in small groups, where the teacher acts as a fascilitator, are mentioned [7].

While the content and structure of PBL courses differ considerably from one university to another and from one area of training to another, the general goals and learning objectives tend to be similar. PBL begins with the assumption that learning is an active, integrated, and constructive process influenced by social and contextual factors [8].

PBL contributes to development of cadets’ intrinsic interest in the subject matter, emphasizes learning as opposed to recall, promotes groupwork, and helps cadets to become self-directed learners.

Savin-Baden distinguishes five PBL models according to acquisition of knowledge and learning, existence of a problem, teacher’s and students’ roles and grades. These models are as following attainment of knowledge, PBL for professional work, PBL for interdisciplinary understanding, PBL for cross-discipline learning and PBL for critical competences [9].

In their analysis of the definitions of PBL, Graaff and Kolmos (2003) distinguish among three levels: the central theoretical principles of learning, specific models based on PBL and various practices that follow the guidelines of traditional educational models but incorporate elements of PBL in their theories, models and practices [10]. In simple terms, cadets are proposed some task or a problem, which is normally selected from the real

life, and “a set of tools” for its solution. The course can be organized in such a way that among the “tools” proposed for solution of a problem there may not be necessary ones.

That is, the cadets are given the direction “look for there” and they are suggested to fill the gaps independently. Students hereby can logically come to some conclusions and techniques. This learning process differs considerably from traditional organization of a teaching process, where students are at first given some theory and only afterwards – evidences and explanations. A reversal from a problem to theory frequently employed in PBL moves the students out of the state of passive reception and understanding of information, providing them with an opportunity “to reinvent the wheel” by themselves.

Among the advantages of PBL the following can be defined:

1. PBL motivates cadets to self-directed learning. As a rule, the cadets are determined to examine information in greater detail and to research much more material to solve the problem as compared to ordinary preparation for the workshop.

2. PBL teaches cadets to cogitate. It is insufficient to learn the offered material. Learning lexical units, rules and definitions is only the first step to understanding of the subject. Unfortunately, the requirements of higher schools to cadets are restricted to the task to learn long and complex texts of engineering specialties. It is impossible for marine engineering cadets to master maritime English without learning special vocabulary, but the latter is frequently perceived by cadets as a kind of ballast which can be offloaded, i.e. forgotten just after a credit or an exam. The learning process is really based on memorizing some language material. However, one has to realize that it is not an end in itself but only an instrument for mastering maritime English.

PBL motivates cadets to analyze and cogitate. Meanwhile the task is perceived as a kind of a game, and a material to be learned is perceived by cadets as rules which are to be followed but they may sometimes be neglected. Learning process is organized according to a suggested principle: problem – instruments for its solution (lexical and grammatical units) – finding a solution to a problem – a solution. The cadet understands why these or those language units and rules are of great importance and treats them in a different way.

3. PBL motivates cadets to think creatively. The correct establishing problem statement motivates cadets to look for nonstandard solutions.

4. PBL keeps cadets interested in mastering English. It is crucial for education process to be interesting and absorbing. The more actively cadet participates, the more interested he gets.

5. PBL prepares cadets for real life. This method provides with an opportunity to interrelate the theory and practice. Thus cadets realize practical aspects of English proficiency.

PBL may be used for forming various communicative competences, among which speaking and listening skills are the most vital for future marine engineers.

The following tasks can be used by a teacher of English in terms of PBL for forming speaking skills:

- A teacher prepares a set of situations or short dialogues that each involves a communication problem. (e.g. 'You are a Second Engineer. You assist a survey superintendent to conduct a maintenance inspection of the main engine on board your vessel. He asks you some questions and gives orders but he speaks very quickly and you find his accent difficult to understand. He seems irritated when you ask him to repeat himself. What do you do?') A teacher copies one set for each group, cut each situation up so that there is only one on each piece of paper and put them into an envelope or face down in front of each group. (Do not supply any answers.) Each member of the group should select one situation at random and read it aloud to the others. Together, they should discuss what the problem is, why it occurred and different ways to deal with the situation. Everyone should try to offer a solution and then the group should try to agree on one solution which is acceptable to all members.

- A teacher prepares a description of a difficult situation onboard a vessel which includes several different problems and writes the situation on the board and then divides the class into groups. The task is for each group to discuss all aspects of the situation and come up with a solution within a limited time period. One person in each group should write the key points of the solution on to a poster-sized piece of paper which they should display on the wall. The groups should walk around and read each others' solutions, comparing them and questioning other groups about their decisions.

The following tasks can be employed as a post-listening one for forming listening skills in terms of PBL. A teacher chooses or creates a conversation that focuses on an unresolved problem on board and give the students a detailed 'while listening' comprehension task to make sure that they understand the details of the problem. After listening, they can work in groups, taking on the roles of the people in the conversation and continue the discussion themselves in order to reach a solution that is acceptable to everyone.

It is to note that PBL has a number of disadvantages. And namely, only key language units are focused rather than learned thoroughly. While organizing English learning process exceptionally on the basis of PBL the

most part of content is given as topics for individual and independent study which will be further practiced at the workshops and discussed in small groups.

Conclusion

Thereby I may conclude that incorporation of problem based leaning into English teaching process may considerably enhance the quality of cadets' knowledge and contribute to the forming communicative competences in English. Nevertheless, this method is rather difficult, requires high professionalism and extra efforts from a teacher and cannot be used as a basic method of organizing all workshops of English. However, priority may be given to PBL tasks while forming communicative competences after acquisition of necessary lexical and grammatical units and also at the last workshops dedicated to the common topic in order the cadets to realize the practical significance of developed habits and formed skills.

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Аннотация. В статье представлены результаты исследования основных аспектов использования метода проблемного обучения для формирования коммуникативных компетенций на английском языке у курсантов-судомехаников, приведены его преимущества, недостатки и примерные задания, которые могут быть использованы в рамках этого метода.

Ключевые слова: метод проблемного обучения, коммуникативные компетенции, инновационный метод, курсанты-судомеханики.

Annotation. The paper focuses on certain aspects of using the technology of problem-based learning for forming communicative competences in English of cadets of marine engineering department, highlights its advantages and disadvantages, includes model tasks in terms of PBL.

Keywords: problem-based learning, communicative competences, innovative method, cadets of marine engineering department.

UDC 159.99

DRAMATHERAPY: MODERN TECHNOLOGY OF WORK WITH YOUNG PEOPLE

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Currently, social and psychological counseling, as well as psychodiagnostics and socio-psychological trainings are beginning to gain popularity in Russia.

These directions are excellent not only help, but also allow the social psychologist to identify differences in behavior among young people, answering the question: "What are the problems of youth are relevant?"

Using such interactive technologies, a social psychologist can identify characteristics of young people with different social problems. The methods of Art therapy in work with young people, its most popular direction "Drama Therapy" are in great demand.

In Russia, young people make up 22% of the total population, and this figure is increasing every year. The new generation replaces the old, thereby creating a new era in our world. Work with young people is very important, because the younger generation's adaptation to the ever-changing conditions will depend on their continued existence. A person is a social being, so working in a group is considered to be a more effective form of work

Drama was coined from Russian in the XVIII century of the Western European languages, although the basis is the Greek noun "drama" with the value "action". It depicts the private life of the individual and his conflict, both with society and with himself.

Drama therapy is the latest technique that allows a person to live a situation that affected his life. Such medical-educational discipline as dramatherapy was created by Jacob levy Moreno. It was he who created the "Theater of spontaneity" in Vienna and the "Therapeutic theater" in new York, which allow people to realize their gaming potential and cope with mental disorders.

It is worth remembering that the basis of this therapy is not based on drama, (emphasis on the situation itself), but on the art of theater, that is, acting out roles. After all, we are talking about solving the problem, which means the most effective way is not to lose the same situation constantly, on the contrary, playing the roles that are most affected at the time. The use of this technique is therapeutic in nature, so it is always able to cause a range of emotional experiences in humans.

The main tasks of drama therapy are the following:

1. awareness of their bodily and behavioral patterns;
2. development of spontaneity, the ability to improvise;
3. the development of "directing" his own life;
4. development of plasticity and plasticity, it can be both physical and emotional (cognitive sphere is not excluded);
5. the ability to change the worldview in relation to any situation;
6. the ability to complete the "unfinished Gestalt" or predict a new task.

Applications of drama therapy in practice

School. Active use of drama therapy originates in children from 7 to 15 years. Acting clubs, school performances, as well as various organizational activities help the child to gain communication skills, thus he/she feels more confident and thanks to this he begins to form a healthy self-esteem.

Universities. Here, drama therapy is most often used among students of the direction of training "Psychology" as a tool of professional training. The technique actively allows to already show their communication skills, as well as more serious about the tasks [1]. After all, in addition to acting, and playing roles, drama can affect deeper topics that relate to young people: finding yourself, a life partner, self-realization in a particular profession, etc.

Work. Here, drama therapy works well as a relief after a hard day's work. A person can professionally burn out at work, so the use of this technique will allow both to rally a new team and to defuse the situation among employees.

Taking into account the age group, which is aimed at this technique, we can conclude that it is relevant! After all, regardless of the age of the drama, the problems that most often disturb young people are closely related to the very specifics of this technique. This method solves a huge number of problems related to the situation in society, the ability to relax and change negative behavior. A person begins to control his emotions, acquires the ability to spontaneous actions and decisions, as well as develops imagination and self-confidence.

It is especially important to understand that each of us has its own individual needs that need to be taken into account. Unlike other areas, drama affects absolutely all human resources, which makes this technique really effective.

Thus, using this technique, which is increasingly gaining popularity in our days, we are expanding our consciousness, as well as a range of behavioral strategies that will help us to adapt to a particular situation in life. And all this is possible thanks to interdisciplinary connections at the intersection of science and art.

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Аннотация. в докладе рассмотрены актуальный и инновационный метод арт-терапии - «Драматерапия», ее создание. Данная технология арт-терапии рассматривается с точки зрения эффективного метода социально-психологических технологий работы с молодежью. Поэтому следует детально изучить данную тематику через изучение цели, задач и технологии использования. Главное достоинство методики - открытость в использовании во всех сферах деятельности и возможности внутренней саморегуляции.

Ключевые слова: драма, драматерапия, эффективность технологии, режиссура жизни, молодежь, терапевтический театр.

Annotation. the report discusses the current and innovative method of art therapy - "Drama", its creation. This technology of art therapy is considered from the point of view of the effective method of socio-psychological technologies of work with young people. Therefore, it is necessary to study this subject in detail through the study of the purpose, objectives and technology of use. The main advantage of the method – openness to use in all spheres of activity and the possibility of internal self-regulation.

Keywords: drama, dramatherapy, the efficiency of the technology, direction of life, youth, therapeutic theatre.

UDC 159.99

RESULTS OF THE STUDENT YOUTH'S QUESTIONNAIRE “DID YOU CHOOSE THE TRAINING DIRECTION RIGHTLY?”

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The study of the features of professional choice of students is becoming more and more relevant every year. Many young people try to choose not the direction of training, which is actually interesting and meets their needs and talents, and the most appropriate and comfortable pastime. It is a conscious choice of profession, direction of training that is a necessary condition for successful professional self-determination [1, 2, 3]. The results of this survey can determine the main trends in choosing the future direction of modern youth.

Empirical research "Did you choose the right direction of training?" was held in April, 2019. The number of respondents included students of Sevastopol State University in the number of 110 people (19 boys and 91 girls). The age of the respondents varied from 17 to 27 years. Among the sample, first-year students were 67, second – 11, third -14, fourth – 8, fifth – 3, master's students – 7.

The question about attendance showed that 80% of respondents attend classes regularly, 16% attend classes several times a week, 4% very rarely attend classes (Fig.1).

To the question "Do you Get a scholarship?" respondents answered as follows: 52 % of respondents do not receive a scholarship, 40% receive a scholarship and only 8 % of respondents receive an increased scholarship (Fig. 2).



Figure 1 – How regularly you attend classes Figure 2 – Do you get a scholarship

66% of respondents made their own choice of training direction, they were not influenced, 22% of respondents had family influence on the choice of training direction, 5 % of respondents – circumstances, 5% of respondents were influenced by teachers and 2% of respondents were influenced by friends (Fig. 3).

57% of respondents chose the direction completely independently, 32% of respondents had a minor impact, 5 % of respondents had a significant impact, 6 % of respondents did not choose the direction of training (Fig.4).

To the question "Did you show interest in the future direction of training at school?" we got the following result:

26 % of respondents showed no interest in the future direction of training, 46 % of respondents showed interest, 28 % of respondents actively showed interest in the future direction of training (Fig. 5).

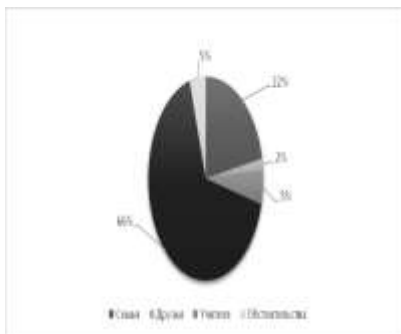


Figure 3 – Who influenced the choice of training

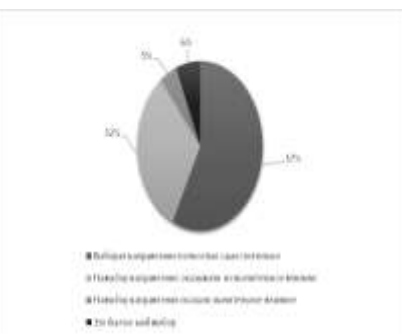


Figure 4 – Was your choice independent

41 % of respondents have professionally important qualities of the chosen field of training, 50% have professionally important qualities by 50%, 4% do not have professionally important qualities and 5% of respondents find it difficult to answer (Fig. 7).

To the question "What qualities should have a specialist in your chosen field" respondents gave the following answers: 12 % - sociability, 11% - attentiveness, 11% - stress resistance, 11% high intelligence, 10% - responsibility, 10% - tact, 7% - goodwill, 7% - understanding, 7% - concentration, 7% - empathy, 7% - diligence (Fig. 6).

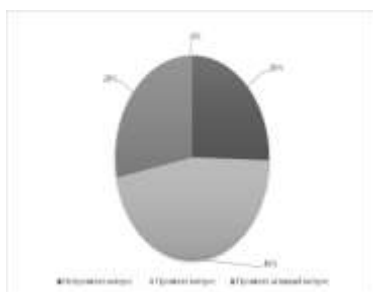


Figure 5 – Did you show interest at school

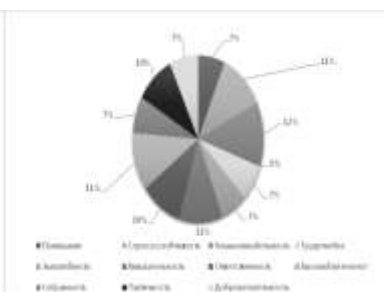


Figure 6 – What qualities should have a specialist

78% of respondents are interested in their future profession, 6% of respondents are not interested in future profession and 16% of respondents find it difficult to answer (Fig. 8)

65 % of respondents are confident that they will work in the chosen specialty, 9 % of respondents do not plan to work in the chosen field of training, 25% of respondents find it difficult to answer, 1% of respondents already works in the field of the specialty (Fig. 9).

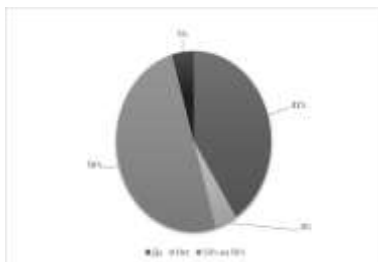


Figure 7 – Do you have qualities

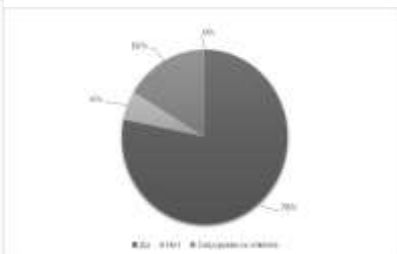


Figure 8 – You are interested in the profession

52 % of respondents are confident in the correctness of their choice and well represent their future professional activity, 34 % of respondents have a vague idea about the chosen profession, but they hope that in the beginning of practical activity everything will become clear, 7 % doubt the correctness of the choice and for 7% it is more important to get higher education than to estimate the area of professional activity (Fig. 10).

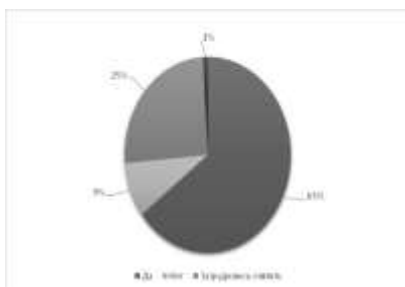


Figure 9 - Do you think to work in the chosen profession

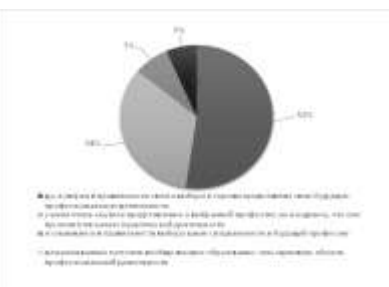


Figure 10 - Do you understand the content of your future profession well enough

It was found that 20 % of respondents are attracted by the process of work, as 20% of respondents are attracted by high material security, 15 % of respondents are attracted by contacts with people, 14% - the usefulness of the results, 9 % of respondents pay attention to the fact that the work is quiet, 5 % of respondents believe that the responsibility is very large, and it attracts them. 5 % of respondents are attracted by working conditions, 4% - independent decision-making, 4% - frequent business trips, 2% - proximity to the place of residence, 2% - romance (Fig. 11).

30 % of respondents believe that the result of their activities should be known only to a narrow circle of specialists, 30% - to the labor collective, 17% - to the whole country, 17% - to the whole world, 2% - to no

one, 1% believes that the results of labor activity should be evaluated by the spouse, 3 % of respondents find it difficult to answer (Fig.12).



Figure 11 – Why did you choose a specialty
 Figure 12 – Who should know the results of your activities

37% of respondents want their work to depend on the life and health of people, 30 % - only wages, 17 % - peace on earth, 13 % - the implementation of production tasks, 1% - the level of education in the world, 1% - nothing, 1% - all in total (Fig.13).

53 % of respondents would like not to think about work after its completion, 20% would like to continue thinking about work, 15% would continue to do it, 7% would not remember it, 2% of respondents would like work to become their hobby, 3% of respondents find it difficult to answer (Fig.14).



Figure 13 – Results of respondents' work Figure 14 – Employment after studies

Thus, on the basis of the study, we can make the following conclusions: the majority of students regularly attend classes, a little more than half of the respondents receive a scholarship, and the smaller part of them receive an increased scholarship.

Also, the choice of direction of the majority of students was most influenced by the family. The greatest number of respondents showed interest in the direction in school. Half of the respondents has professionally important qualities in their field of training. A greater percentage of students

are interested in the future profession and more than half of them is sure that they will work in the specialty, and more than half is confident in the correctness of their choice. A quarter of respondents wants the profession to depend on the life and health of people.

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Аннотация. В докладе рассмотрены результаты анкетирования студентов очной формы обучения, в рамках которого были выявлены возможные причины выбора будущей профессии.

Ключевые слова: анкетирование, выбор профессии, студенческая молодежь.

Annotation. The report reviewed the results of a survey of full-time students, within which possible reasons for choosing a future profession were identified.

Keywords: questionnaire, choice of profession, student youth.

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SELF-EXPRESSION AND SELF-DEVELOPMENT AS THE MAIN MOTIVES OF LEARNING FOREIGN LANGUAGES AMONG THE STUDENTS

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In our modern world and society expanding international and communication relations and affairs have a great importance, thus, there is a phenomenon when people begin to learn foreign languages. Both in home and foreign psychology there are a lot of works dedicated to researches of motivation and motives of learning foreign languages. This topic remains quite relevant if we look at some correlations between motives of learning a foreign language and age and education, especially among the youth, because this layer of society is open to new things and events of our constantly changing world.

The notion of a “motive” and “motivation” is widely used in philosophical, ethical, psychological, teaching works and science fiction, and different authors put different meanings into these notions. But taking this into account, we stop on a more detailed concept of a motive, and especially of a motive of learning.

Firstly, let us see the most popular definitions of the word “motive”. The easiest one is given in Russian Teaching Encyclopedia: “Motives – fr., sing. *motif*, lat. *moveo* – to move, – are the driving forces of any activity, that develop under the influence of the living conditions of the subject and define the direction of his or her activities”[3].

In Philosophical Encyclopedic Dictionary we can find this one: “Motives – fr. *motif*, lat. *movero* – move, in psychology, – is something that makes people do an activity and for what this activity is done”[4, p. 389-390]. In “Modern Dictionary of Psychology”, “motive is a choice that is encouraged by an exact action to satisfy one’s needs and goals” [5, p.373-376].

The term “motive” is used in all spheres of psychology that study all causes and instruments of determined behavior of a person. A lot of scientists contributed to the development of the psychology of motives like Wilhelm Wundt, Curt Levin, William James and others but the most famous one is Abraham Maslow who was supported the humanistic psychology and created an hierarchical pyramid of human needs, ranging from basic ones, like physiological, to the highest ones, like our needs in respect, dignity and self-realization. This theory was supported by Henry Murray, who was the first to define the term “motive of achievement” – it is an sustainable desire to do something successfully and achieve a certain level in any action quickly. This desire, to his mind, is an unconscious impulse to achieve perfection.

Nowadays the motives of achievement in learning is studied by home and foreign psychologists and teachers, who has made two groups of psychological characteristics of motives of learning: motivational, or substantial, and social, or dynamic. The motivational ones are:

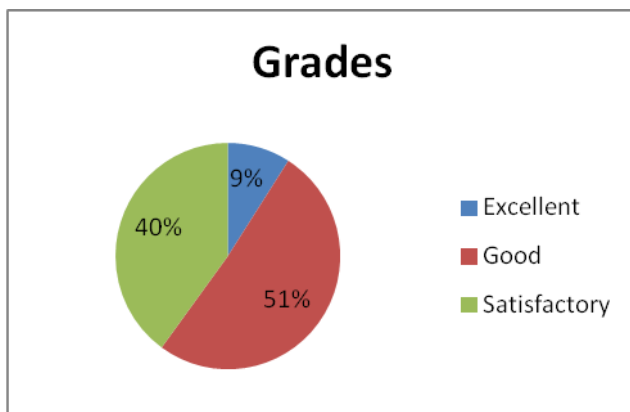
- 1) a pupil has a personal meaning of learning;
- 2) there is a powerful motive that influences on a pupil and the progress of learning;
- 3) the place of the motive in the general structure of motivation;
- 4) the independence in occurrence and signing of the motive;
- 5) the level of the motive's dissemination to different types of activities, subjects, forms of exercises.

The second group, the dynamic characteristics, describes forms and the dynamics of expression of these motives.

- 1) stability: a pupil studies willingly even against some negative external impact and hindrances or he or she doesn't want to study at all;
- 2) modality, that occurs in positive or negative motivation of studying;
- 3) other forms, like the strength of the motive, its evidence and rapidity of occurrence.

To study motives of learning foreign languages, there was a survey conducted for 105 young people aged from under 18 to 25 and older who are studying at school, college or university. Then there was a question "Specify your type of education", and 59% - are studying at university right now, 28,6% - are studying at school and others have already graduated or finished school.

To show the correlation between motivation of learning foreign languages and grades at school or university, there was a question suggested "What is your performance at school or(and) university?", the results are shown in the Picture 1.



Picture 1– The percentage of the grades of the respondent

Among the respondents who is studying at school the most popular answer is “Satisfactory” – 19 pupils. Among the students – “Good”, 32 people.

The next question was “How many foreign languages do you know\are you studying?” and it showed next results. The most popular answer among both students and pupils of schools was “Only one”. Less popular one was “Three or more” – only 13,3%, while one language is rated by 51,4%.

Other question “How many years have you been studying foreign languages?” showed that the bulk of respondents have been studying them for six years or more – 70,5%.

Furthermore, there was the question presented “How do you evaluate your level of the language?”. The most of the students and school pupils chose a variant “Average level” – 51,4% of respondents.

The last but not least is the question “For what purposes are you studying languages?”. We should notice that it was offered to them to choose two or more answers, and the results are shown in the Table 1.

Based on the results of the research, we can draw a conclusion. Speaking about those who are studying at school, we can note the correlation between their performance and motivation of learning a foreign language. People with satisfactory and low performance in most cases are likely to have decreased motivation or even its absence, among those who have good grades there is a medium degree of motivation that can be increased, and A-grade ones are characterized by a high degree of motivation that can be resulting from the desire to get only excellent grades, to grow in knowledge and discover the world.

Table 1. Answers to the question about the aims of learning foreign languages

To understand music, films and series, books in a foreign language	67,5%, where 25 – school pupils, 44 – students.
For self-development	60%, where 23 – school pupils, 41 – students.
There is an interest to foreign culture, language and way of life	49,5%, where 19 – school pupils, 31 – students.
For travelling	55,2%, where 18 – school pupils, 49 – students.
I was\am forced to study them at school or university	48,6%, where 18 – school pupils, 37 – students.
To have a linguistic profession	34,3%, where 10 – school pupils, 28 - students
To communicate and get acquainted with foreigners	37,1%, where 13 – school pupils, 24 – students.

The amount of years and time of learning influences motivation as well – judging by results, we can conclude that most of the students learn only one language because of their satisfactory grades and coercive studying. Looking at the motives of learning a language, it must be noted that among the school pupils the most popular reason is the possibility of understanding and acknowledging different types of entertaining content in different languages. Among the students – the same reason, adding the possibility to travel and for self-development. It reflects an increased level of consciousness and determination to broaden one's horizons. Moreover, more and more people, due to their studies, are interested in travelling in order to practice their language skills with native speakers, experience the atmosphere and learn all the nuances and aspects of the language.

Now let us summarize all the information above. The brief analysis of psychological, teaching and sociological works lets us understand the concept of the motive – it is the force that makes people do a certain activity for a certain purpose. The motives of learning have been studied by different scientists, nevertheless, this problem still remains opened for further researches, because every human has a unique personality that consists not only of the basic but the highest needs, which are characterized by individual skills, level of education, IQ e.t.c. The motives of learning have their peculiarities as well, and we can judge the meaning of the motive, its strength, evidence and rapidity of occurrence by them. In our modern public situation, when foreign languages demand learning, the youth is motivated by thrive to acknowledge foreign culture, that is promoting intensively by mass-media, also self-expression and self-development.

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Аннотация. В статье осуществлен краткий обзор понятия «мотив», «мотивация», рассмотрена природа мотивов учебной деятельности, обозначен вклад как отечественных, так и зарубежных педагогов и психологов в развитие теории мотивации. Отталкиваясь от исследований в сфере социологии и психологии, автор делает выводы о различном характере мотива изучения иностранного языка (языков). Проведенный автором статьи опрос выявил особенности мотивов изучения иностранных языков у школьников и студентов, а именно саморазвитие и самовыражение как основные мотивы изучения иностранных языков среди студентов.

Ключевые слова: мотив, мотивация, изучение, иностранный язык, студент.

Annotation. In the article there is a brief review of a concept of “motive”, “motivation”, nature of the motives of studying, contribution both home and foreign teachers and psychologists to the development of motivation theory is stated. Proceeding from the researches in the sphere of sociology and psychology, the author draws a conclusion about special nature of motives of learning foreign language or languages. A survey done by the author revealed different correlations between age, education and motivation of learning foreign languages among the young, exactly the self-expression and self-development as the main motives of learning foreign languages among students.

Keywords: motive, motivation, learning, foreign language, student.

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PERSONAL CHARACTERISTICS OF THE RISK-INCLINED STUDENTS OF THE MILITARY SCHOOL

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At present, the urgency of the problem of researching individual psychological characteristics that determine the propensity to take risks among young people is due to the understanding that students in their work constantly have to deal with situations that require them to make a quick decision [5]. Actually, in these conditions, a wide range of personal characteristics is manifested, which in turn can influence the decision-making process and show whether a young person can take a risk or not. Which in turn is an important parameter for predicting the determinants of students' activities and behavior.

The concept of risk is very broad and covers various aspects of human life. Every person is faced with situations that seem ambiguous and require a decision. Risk is a continuous and not eliminable element of any social activity, it is not just some kind of sociocultural environment or condition of action, but also an integral part of sociality [3].

The analysis of research studies showed that for the first time the etymology of the word "risk" N. Luhmann attempted to predetermine in their writings in 1994. This term began to appear in Europe already in medieval sources. However, it became popular only from 1500 with the beginning of printing, primarily in Italy, Spain, and touched a collection of very different spheres of scientific knowledge [5].

O. Rennes, analyzing the nature of the origin of the risk and its meaning, writes about what presents significant importance in the life activity of both society and the individual. He affirms that this phenomenon contributes to the development of personality [8].

Considering risk in the context of military specialization, R.A. Abdurakhmanov and A.Ya. Antsupov writes that the concept of "risk" is fully revealed in the aspect of active preference by the subject of a dangerous variant of the event - a safe one [1]. Analyzing the concept of "risk" in the life of students of a military school, it should be noted that it is not fully possible to exclude its manifestation, since it is an integral part of this specialty [2].

The relevance of the study of the psychological characteristics that determine the propensity to take risks for students of military schools, in the future military personnel, has led to the understanding that people in this profession constantly have to deal with situations that require them to make quick decisions. Actually, in these conditions a wide range of personal characteristics is manifested, which in turn can influence on the decision-making process and show whether the student will be able to take risks or not.

The purpose of the article is the identification of personal characteristics of third-year students of a military school with a different level of risk tendency.

The experiment was attended by 27 military school students aged from 19 to 24 years of the third year of study. The sample consisted exclusively of representatives of the male gender.

To implement the goals set in the work, and also to conduct an empirical study, the following methods were chosen: for revealing risk tendency — the method “Diagnosing personal readiness for risk” [A.M. Schubert [6], test questionnaire for quality components of risk tendency “Risk features” (O.P. Sannikov, S.V. Bykova) [7], projective methodology “Placing yourself on a conditional risk scale” (O.P. Sannikov, S.V. Bykov) [7], for studies of individual psychological traits of personality - the sixteen-factor adaptation of Cattell (in the translation A.N. Kapustina, L.V. Murgulets and N.G. Chumakova) [4].

The results obtained in the course of the study according to the method of A. M. Schubert made it possible to diagnose a high level of risk in 56% of the test subjects (15 people). What says about the desire to achieve the goal, regardless of external circumstances, independence, inclination to dominate and excessive impulsiveness in behavior.

The owners of the average level of values were 8 people and made up 30% of the sample. Such data indicate a rare manifestation of risky actions and are more situational in nature.

Caution in behavior showed 15% of the subjects (4 people). This indicates a lack of propensity to take risks and can be caused by the internal uncertainty of the subjects or the unsuccessful experience in the past.

The second stage of the study was the diagnosis of the prevailing quality indicator of the propensity to risk in the sample using the "Risk features" technique of O.P. Sannikov, S.V. Bykov. Mainly among cadets with different levels of risk tendency, the prevailing type of risk in each group was distinguished. The results allowed us to state the prevalence of the emotional component in the study participants who have high (73% out of 11 students) and moderate (50% out of 8 students) levels of risk tendency. This indicates the variety and intensity of emotional experiences associated with the phenomenon under investigation. The situation of experiencing risk brings to people a vivid emotional palette of a different sign and modality. Among the 50% of study participants (2 people) with a low level of risk readiness, the prevalence of the control and regulatory component was revealed. That indicates the manifestation of mental activity aimed at self-control and self-regulation. This category of students is

characterized by a tendency to assess and control their own "risky" experiences, thoughts, actions and moves.

To determine the level of self-esteem, the projective technique was used "Placing yourself on a conditional risk scale" (O.P. Sannikova, S.V. Bykova). The results obtained revealed that 13 cadets (84%) out of 15 with a high level of risk tendency had a high level of personal self-esteem. This testifies to the appreciation of the subjects of their personal qualities, capabilities and merit, as well as confidence that the failures occurring with them are more a coincidence than a circumstance depending on themselves.

Groups of subjects with medium and low levels of risk readiness were characterized by lower levels of self-esteem. Thus, its high level was detected in 50% (4 people) of cadets who have a situational risk type and in 25% with low readiness for it. This indicates that these categories of subjects are less self-confident, underestimating their qualities and merits. From the above, we can conclude that the higher the level of personal self-esteem, the higher the risk tendency for students.

The final stage of the study was the diagnosis of individual psychological personality traits of students with different levels of risk tendency using the Cattell questionnaire (in adaptation by A.N. Kapustina, L.V. Murgulets and N.G. Chumakova) and the test of A.M. Schubert. The results showed that the studied with a high level of risk readiness dominated by such qualities as: high intelligence, cruelty, practicality, self-confidence, high self-control. Such results suggest that abstract thinking, ingenuity and fast learning are characteristic of this category of people. In decision-making, they, for the most part, are not guided by impulsivity and emotionality, but by the cognitive component, while focusing on generally accepted norms and focusing attention on trifles. When taking a risky action, students are confident in their actions and purposefully and methodically go to achieve their goals. It is necessary to note masculinity, rationality, practicality and some rigidity in making decisions.

The following psychological characteristics were diagnosed for subjects with a medium risk level: low intelligence, cruelty and high self-control. From which it follows that the taken risky action is situational in nature due to the developed self-control. Such people follow their own ideas about themselves, control well their emotions and behavior. Their inherent focus and integrativeness contribute to bringing the goal to the final result.

Students who do not have a propensity to take risks, but rather the opposite — some caution is characteristic of their behavior, have become carriers of such traits as: straightness, conservatism and cruelty. Such data testify to stability in relation to traditions, and as a result, a dubious attitude to new ideas, a tendency to moralization and moralizing. Since here there is

a negativism in relation to change, then the propensity for risky actions will be low.

Thus, the study showed that students of a military school with a high level of risk tendency are dominated by such psychological characteristics as self-confidence, high level of self-esteem, rigidity and focus in the situation of the need to achieve the desired result. This category of subjects experiences vivid emotion when taking a risky action.

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Аннотация. Статья посвящена описанию феномена риска в современной психологической науке. В данной статье рассмотрены особенности проявления риска среди лиц военной специализации. В статье с помощью эмпирического исследования предпринята попытка выявить индивидуально-психологические особенности у курсантов с различным уровнем склонности к риску.

Ключевые слова: риск, склонность к риску, индивидуально-психологические особенности.

Annotation. The article states the phenomenon of risk in modern psychological science. The features of risk among persons of military specialization are described. The article attempts to identify individual psychological characteristics of students with different levels of risk tolerance by means of empirical research.

Keywords: risk, propensity to risk, individual psychological features.

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PECULIARITIES OF COGNITIVE PROCESSES OF STUDENT TRANSLATORS AND INTERPRETERS

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Nowadays, there are a variety of ways of doing personality testing at the present stage of development of psychological science. People of different ages, confessions and beliefs google for different variations of tests every day. These variants vary depending on the age. Some carefully select a compatibility test, others are trying to determine their psychological age. But "Schulte Table" and Cattell's IQ test are the most common tests among the younger generation.

If you check the statistics of the requests of such search engines as Yandex and Google you will be surprised that this kind of requests are found even more frequently than requests of "funny cats" kind of videos. So, what can this method of the German psychiatrist and psychologist Walter Schulte with his world-famous tables that have the same name really be?

Tables, designed by the German psychiatrist Walter Schulte in the middle of 20th century, are a set of cards with randomly placed numbers on each. The task of the subject is to name all the numbers in the correct order, pointing them out with a pointer or by crossing them out with a pencil if it's convenient for the subject. The traditional version of the stimulus material is 5 tables 60x60 cm, made on thick paper. Each sheet should be divided into 25 squares with numbers from 1 to 25 inscribed in them.

The diagnosis helps to explore: stability of attention; efficiency of independent work; mental stability; speed of approximate search movements of a look; volume of attention.

The method is to train and improve peripheral vision. This is the key to speed reading, as it reduces the time spent searching for certain information in the text. That is, the tables do not only perform a diagnostic function, but also serve as a speed reading simulator. At one of on the Psychology seminars students of the Sevastopol state University were offered to pass

such a test by the method of Schulte. 106 student of linguistics and translation studies took part in the diagnostics. The total number of students of the Faculty of Translation and Translation studies that participated in the diagnostics was much bigger [2].

Cognitive processes, first of all, are necessary for orientation in space, adaptation. During human development mental processes become arbitrary, conscious and mediated. The technique of the Schulte table was used to study selective attention, in which the following indicators are distinguished:

- A) the efficiency of selective attention;
- B) the level of workability;
- C) the level of the attention stability

Pic 1 shows the results of the diagnosis on the criterion of the efficiency of attention.



Pic. 1 – Percentage of indicators of the efficiency of attention of subjects

Thus, with the passage of 5 tables Schulte 68 students spent an average of 28 to 30 seconds, which is the average for all subjects aged 18 to 25 years. The best result was shown by 30 students, who have completed the test on average for a time that is less than 28 seconds, the remaining 6 students had an average of more than 30 seconds. The results of the first and second groups of students are high. The results of the students, who were included in the number of 6%, say that they have something to work on.

The second indicator of selective attention is the level of workability. The results are shown at the pic 2.



Picture 2 – The percentage ratio of indicators of workability in the studied sample

The results of this testing showed an index of 1.3. The level of workability, which was determined by 14 students, says that they need more time to get involved in the work. The index of 1.0, which was determined by 49 students, is the average for the student age. This number is a conditional facet of the level of workability, It's normal and indicates a good degree of workability. The index of less than 1.0 was determined by 41% of the subjects. An index of less than 1.0 indicates a high level of workability and that a person is able to get involved in the work instantly, which is an excellent quality for students.

The level of stability of attention - the final index is less than 1.0 indicates a good level of stability of attention, respectively, the higher this indicator, the worse the mental level of stability of attention of the subject (Pic. 3).

So, the index of less than 1.0 one was shown by 62 students; 1.0 by 30 students; 12 subjects received a result greater than 1.0.

Summing up the results of testing of students of the Faculty of theory and practice of translation, we can conclude on average 60% of students has a high level of selective attention, the level of workability and the level of sustained attention by the methodology of the Schulte Table. On average, 30% of students show good, average results and only the remaining students came to the conclusion that they should work on improving each of the indexes.

We used R. Kettel's test to study the General cognitive ability of intelligence. Students had to determine the intelligence quotient (IQ) [1], which is an integral indicator of the intellectual development of the subject. The results of the students were determined and called at once, thus out of the total number of students of 106 people:

- total amount of 65 points, i.e. 101 points (IQ) = 43 students
- the total amount of 65-72 points, i.e. 101-111 points (IQ) = 38 students

- the total amount of 72-77 points, i.e. 111 - 121 points (IQ) = 23 students

- total amount of 77+ points, i.e. over 121 points (IQ) = 2 students

Thus, it can be concluded that the level of IQ is high or above average for students practicing foreign language learning. According to the generally established rules, the world knows that a person with an IQ less than 49, a priori, will not be able to apply for a high position. The employer will most likely offer the candidate a position no higher than of a "cleaner Manager" or of a loader.

In the work of an interpreter, one needs to have a clear idea of what kind of memory prevails in them, since this professional activity is associated with working with a large amount of information. Therefore, it was interesting to identify the features of the predominant type.

The predominant type of memory is determined by the method of differently presented words. Psychological testing consists of four phases. At the first stage, the words to remember are given for listening. At the second – visually, and each word should be correctly written on a separate card. At the third stage, the motor-auditory form of presentation is used and at the fourth – a combined form, which combines auditory, visual and motor perception of the material. A series of 10 words is enough to prepare to determine subjects type of memory in order not to mentally exhaust them. Thus, the leading type of memorization of 106 student, is mainly the visual and the combined one. This is a standard practice for people involved into learning languages, as the study mostly involves a well-developed type of visual memory. This allows to them to remember the words after they were once added to the vocabulary. It is easier for students with a combined type of memory to remember audio material or tips and guidance of his professors [3].

Thus, we can draw the following conclusions after having done all three tests of the features of attention, memory and intelligence of the students of the Faculty of theory and practice of translation:

1) Students who have chosen this specialty must have a high level of selective attention, the level of workability and stability of attention. Out of the 106 students, about 70% have the necessary characteristics.

2) By determining their IQ level students found out that it is above average for most of them and a smaller percentage of the subjects has a high IQ level.

3) Determining the predominant type of memory, we came to the conclusion that the prevailing type is visual and combined.

Summarizing everything that was said above, it should be noted that this article was aimed at determining the necessary level of skills for the

profession of translator and interpreter for a successful career in this sphere. Also, this article is informative for students who have decided to connect their lives with the translation, it will provide a list of the necessary abilities that a translator must have. But one should not blow off the desire of joining the ranks of the interpreters, if your results are not high. They are to be improved, you just need to make a little effort.

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Аннотация. В статье описаны и определены ключевые особенности психических когнитивных процессов будущих переводчиков и переводчиц.

Ключевые слова: умственные познавательные процессы, внимание, память, уровень IQ, студенты-переводчики, переводчицы.

Annotation. The article describes and identifies key features of mental cognitive processes of future translators and interpreters.

Keywords: mental cognitive processes, attention, memory, IQ level, student translators, interpreters.

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VIABILITY AS A FACTOR OF SUCCESSFUL PROFESSIONAL ACTIVITY OF FIREMEN

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In the process of performing professional tasks firefighters are influenced by a number of stress factors that cause a high level of physical and neuropsychic tension of work. Among the main professional tasks of

firefighters are rescue of people injured during fires, at the same time, life and health of firefighters as well.

A number of scientific researches are devoted to the problems of professional activity of employees of extreme profile. In particular, different aspects of professional stress were investigated by V.A. Bodrov [1], L.A. Kitaev-Smyk [3], A.B. Leonova [2], psychological features of professional activity of firefighters were considered by A.P. Samonov, M.I. Maryin, G.O. Netsky [2]. A significant number of scientific papers is devoted to the issue of professional-important qualities of fire (Osipov A.V., Dikina J.A., Marin M.I. [4]), including the physiological and character features of the person, the combination and severity of which may contribute to the effectiveness of a professional in extreme conditions.

According to S.L. Rubinstein's point of view, the founder of the concept of conscious activity of the individual, aimed at overcoming life obstacles and self-determination, a "Man is a responsible subject of his/her own life, able to independently build the conditions of life and his/her attitude to it" [7, p. 171].

S.L. Rubinstein also emphasizes the ability of a person to create himself/herself as a subject of overcoming. According S.L. Rubinstein, personality is a join set of internal conditions through which all external influences are refracted. Internal conditions act as the causes and driving forces of development, and external conditions – as the circumstances in which the development and formation of personality [7].

S.L. Rubinstein states the importance of the internal conditions of human development, which is important for understanding the meaning of the concept of resilience introduced into psychology by the American psychologist S. Maddy, who designated it as one of the key resources that affect the ability of the individual to overcome difficulties arising on the path of life [5].

According to S. Muddy's concept, viability is the ability of the individual to conscious activity: the quality of personality, through which a person takes an active life position in relation to what is happening, aimed at overcoming obstacles, transforming reality, processing and assimilation of life experience in order to use it on the way to goals.

Thus, if we consider professional activities, the external conditions will be ones connected with specialists' performance of professional tasks. These are the extreme conditions of professional activity of firefighters. The internal conditions for overcoming external obstacles will be those values and goals which are priorities for entities engaged in activities.

The internal conditions of human development, including in the context of professional activity, can be attributed primarily to the

components of the value-semantic sphere of personality: personal values and life meanings, personality. It is through the prism of personal meanings as internal conditions that human activity is refracted and then unfolds to overcome external conditions and circumstances.

According to S.L. Rubinstein, an important internal factor that contributes to the realization of value-semantic attitudes of the individual is the will. It is by means of volitional acts that the implementation of personal attitudes to overcome external and internal obstacles takes place [7].

As already mentioned, the theory of personal quality of vitality with the theories of stress resistance was developed by the American scientist S. Muddy. The concept of "viability" reflects, from the point of view of S. Muddy, psychological vitality and enhanced effectiveness of a person, as well as an indicator of his/her mental health [6]. He also developed a methodology for measuring "viability", based on the study of the scales of the Minnesota Multifactor personality questionnaire. The concept of "viability" characterizes a person's attitude to change, his/her ability to use and manage the available internal resources in order to overcome the difficulties, both those that he/she faces every day and those which are extreme. S. Muddy presented "resilience" as a set of three characteristics describing 3 levels of the relationship of the individual to the world, namely: inclusion, control and acceptance of risk [5].

In connection with the need to assess the success of the professional activity of firefighters, subjective criteria of success were identified and justified that meet the assumption of the special role of the psychological factor in the professional activity of firefighters:

- the presence of professionally important personal traits;
- positive professional self-attitude;
- the level of job satisfaction;
- level of personal self-efficacy;
- the level of professional decline.

The purpose of this empirical study was to identify and analyze the relationship between the level of development of resilience and subjective indicators of the success of the work of firefighters. The study involved 25 people – firefighters of fire units 1 PSO FPS in the city of Sevastopol: men from 25 to 47 years with experience work from 2 to 10 years.

For psychodiagnostics the following methods we used: test of viability of S. Maddi in adaptation of D. A. Leontiev; method of determination of satisfaction with work of A.V. Batrashev; scale of general self-efficacy of R. Schwarzer and M. Erzalem in adaptation of V.G. Romek; method of diagnostics of professional self-relation of personality" Karpinski K.V.;

method of diagnostics of professional burnout (K. Maslach, S. Jackson, in adaptation of N.E. Vodopyanova) [4].

To test the hypothesis, the data obtained were statistically processed using Spearman's correlation criterion, the results of which are presented in Table 1.

Table 1 – Results of statistical data processing using Spearman correlation criterion.

Variable	Variable	N	Importance	Correlation coefficient	Feature
viability	professional self-relation	25	$P \geq 0,05$	0,673	moderate
viability	self-efficacy	25	$P \geq 0,05$	0,554	moderate
viability	satisfaction with professional activity	25	$P \geq 0,05$	0,41	weak
viability	emotional exhaustion	25	$P \geq 0,05$	-0,56	moderate

Thus, it was revealed the presence of statistically significant relationships between resilience and most of the studied subjective indicators of professional success: professional self-attitude (0.673), personal self-efficacy (0.554), emotional burnout (-0.56). There was no statistically significant relationship between resilience and job satisfaction (0.41).

Accordingly, we can say that with the increase in the level of vitality increases the indicator of positive professional self-attitude. Professional self-attitude is a reflection in the mind of a specialist of the objectified level of development of those personal properties that contribute to the successful implementation of professional activity.

With the increase in the level of vitality, the specialist's assessment of their personal effectiveness increases as well. Despite the fact that self-efficacy is a self-assessment of a person's capabilities and abilities, it is objectively related to the real achievements of a person in different areas of his life, including in the field of professional implementation.

Also vitality prevents specialist' professional depression: the higher the level of vitality, the less a person is exposed to emotional decrease in the profession sphere, and is able to maintain a sufficient level of functional and psycho-emotional state necessary for the successful performance of professional activities. At the same time, resilience does not have a significant impact on the level of satisfaction with professional activities.

On the basis of obtained data, we can say that the proposed hypothesis of the study was confirmed: the level of development of personal quality of vitality affects the success of professional activity of firefighters.

Due to the empirical obtained data, practical recommendations were developed to improve the resilience of firefighters and can be used as part of the preventive work of psychologists of the Emergency Psychological Service of Russia.

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Аннотация. В работе рассмотрена проблема жизнестойкости как качества, описывающее способность и готовность человека активно и гибко действовать в ситуации стресса и трудностей, которое можно рассматривать как интегральную оценку личностного потенциала

специалиста экстремального профиля, в данном случае – у пожарных. Статистический анализ полученных показателей жизнестойкости и профессиональной успешности пожарных показал наличие статистически значимых корреляционных связей жизнестойкости с большинством показателей профессиональной успешности.

Ключевые слова: жизнестойкость, профессия, показатели успешности профессиональной деятельности.

Annotation. The paper considers the problem of viability as a quality that deals with the ability and willingness of a person to act actively and flexibly in a situation of stress and difficulties, which can be considered as an integral assessment of the personal potential of a specialist of extreme profile, in this case – in firefighters. Statistical analysis of the obtained indicators of resilience and professional success of firefighters showed the presence of statistically significant correlations of resilience with most indicators of professional success.

Keywords: viability, profession, indicators of success of professional activity.

SECTION 10: PHILOLOGY



UDC 811.111

LANGUAGE MARKERS OF GENDER ORIENTED ENGLISH- LANGUAGE ADVERTISING SLOGANS OF PERFUME BRANDS

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Introduction. Advertising is a bright phenomenon of today's reality. On the one hand, accumulating the experience of society, it reflects the social, economic, political, spiritual, ideological processes and relations, on the other hand, it forms the strategies for the development of all these processes. To achieve marketing goals advertising aims to reach the target audience as fully as possible. Creating an advertising message tailored to the specifics of the target audience, including its gender features, leads to its effectiveness.

There is a lot of research on advertising text devoted to the analysis of its structural, semantic, genre and communicative peculiarities (S.V. Gusenko, O. I. Zelinskaya, Kh. Kaftanjiev, L. A. Kochetova, Yu. B. Pikuleva, Ye. A. Selivanova, K.V. Shido, etc.), stylistic and semiotic characteristics (N. L. Kovalenko, Ye.Ye.Tkachuk-Miroshnichenko, etc.), studying the pragmatics of advertising text (A. A. Vornachev, T. V. Gulak, O. V. Dmitruk, V. V. Zirka, M. L. Kramarenko, N. S. Lissa, etc.). Few dissertation studies a gender problem of advertising text (Ye.V. Vetlitskaya) [1], M. P. Gnativ [2], M. V. Semkina [4] etc. At the same time linguistic problems, connected with the realization of communicative strategies of influence in advertising slogans, tailored to the specifics of language markers of gender oriented English-language advertising perfume brands slogans, have not yet been the subject of a special research.

Necessity to reveal ways of linguistic representation of gender features of advertising slogans, to describe their communicative-pragmatic functions, as well as to describe «the structure and semantics of the advertising text, followed by the identification of the creolized text mechanism of impacting the addressee» [1, p.4] determines the relevance of the research.

The research goal is to reveal the language markers of gender oriented English-language advertising slogans of perfume brands in the context of the realization of the advertising message communicative and pragmatic objectives.

The actual research material consists of 500 English-language perfume brands commercial advertising slogans, that function in contemporary world advertising space.

The main part. Creating an advertisement, an advertiser, in the first place, directs his message to a particular consumer group. Creator of advertising anticipates predictable reactions of the audience to the message, simulates the process of reception of the text by the recipient. This is largely determined by the purpose of the ad text which is to interest the recipient in the properties of a particular subject and thus encourage the addressee to buy it or use it. It is precisely this purpose that makes it possible to use in the text of the advertisement exclusively positive evaluations of an object that will affect the positive choice of the subject of the advertisement. Eg: *Very elegant, very cheerful, very yours ...Givenchy; So delicate. So Beautiful. Estée Lauder.*

The appeal to gender in advertising depends on the target audience. Some gender features of advertising slogans of perfumes are related to the orientation of products for male (*A gift for the man, calling passion . TSAR*) and for female audience (*A dream for a woman. Noa Dream. Cacharel*).

Concepts of «masculinity» and «femininity» have a categorical nature and appear as links of a dual associative relation: first, as links of the metonymic association of man → masculinity / woman → femininity, the dominant source of which is the bodily essence of man and woman, and realm of purpose - abstract essence of masculinity and femininity; and secondly, a number of associations, lying in the base of the orientational metaphor, as they are the result of «embedding» the concepts of «masculinity» and «femininity» into the system of social and cultural motivated axiological landmarks of the English-language cultural tradition [5, p.8].

The rational motive gender base doesn't almost use in the advertising slogans (*Caron for Men. Caron. Les Plus Belles Lavandes*), but the figurative, expressive means of accentuating masculinity and femininity

prevail: *Intuition For Men. ESTEE LAUDER; The Style makes the man. Chanel Allure Homme; One In A Million CHANCE For Women. Chanel CHANCE ; The Scent Of A Woman. Chanel* °5.

The emphasis is on imagery, expressiveness associated with age specific features of the target audience. So, for example, epithets *elegant, spirited, young* and state phrase *woman in love* in the advertising slogan *For elegant and spirited young woman in love. Miss Dior* in combination with the brand name component provide a focus on perfume for young women. The advertising slogans of the macaronic type using English words *perfume, for* and the French phraseological unit *Femme Fatale* target the advertising slogan *Perfume For Femme Fatale. COCO by CHANEL* for a more mature female audience.

Advertising slogans are created taking into account the model of an abstract, imaginary addressee, which is understood as «the embodiment of the most common features of the ideal recipient, able to understand both the explicit and implicit content of discourse» [3, p.9].

Lexical and semantic, functional and stylistic specificity of creation of slogans determined by the model of the addressee and its typological properties. For example, the original epithet *allure* in the advertising slogan *Chanel Adds Extreme To Allure Homme. Allure Sport Extreme* emphasizes the orientation of perfume to the audience of men who have an extraordinary vitality. The epithet *alpha* in the advertising slogan *Chanel Fragrance For Alpha Men. Allure Homme Blanche* is aimed at men with dominant sexual activity.

Some gender roles are manifested somewhat differently in the advertising perfume discourse. So, the temptation of a woman who cares about her appearance emphasizes the expression *feminine look* that we can see in the slogan *For that Feminine Look You Always Wanted. Rachel's Wigs & Beauty Salon*.

Perfume advertising for men is aimed at an audience of real, strong, sensual and free men. The accentuation of the perfume benefits, which is intended for real men, is manifested in slogans: *Separates the men from the boys. Baldessarini; Men's power. Estee Lauder*. The phraseological unit *free man* outlines a specific segment of the male audience: *Odour of a «free man». Yves Saint Laurent. L'Homme Libre*. Advertising slogan *Sensual Men's Allure By Chanel. Allure. Homme Sport* is addressed to sensual men.

Taking into account the psychology of the consumer and using the psychological motives in advertising, creators appeal to the motive of importance, self-realization and self-satisfaction. Focusing on the female audience and realizing that every woman wants to be the only one, first and

unique, advertisers emphasize that the perfume is designed for the unique (*Every woman deserves to be first. Van Cleef & Arpels; One In A Million CHANCE For Women. Chanel CHANCE*), rare women (*Rare Fragrance For Rare Women Chanel CHANCE. Eau Fraiche*).

The functional and stylistic means, used in slogans, segment the target audience. So, the French expression *Femme Fatale* delineates a circle of fatal female consumers or those consumers who want to be such women (*Perfume For Femme Fatale. COCO by CHANEL*). The epithet «provocative» is directed to the category of women-temptresses (*Provocative woman. Elizabeth Arden*). Using the metaphor «queen», comparison «like a queen», advertisers attract the target group of women with high self-esteem, seeking to raise the self-image (*Be Queen of the Night. Dior. Addict; Feel like a queen Cristina Aguilera. Royal Desire*).

Aphoristically sounding slogan *Femininity is timeless. Chanel 5* is aimed at women, who are committed to the classic concepts of feminine beauty, positioning femininity as its dominant.

Targeting the audience, advertisers use gender-oriented precedent phenomena.

So, the slogan *A new Cinderella is born. Dior. Midnight poison* produces cultural meanings that are attractive to young girls: perfume, like a fairy wand from a famous fairy tale, can turn an ordinary girl into a fairy princess.

Unlike the features of artistic discourse in the advertising discourse, relating to the promotion of perfumes, masculine is mainly accentuated by the appeal to the symbolic image gender characteristics, such as «Macho», «Owner», «Head», «Defender», «Knight» (*Separates the men from the boys. BALDESSARINI; The gentlemen is back. Givenchy. Pour home*), feminine is mainly accentuated by the appeal to the symbolic image characteristics, such as «Lady», «Queen», «**Temptress**» (*Preparing to be a beautiful lady. Pears; Feel like a queen. Cristina Aguilera. Royal Desire; Be Queen of the Night. Dior Addict*).

Even the image of a business woman is emphasized very rarely. Purely male and female characteristics are predominant: *Men's power. ESTEE LAUDER; Every woman deserves to be first. Van Cleef & Arpels; A woman able to win from the very first glance. Agent Provocateur. Maitresse*.

Contemporary gender transformations in society lead to the emergence of unisex products. Accordingly to this trend, the lexical-semantic content of the advertising slogans changes. Eg: *All ages, all races, all sexes. Mac Cosmetics*.

Conclusions. The advertising slogans of perfume brands are focused on women, men and mixed audience (unisex). Gender oriented English-language advertising slogans of perfume brands, which function in modern advertising space, appeal to the emotional psychological motives of advertising message. The manifestation specificity of masculinity in advertising slogans shows that appeal to the symbolic gender characteristics of potential consumers, such as «Macho», «Owner», «Knight», prevails. Accentuation of femininity is demonstrated mainly by symbolic image characteristics: «Lady», «Queen», «Temptress». Gender orientation of the English-language slogans of perfume brands is mainly provided by lexical and phraseological, functional and stylistic means. There is a functional and pragmatic correlation of linguistic markers and gender orientation of an advertising message.

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Аннотация. В статье рассматриваются гендерно ориентированные англоязычные рекламные слоганы парфюмерных брендов, функционирующие в современном рекламном пространстве. Охарактеризована специфика манифестации в рекламных слоганах гендерных ролей потенциальных потребителей. Выявлены лексико-

фразеологические, функционально-стилистические маркеры гендерной направленности англоязычных слоганов парфюмерных брендов. Установлена функционально-прагматическая корреляция языковых маркеров и гендерной ориентации рекламного сообщения.

Ключевые слова: реклама, рекламный слоган, парфюмерный бренд, языковые маркеры, гендерная специфика.

Annotation. The article deals with the English-language gender oriented advertising slogans of perfume brands, operating in the contemporary advertising space. The specific character of manifestation of potential consumers gender roles in advertising slogans has been characterized. The lexical and phraseological, functional and stylistic markers of gender orientation of the perfume brands English-language slogans have been revealed. The functional and pragmatic correlation of language markers and gender orientation of the advertising message has been established.

Keywords: advertising, advertising slogan, perfume brand, language markers, gender specificity.

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STUDYING INERCULTURAL COMMUNICAION AND ITS INFLUENCE ON PERCEPTIONS, COMMUNICATIVE STYLES, VALUES AND BELIEFS

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“The Common European Framework of Reference for Languages” [7] is a document that contains statements for the improvement of curricula, plans, etc. Due to differences in the educational systems of European countries, a single standard was needed that would define the main goal of language learning with the help of intercultural approach. So the goal of this work is the desired full development of the personality and the awareness of his/her individuality through the acquisition of experience within the study of a foreign language and elements of another culture. The main role in determining the Council of Europe’s foreign language teaching policy is given to the concept of “plurilingualism”, which differs from “multilingualism” that comes down to knowing a certain number of languages. At the same time, “plurilingualism” is considered to be the part of the concept of “pluriculturalism”. Thus, teaching the language sets the task to the teacher not only to form the skills and abilities of speaking, writing, reading and listening, but also to form the concepts of intercultural communication.

The problems teaching English to students of technical and economic universities are studied by many modern scientists (Y. Avsyukevich, T. Korzh, Y. Kuzmenkova, T. Smirnova). They explore various aspects of teaching a foreign language - from computer technology in training to the formation of a competitive personality of a technical profile specialist.

The purpose of the article is to analyze the reasons of the differences in the speech behavior of English-speaking and Russian-speaking interlocutors based on the archetypes of the culture of the British-American and Slavic communities. The need for such an analysis has appeared in connection with the constantly decreasing level of general education of students (their ignorance of basic facts from world history, geography, foreign literature and other subjects of natural science), as well as increasing demands for language proficiency. When training international economists, special attention should be paid just to intercultural or pluric knowledge as one of the most important factors of their future career growth, because the formation of the sociocultural competence of future international economists will require background knowledge from the field of culture, both native and foreign.

Let us try to consider the main reasons for the differences in speech behavior of the British and Americans from the familiar to us, Russians. As noted by Y. Kuzmenkova, such differences “are associated with discrepancies in the interpretation of politeness. Polite treatment correlates with the implementation of social attitudes adopted in a particular society, varying from culture to culture ... At the same time, mutual misunderstanding or conflict situation often have a single source - lack of knowledge about what is considered normal” [4, p. 3]. In the modern world, where English is the language of business communication and the recognized language of international communication, there is a situation when native speakers (English-language ones) expect language learners and speakers of foreign languages, to be committed to cultural traditions (archetypes) of Britain, and today the USA as well.

As modern philosophers have noted, “the archetypes of national culture as its original foundations do not only separate one nation from another. The meaning of the concept of the archetype of national culture lies in the fact that it makes it possible to enlighten the specifics of national culture as a phenomenon included in world cultural communication. That is why each archetype of national culture in its unfolded forms is also the archetype of culture as such, i.e. free communication between national cultures; what is special in it expresses the general and under certain conditions (when the national culture goes to the world level) can become a universal principle that actualizes cultural communication” [6, p. 406]. In

today's realities, it is too early to speak of the archetype of British or American culture as a hegemon just because direct borrowing of another system is extremely ineffective: too different socio-cultural and historical characteristics are as well as pedagogical legacy and mentality of all nations participating in the process of globalization.

The British themselves ridiculed their commitment to the traditions in Noel Coward's popular song "Mad Dogs and Englishmen go out in a midday sun" as early as the 1930s:

Mad dogs and Englishmen go out in the midday sun.

The Japanese don't care to, the Chinese wouldn't dare to,

Hindus and Argentines sleep firmly from twelve to one,

But Englishmen detest a siesta,

In the Philippines there are lovely screens, to protect you from the glare,

In the Malay states there are hats like plates, which the Britishers won't wear,

At twelve noon the natives swoon, and no further work is done -

But Mad Dogs and Englishmen go out in the midday sun.

The situations described in the song eloquently characterize the behavior of foggy Albion citizen in any other country (when a day walk is considered a rule, but it looks extremely unusual in tropical colonial countries, where siesta is a necessity). Archetypes are formed in all spheres of life - in behavior, in communication, in economics.

The basis of the development of "British character and behavior" is described by Y. Astafiev in his article "The Economics of Love: the Formation of Gender Stereotypes" [2]. Emotional restraint of the British is rooted in the traditions of the Protestant upbringing, which required refraining from displaying emotions in all situations of life (except for the funeral). Astafiev sees the main reason for the change of economies in the bourgeoisie coming to the place of the feudal aristocracy. "It" the author points out, "brought a new look at society, at production and consumption. The bourgeois showed ethical norms and qualities alien to the knighthood - hard work and thrift. New views on labor and accumulation were established in Europe with the appearing of the Puritans on the historical scene. The connection of the religious and ethical ideas of this trend of Protestantism with the development of capitalism was first discovered and described by M. Weber. In order to gain confidence in religious salvation, every true Puritan had to count his income and losses daily. Income extraction and, therefore, enrichment becomes not so much a goal as a mission. You cannot enjoy life, because it can cause losses. Consequently, investments are needed: in trade, in usury, in production" [2].

Further, Y. Astafiev indicates that the fundamental value is not accumulation in itself, not wealth, but the constant use of the accumulated in order to ensure sustained production growth, trade balance increase, credit increase. At the same time, this is a purely individual enterprise, when everyone is for himself: joint salvation is meaningless, and relying on another, trusting him is stupid and reckless.

The author's opinion is interesting that an economy that has been formed on such an ethical basis turns out to be comprehensive: labor, trade, and everyday life are no longer divided.

Since the article by Y. Astafiev is devoted to love as an economic unit, he makes a detailed analysis of the relationship between a man and a woman in Puritan society, where there could be no question of love distracting from professional activity. Everything was measured by utility: one can marry only at the age when a person has already acquired a fortune and can afford the luxury of supporting a family; when choosing a bride, one should not be guided by feelings, but rather soberly assess the situation.

Puritan husbands methodically calculated how much they spent on the family, summed up the cost of food, clothes for households, the maintenance of the house, which could accommodate a wife, children, servants. Sexual relations with the spouse were also priced, the amount and intensity of which were determined by the utility. Any excesses were regarded as waste. In bourgeois society, unlike feudal society, a married woman was deprived of all rights, both social and economic and financial. Getting married, she transferred her property at the complete disposal of her husband. The woman even lost her surname, which the medieval nobility had not practiced.

In the bourgeois economy, any woman was essentially a commodity that had its price. So, on the marriage market, the beauty and virginity of the future spouse, ability to farm, good manners, light character, etc., were important. Also "keeping a woman" was widely distributed. Unmarried women, who, as a rule, did not have anything but external attractiveness, were kept by a rich man, who often had a family, for the sake of receiving money, losing the opportunity to have a "good name". Practically all the works of Jane Austen (*Sense and Sensibility* (1811), *Pride and Prejudice* (1813), *Emma* (1815)) are devoted to this dilemma. And these are not the only indicative moments of the Puritan attitude to life.

Bourgeois literature (especially British) has left many examples by which one can trace the main and characteristic features of behavior, which later will be reflected on the linguistic level.

The classic novel by Henry James "The Turn of the screw", published in 1898, is indicative from the point of view of interaction in society, when

the main character, the governess, was informed by her employer, the young aristocrat, that no requests, letters and complaints about children, which the girl had to take care of, should be sent. This is the core of British (Puritan) education: children can be seen, but not heard; one should communicate with them with restraint, not expressing extra emotions not to say love. In the same novel, one more quality of British communication is traced – non-interference: the housekeeper Mrs Grose knew about the depraved actions of servants with children, but did not consider it necessary to stop them or inform the owner. Distance and focus on individualism (mind your own business) is a characteristic feature (archetype) of British education. It is not by chance that modern philosophers point out that “the archetypes of national culture are the fundamental result of the internal communication of a particular nation. That is why they are the deep underlying foundations of a nation that break into human existence and can unfold in any form in the time-space of history. Thus, the national culture is to a large extent the process of identifying and modernizing archetypes, but not abstract-essentially, but existentially, personally, in the work of people”[6 p. 403]. It is worth noting that the characters of “The Turn of the Screw”, who even slightly stood out from the general “scheme” of individualism, were either manipulating others (like Miss Jessel and Peter Quint, who were not ashamed of anything, knowing that Miss Grose and the other maidservants raped by Peter would act according to the “scheme” – everyone solves his/her own problems independently) or went crazy (like a story-teller, who was alone with the conspiracy of silence and mental problems of children who, due to their age, could not resist adults).

The distancing, as a linguistic and empirical phenomenon, will be discussed further.

If we analyze the most characteristic features of Russian and English-speaking communication in the context of politeness, then historically, in Slavic communicative culture, politeness belonged to the moral and ethical sphere. Y. Kuzmenkova notes that “politeness in the Russian tradition is unthinkable without such components as intuition and tact, courtesy and compassion, the spontaneity of expressing emotions and genuine interest” [4. p.16]. Russian-language communication does not prioritize the desire to keep the conversation within the predetermined boundaries, which are controlled from the standpoint of rationality. The high degree of frankness of the Russian-speaking interlocutors in the verbal form is manifested in the form of intimate conversations and indicates the priority of contacts based on mutual trust and the free expression of personal relationships. The traditional dominant of Russian-speaking communication is “naturalness”, and such features as unambiguity, straightforwardness and emotionality.

It is interesting to note that in English, adjectives such as *emotional*, *excitable*, *demonstrative* have a negative connotation (actually, most English verbs of emotions are state verbs, not actions). Emotional behavior is associated with inefficiency, lack of composure, and other negative characteristics. In Russian, the verbs of emotions are “active” (*радоваться*, *тосковать*, *злиться*, *грустить*, *волноваться*), since for Slavic culture verbal expression of emotions is one of the main functions of speech.

For English-speaking communication, the dominant feature is conventionality (ritualization), which reflects the pragmatic attitudes of the individualist: mind your own business. This principle of non-interference corresponds with the key concept of “privacy”, i.e. the desirability of isolation from others and the outside world, and the freedom to do your own things. This feature of world perception is considered to be “distancing”, and it is the basis of “strategic” communication, when a person can consciously control not only the course of the conversation, but also his/her emotions.

Thus, the increased attention to the formal side of communication overshadows the more significant side – informative. In the practice of communication, such regular differences of semantic and pragmatic meanings lead to a contradiction between what is being said and what is meant. In the discursive field of training English-speaking specialists, especially economists, knowledge of strategic communication is vital because it will avoid many problems in communication, negotiation and a general understanding of reality.

The formation of concepts about intercultural communication is one of the interesting and topical problems of the modern educational process, since future international economists will have to form their own communicative space, and today the task of teachers is to ensure that in the future communicative space nowadays students feel themselves free using not just language, but also basic general educational knowledge, as well as could analyze the origins of the behavior of their interlocutors.

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Аннотация. В статье проанализированы причины отличий речевого поведения англоговорящих и русскоговорящих собеседников на основе архетипов культуры Британо-Американского и Славянского сообществ в свете необходимости формирования понятий о межкультурной коммуникации.

Ключевые слова: межкультурная коммуникация, стратегическое общение, архетип национальной культуры, ритуализованность.

Annotation. The article analyses the reasons of differences in verbal behavior of English-speaking and Russian-speaking interlocutors based on cultural archetypes of British-American and Slavic communities because of the need to develop concepts of intercultural communication.

Keywords: intercultural communication, strategic communication, the archetype of the national culture, commitment to the rituals.

UDC 336

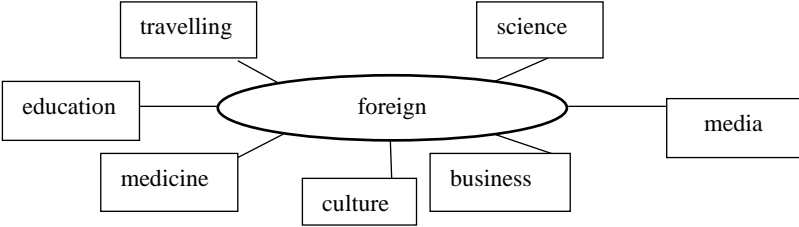
THE MEANING OF FOREIGN LANGUAGES IN INFORMATION SOCIETY

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Nowadays the learning of foreign languages is one of the most important tasks for educated people. First of all, it gives opportunity for

every person to learn traditions, customs, and culture of different countries [1, p. 4]. Undoubtedly, learning of foreign languages develops memory, culture of speech, mentality and imagination. Moreover, knowledge of foreign languages gives opportunity to cooperate with different countries in many important fields such as politics, economics, science, education, medicine, art and so on. Everybody knows that knowledge of foreign languages nowadays is very important part of professional competence.



Pic.1 – Scheme of using foreign languages

Last events in the world clearly show the process of globalization. It means the spreading of the world hybrid culture and the development of cooperation between peoples of the world. It is reflected in all fields of people’s activities: in sports, culture, education, social life and so on [2, p. 7].

The process of globalization and integration gives great opportunities to establish contacts in different fields. They include: participation in international conferences and projects, sports competitions, doing special courses of specialists and scientists, travelling, joint ventures and many others. I am sure that important condition for the development of the social area is knowledge of foreign languages.

A very important role in the process of the global integration plays foreign languages. English is the language of the world communication but the meaning of the other world languages does not reduce. They play as a very important link in the world cooperation and integration [3, p. 2].

The task of investigation is the spreading of world languages.

Political, cultural and social-cultural processes, which have been hold in the world, greatly increase functions of world languages. Our country has extended the borders of contacts with foreign countries that gives opportunity for communication between different social groups. Increasing commodity circulation between countries, joint projects, exchange programs of experience greatly increase the role of foreign languages in modern society. Foreign language has become an important part of modern education.

List 1 Data of investigation of spreading of world languages

place	language	native	second	people	countries
1	Chinese	1,2 billion	No data	About 1,2 billion	33
2	English	335 billion	505 million	840 million	101
3	Spanish	399 billion	До 90 million	About 500 million	31
4	Russian	166 billion	125 million	291 million	16
5	Arab	242 billion	21 million	263 million	60
6	Portugese	203 million	28 million	231 million	12
7	French	76 million	87 million	about 274 million	No data

The development of new technologies and professional cooperation causes necessity of specialists, speaking foreign languages, for successful cooperation [4,5].

Besides, knowledge of language gives great opportunities for getting education, interesting and well-paid job, making career. 87% of the citizens of Russia are sure that it extends their opportunities for improvement of quality of life and cultural growth.

The way of allowing to increase the level of knowledge of foreign languages is the proper system of teaching languages in educational institutions.

It is impossible not to recall the meaning of foreign languages in stabilization of political situation in the world and improvement misunderstanding between peoples. I want to underline the importance of foreign languages in the development of international law and international organizations fighting for peace.

There are factors, contributing to the learning of foreign languages:

1. international communication;
2. education;
3. religion;
4. tourism;
5. employment;
6. science;
7. broadening the mind;
8. the development of tolerance;
9. humanitarian projects;
10. moving abroad.

So, we see that using foreign languages is many-sided and actual nowadays in the world.

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Аннотация. Статья посвящена важности знания иностранных языков в современном обществе. Особое внимание уделяется значимости мотивации в преподавании языков в учебных заведениях.

В данной статье изучается вопрос использования иностранных языков в различных сферах деятельности людей для установления и развития речевого общения.

Ключевые слова: знание, иностранные языки, менталитет, культура, образование.

Annotation. The article is devoted to the importance of knowledge foreign languages in society nowadays. Special attention is paid to the significance of motivation in the teaching of languages at educational institutions.

In this article I study the issue of using of foreign languages in different fields of people's activities for establishment and development of speech communication.

Keywords: knowledge, foreign languages, mentality, culture, education.

HOW TO READ AUTHENTIC TEXTS

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One of the main aims for any learners of English is to be able to read authentic texts. In linguistics and education, it is considered that “authentic text” is a text written for any purpose other than teaching / learning a language. Different texts of all genres written for native speakers such as novels, scientific articles, blogs, websites, textbooks, newspapers and magazines are known as authentic texts. It is well-known fact that reading of such texts is a very useful for learners but it requires a very large vocabulary. Before reading authentic texts easily English learners will have to learn a lot. So the problem of reading authentic texts is studied in this article.

Due to the fact that students need to read the text in order to gain knowledge and use selected parts of it in their own new text (such as an essay or presentation), it's important to define the main tasks of reading. Do you want them to gain a comprehensive understanding of the whole text, or will they use it more superficially – for example, in order to identify key words?

Depending on the purpose there are four types of reading:

1- **Skimming:** reading for the gist or the main idea of the text.

2- **Scanning:** reading to find specific information.

3- **Extensive reading:** reading for pleasure and general understanding.

4- **Intensive reading:** reading for getting the details.

Different types of reading strategies should be taken into account before, during and after reading. First of all we should control the vocabulary and the number of unknown words. Grammatical structures should be known to the students due to background knowledge. Learners mustn't be overburdened by a large number of unknown words because if the number of unknown words is too large, they cannot participate in an authentic reading experience. The research [6] shows us that admissible percent of unknown words for comprehension is about two. You should

realize that even text with known words can be difficult for understanding if students don't have background knowledge of the topic and it may cause enormous reading problems.

Secondly, we must create different types of exercises that will help students to find and analyze the content of the text. Such tasks give learners an opportunity to practice in reading.

Also we may use context clues to assist comprehension by figuring out new words based on the context of surrounding words. It is good practice to predict about what will happen next or to use visualization. If you're listening to a story being read, draw a picture of the story line as you listen[6]. It is recommended to underline important information and make notes to be reviewed later, to write down questions for better comprehension of the text.

After reading it is desirable to give you opinion on the book's subject, write out the summary to demonstrate understanding. It is achieved by identifying and noting down the main points (the task), which they then use to form the basis of their Annotation.

Fluency should be developed. The aim of such activity for students is to become faster and more fluent readers. It can be obtained by rereading a text that the students have already read.

So, taking into account above mention information we may say that exercises aimed to develop reading comprehension can be divided into several groups depending on the purpose you want to achieve. They are:

1- **pre-reading exercises**: the students should see all the tasks before reading the text.

Pre-reading activity establishes a purpose for reading, activates prior knowledge, presents new concepts and key vocabulary, asks students what information they predict in the text, previews the text.

2- **while reading exercises** : they teach the students to extract specific information.

Students read, comprehend, visualize and build connections; they integrate the knowledge and information they bring to the text with new information in the text, pay attention to the structure of the text, read to achieve the purpose for reading, think about answers for certain questions, determine the meaning of unfamiliar words and concepts.

3- **Post reading exercises**: they are more connected with summing up the content of the text, investigation into the writer's opinion and may entail some kind of follow-up-task related to the text [8].

Students expand prior knowledge, build connections and deepen understanding.

So, it may be noted that teaching authentic reading is very important. We should remember that the aim of reading is to understand the texts. We consider that in order to become proficient readers in English, the students need access to texts that make it possible for them to respond in an authentic way to what they have read. To read and comprehend authentic texts well, you need to increase your vocabulary constantly and read original texts as more as possible.

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Аннотация. В статье дается определение термину аутентичные тексты, показана необходимость увеличения словарного запаса, объясняется важность изучения лингвострановедения, анализируются принципы аутентичных текстов и их роль в овладении иностранным языком.

Ключевые слова: аутентичные тексты, чтение, понимание, грамматические структуры, словарь.

Annotation. The article gives the definition to the term authentic texts, shows the necessity of increasing our vocabulary, explains the importance of linguistic and cultural studies. It analyzes the principles of

authentic texts and their role in mastering a foreign language.

Keywords: authentic texts, reading, comprehension, grammatical structures, vocabulary.

UDC 808.1

LITERARY CREATION OF YOUNGER STUDENTS

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Creativity is the creation of new and beautiful things. It opposes destruction, pattern, backwardness, it fills life with joy.

The child, who every minute discovers all the new secrets of the world around him/her, has a tremendous creative potential: he/she has a free imagination, not constrained by the rules and prohibitions.

According to the pedagogy of creativity it is important to uncover "the gift of God", to contribute to the mysterious flowering of poetry in the soul of a child, student.

"The spiritual world of a person (at any age) is not only intelligence, thinking and speech, but it's also the world of emotions, imagination and dreams, moral feelings and conscience, the world of faith in good, communication with oneself, an intuitive understanding of the feelings of another person and the tact of empathy" [3, p. 228].

Comparing the work on the section "Coherent speech" in the course of the Russian language of the traditional system and the new standard of developmental education, we clearly see the difference: creative works. "The meaning of creative works is to open the child's eyes to the living reality, to teach him/her to see in it the source of exciting impressions and find them an adequate expression in the word. The efforts of children are directed to the search for an accurate, capacious, expressive word. This work helps the children to learn the native language wealth and to understand a literary work as art of a word. As L.S. Vigotskiy believed, creativity allows a child to overcome that steep pass in the development of creative imagination.

Among the methodists there is a dispute about when and in what classes you can offer written creative works to students.

Methodists and teachers are afraid of the possibility of spelling errors in such illiterate people – students of the first and second grades.

Well-known methodist of Russian literature M.A. Rybnikova objected these arguments convincingly. She wrote that teachers who were afraid of essays and statements because of the possibility of errors, reminded the mother, which did not allow the child to get up from the chair out of fear

that he would hurt his/her nose. But if you do this, the child will never learn to walk. But it is inevitable that you will begin to walk – will fall, but to go learn. You also have to decide to learn to write. The spelling will be at odds with the style. But it is balanced, develop skills, the child will write meaningful and interesting. The work is a way from a small writer to a large reader.

Adherents of the traditional method emphasize that writing is one of the types of written exercises that writing works should be taught. Skills should be developed on the basis of the development of oral speech, and the presentation is considered as a preparatory work for the composition. The difference between the presentation and the composition is only in the degree of independence and creativity.

L.V. Zankov writes that "the exposition and composition by its very nature are completely different forms of written speech of a student. A statement is the transmission of the content of a text written by someone else. The composition is an expression in the speech form of impressions, thoughts, feelings of the author. The general similarities between them are that the student writes something" [2, p. 166-167].

Children should be given the opportunity to speak freely. After all, in the early stages of training is especially important:

- to reveal the creative initiative of the child;
- develop an interest in self-writing.

The child expresses himself/herself in the word. And he/she is given complete freedom.

Before writing works of a creative nature there should be no preparatory work:

- 1) elaboration of the content;
- 2) dictionary and spelling preparation;
- 3) preparation of the general plan of retelling;
- 4) the reading of the samples.

Such indicators of the quality of works are also very important:

- emotional coloring;
- independence of judgment;
- liveliness, spontaneity in the transfer of thoughts and feelings.

What are the criteria to establish the difficulty of one description compared to another, or one story compared to another? As a result, the content of the work, which should determine its form, has come into full dependence on the form. And all the rich possibilities of works fall into full dependence on the correctness of written speech. It deprives children the opportunity to ponder over the subject. Narrow, boring topics do not affect the mind, feelings, emotions of children.

The formulation of creative themes should affect not only the child's mind, but also his feelings. After all, the composition is not only a means of developing writing, but also an indicator of the overall development of students, reveal its spiritual world, break the division into strong and weak. There are topics that require:

- the highest level of generalization of the material;
- transfer of knowledge, impressions;
- reliance on personal experience of children.

The level of difficulty is high. But compliance with the measure of difficulty is ensured by the fact that they:

- based on the experience and knowledge available;
- the student can find the closest and most familiar aspect, reveal it.

That is, there is a certain freedom in the selection of the content of the work. It is important that children have no fear of corrections.

It is always necessary to remember three mandatory conditions in the analysis of works:

- discuss with the children written essays;
- mention all children;
- give the opportunity to edit.

When the works are written, the basic techniques of working on them are applied:

- analysis teacher: the selection is interesting, strong parts; correction of errors;
- oral analysis in class; to read the best reviews;
- self-revision;
- reviewing: oral, written.

Several of the weakest works can be proposed to analyze groups. Give the task: to perform, to find in them as much as possible is good.

Essays are invaluable material for teachers. They help to learn more about the world of children, break the established division of students into strong and weak, reveal the unexpected possibilities of lagging and so-called silent.

Due to the fact that the works can be not only a means, but also an indicator of the overall development of the child, his/her morality, the quality of assimilation of the content of primary education, there is a huge number of possible lines of their analysis and evaluation criteria.

Here is one of the options that characterize the formation of literary creativity.

Children's work can be measured by the following indicators:

- 1) completeness and correctness of the topic disclosure;
- 2) correspondence of the content of the composition to the level of

communication of the material;

- 3) consistency of presentation;
- 4) existence of generalized judgments;
- 5) availability of author's ratings, comments;
- 6) correspondence of presentation form to the sound of the topic.

Analysis of these indicators will help to attribute the work to reproductive or creative. After all, the theme of reproductive nature can be opened by a creative method.

For the manifestation of literary creativity is taken any attempt of the student to comprehend some fact, to express his/her personal opinion about it, to select for evidence is not repeated from anyone material.

Essays are written in a special notebook. At the end of the quarter, you release the magazine. The process of literary creation organization includes the following stages:

- stage of indirect training associated with the focus of the entire learning process to achieve optimal overall development of the student;
- stage of direct work on the composition (selection of the topic, presentation of the topic in accordance with its nature, organization of independent work);
- stage of work on the composition after its writing (oral discussion, editing, use in other subject lessons).

The disclosure of broad ideological themes takes a whole lesson. The next day 1 lesson is devoted to their discussion and editing. Narrow topics are part of the lesson. Reading and analysis of them immediately are possible in the classroom depending on the theme, on the purpose of the work, the process of working with it may change. Flexibility, mobility techniques are an integral features of developing learning. It is characteristic of the methods of the organization of literary work. The statements are completely replaced by works of a reproductive nature. The system of compositions involves reproductive and creative works.

Creative writing is a multifunctional didactic tool:

- formation of personality as a whole (creative thinking, emotional, volitional spheres);
- enrichment of the content of primary education;
- integration of knowledge of different sections, parts of courses and individual courses;
- students' awareness of the process of learning and knowledge;
- “evaluation of training effectiveness in all areas: education, development, education” [5, p. 103-104].

"Free correct use of the language is formed not so much by training exercises as by the frequency of using "live" speech in different situations"

[6, p.104].

In conclusion it should be noted that literary creativity will help the student to study: who? what I want to be and whom? what do I know, what can I do, what do I want to learn?

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Аннотация. Исследованы основные особенности литературного творчества школьников. Автор сопоставил работу по разделу «Связная речь» в курсе русского языка традиционной системы и по новому стандарту развивающего обучения. Отмечено, что сочинение является не только средством развития письменной речи, но и показателем общего развития школьников, раскрывают его духовный мир. Приведены основные показатели, по которым оцениваются работы.

Ключевые слова: литературный, творчество, сочинение, самовыражение, мировоззренческая тема.

Annotation. The basic features of the literary creativity of students are researched. The author compared the work on the section "Coherent speech" in the course of the Russian language of the traditional system and the new standard of developmental education. It is noted that the composition is not only a means of development of writing, but also an indicator of the overall development of students, reveal its spiritual world. The main indicators of work evaluating are stated.

Keywords: literary, creativity, composition, self-expression, worldview theme.

**CONTRIBUTION OF V.A. ZHUKOVSKY TO THE
DEVELOPMENT OF LITERATURE AND TRANSLATION**

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Being closely associated with the problems of education, V.A Zhukovsky think about the issues of literature. In general, he negatively assessed the contemporary children's literature, selecting out only some phenomenon.

According to Zhukovsky, art book, should have an impact on moral education, to excite mental strength, to develop imagination.

"The winner of the pupil from the vanquished teacher" this historic phrase written by V. A. Zhukovsky on the back of his own portrait , which in turn was presents as the gift to A.S. Pushkin in 1820 devoted to the first poem "Ruslan and Lyudmila".

In general, almost all works were usually attributed to the early period of the great poet. And the fact that Alexander Sergeyevich changed romanticism on realism , did not affect their relationship. So in 1825, Vasili Andreevich , then serving at court intercedes for Pushkin before the king, who was under suspicion after the uprising of the Decembrists .And in the most difficult period for Pushkin during 1836-1837 Vasily Andreevich tried to prevent the imminent fatal duel for the poet with Georges Dantes. However, all efforts were useless. Pushkin didn't want to follow Zhukovsky's advice. The date of January 29 is the birthday of Zhukovsky, it is also a tragic day of Pushkin's death. Vasily Andreevich endures this loss extremely hard, understanding that not only his friend, but also the real genius passed away from life.

Zhukovsky had the gift of not only writing, but also professional translation. It was he who introduced the best poets of England (gray, Scott, Byron), Germany (gette, Schiller), France (Lafontaine), Greece (Homer), Persia (Ferdowsi), Rome (Virgil) and other countries into the cultural turnover of our country. A knowledge of old Slavonic allowed him to translate "Words about Igor's regiment» into modern Russian.

Perceiving the translation as creativity, he spoke about this occupation as follows: "the translator in prose is a slave; the translator in verse is a rival".

In the period from 1831 to 1836, Zhukovsky translated Fouquet's novel "Ondine" while giving it a poetic form. All this makes his translation style original. Gogol described it as "original", admiring the accuracy,

calling him "the genius of translation". And the name of Vasily Zhukovsky will forever be inscribed in the history of not only Russian but also world literature. However, the "craft of words", though the most famous facet of the talent of this great man.

The fact that Zhukovsky was the mentor of the heir to the throne ,who later became Emperor will go down in history under the name of Alexander II, is widely known ,largely due to the fact that most researchers consecrated this particular moment in the context of the question of what impact the humanistic views of Vasily Andreevich had on the personality of his pupil.

Approaching the task with the care he had developed several possible options for training. He took into account the principle that it is necessary to ensure the establishment of a relationship between objects. For example, elegant literature was supposed to be studied in chronological order. The first reading would be philosophical, the last would be aesthetic; and both would form a complete idea. It is necessary to distribute the best poets chronologically and then according to the kinds of poetry; after this distribution to assign the order of their reading.

In addition to history , literature and literature, there were a number of other important subjects .In general, the training on the innovative pedagogical system of Zhukovsky ,created under the great influence of democratic ideas of education set out in the pages of the works of Rousseau , included the following: history ,elegant literature(languages), philosophy (preliminary concepts of nature, of man and logic), works [2].

And this first teaching experience will greatly assist to Vasily Andreevich successfully pursue a career at court. After all, initially in 1815 he was appointed a reader at the Dowager Empress, Maria Feodorovna. Two years later, Vasily Andreevich was a teacher of Russian language and literature for Princess Charlotte, the future Empress Alexandra Feodorovna, wife of Nicholai I.

It was at her request , he translated poems by German poets — Schiller Goethe, Kerner, which were included in the collections "For the few" ,released Zhukovsky not without the help of the Grand Duchess . These translations Alexandra learned by heart, memorizing poetic phrases. This continued until 1820.

Beginning in 1830, translation works were represented mainly. Vasily Andreevich had an outstanding talent as an interpreter. Due to the activities of Zhukovsky in the period after 1830, the Russian reader was able to get acquainted with the works of the best poets of England (Byron, Scott, Thomson, gray), Germany (Burger, Schiller, Goethe), France (Lafontaine, Guys), Greece (Homer). Zhukovsky's hymn, written in praise of the great

deeds of his contemporaries, the heroes of the Patriotic war of 1812 – "Singer in the camp of Russian soldiers" is well-known. This poetic work is really written "in the camp", as Zhukovsky was in the army among the volunteers [1].

Zhukovsky's work is strong in the part that tells us about love and friendship. Unusually sincere, musical poems are written in a light syllable, many of them are put to music.

Poems about the nature differs with a vision of the subject. The desire to capture all the nuances of human emotional experiences, skillfully show them in their compositions. It was these qualities that colleagues in Peru welcomed as the beginning of a new direction in literature. Vasily Andreevich was brought up on the European literature, but he was also an excellent expert on Russian poetics [1]. Zhukovsky has one such amazing quality: when he translates for readers of Russia the Western European sample, eventually the present Russian work with national color turns out. Such thoughts of Zhukovsky about literature, which are the link between the XVIII and XIX centuries, paved the way for the activities of V.G. Belinsky.

In conclusion, we note romanticism often contrasts civilization untouched nature, natural human relations, a simple way of life that in the works of Zhukovsky. All this is probably due to dissatisfaction, the world, uncertainty about the possibility of earthly happiness. The thirst for harmony with the world will become a constant companion of the poet and largely determined the nature of his work. Zhukovsky was distinguished by a constant "desire beyond the world."

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Аннотация. Охарактеризован особый вклад В.А. Жуковского в развитие литературы и перевода. Как он отмечал, по-настоящему художественное произведение может воспитывать. Подобные мысли Жуковского о литературе, являющиеся связующим звеном между XVIII и XIX столетиями, подготовили почву для деятельности В.Г. Белинского.

Ключевые слова: В.А. Жуковский, художественная литература, перевод.

Annotation. The special contribution of V.A. Zhukovsky to the development of literature and translation is characterized. As he pointed out, truly a work of art can educate. Such thoughts of Zhukovsky about literature, which are the link between the XVIII and XIX centuries, paved the way for the activities of V.G. Belinsky.

Keywords: V.A. Zhukovsky, literature, translation, romanticism.

UDC 159.95

THEORETICAL ANALYSIS OF LITERATURE ON THE PROBLEM OF SPEECH DEVELOPMENT IN CHILDREN

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Any person cannot do without using speech in everyday life. The better the person possesses his/her own speech, the more actively he/she develops the fields of activity chosen by him. It is directly related to preschool age because the highest forms of cognitive activity conceptual thinking are being formed at this with development of speech [10]. Speech communication creates the necessary conditions for the development of various forms of activity and teamwork skills.

Developing speech, the child finds a powerful source of intellectual and spiritual formation of personality, which is necessary condition for the social activity of each person.

A number of scientists studied the problem of the development of speech. Among them, we can distinguish the following: L.S. Vygotskii [1], J. Piaget [6], M.I.Lisina [4], A.A. Leontev [5], G.A. Uruntayev [7] and Yu.A. Afonkina [7].

Thus, L.S. Vygotskii noted that speech is a sign system that appeared in the process of the sociohistorical development of a man. It is able to transform children's thinking, helps to solve problems and form concepts [1].

G.A. Uruntayeva pointed out that at the preschool age the child acquires the generalizations of various levels contained in the word, learns to understand the causal relationships, for example, he can finish a sentence, make up an end of a story or a fairy tale on the proposed topic [7].

A.N. Leontiev distinguishes four stages of the child's development of the speech: nursery, which lasts up to a year, preparatory – up to three years, preschool – up to seven years and the school one.

The objective of this work is to identify theoretically and to describe the peculiarities of speech development in the preschool age.

According to V.P. Glukhov, there is a considerable vocabulary expansion of a child at the preschool stage; by the age of four till six, his vocabulary range already reaches the level of 3000 – 4000 words. At this period, a child mainly uses the meaning of the words correctly [2].

Along with the increase of vocabulary expansion, in the view of A.N. Gvozdev, children have already got all the basic categories of the grammatical structure of the speech being formed. The child begins to make active use of all parts of speech. Step by step the skills of word formation are being developed. By the age of four, the child mostly uses simple extended sentences in the communication. By the age of five, different conjunctions begin to be found in the speech (because of, in order to, as if, etc.).

A coherent speech appears and for this reason the structure of the sentence is getting more complex.

Children are relatively free to use the structure of compound and complex sentences [9].

A number of authors such as L.P. Fedorenko, L.S. Vygotskii, A.R. Luria point out that starting from this age, a child can easily make up a retelling of a fairy tale or a story of 40-50 sentences, which indicates that he has already acquired one of the difficult kinds of speech - monologue [8].

During the whole preschool period, children develop the skill of auditory monitoring over their own pronunciation, the ability to correct it in some individual cases. In other words, a phonemic perception or so-called "sense of language" is formed. K.D. Ushinskii was giving a particular importance to it and according to him, it prompts the child the place of the stress in the word, the grammatical phrase, the way of combination of words in the sentence [9].

A sufficient level of phonemic perception allows children to acquire the necessary skills of sound synthesis and analysis, which is a condition for mastering literacy in the period of schooling. <https://studopedia.info/7-59089.html>

Thus, we can come to conclusion that the peculiarities of speech development in the preschool period include: the expansion of the active vocabulary, the complication of speech, the development of skills of word formation and phonemic perception, or the so-called "sense of language" and appearing of monologic and contextual speech. Moreover, the skills that

encourage better literacy in the period of schooling are being developed.

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Аннотация. Тезисы посвящены теоретическому изучению особенностей развития речи у дошкольников. Отмечается, что развитие речи – это сложный нервный-психологический процесс, который происходит в результате взаимодействия ребенка с окружающей средой.

Ключевые слова: дети, дошкольный возраст, развитие речи, фонематическое восприятие.

Annotation. The theses are devoted to the theoretical study of the development of speech in preschool children.

It is noted that the development of speech is the most complicated neuropsychological process that occurs as a result of the child's interaction with the environment.

Keywords: children, preschool age, speech development, phonemic perception.

UDC 81-2

LACUNA IN ENGLISH AND RUSSIAN LANGUAGES

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The problem of national specificity of thinking is currently widely discussed in various aspects. Lexical lacunarity is one of the most important aspects of this problem.

Language, being closely connected with the life of society, reflects its social, economic and political life. As society develops, the language is enriched with new concepts and terms, each individual system has its own peculiarities of development, which immediately affect the lexical composition.

When comparing the vocabulary of several languages, you can find gaps, white spots in the semantics of one of the languages. These problems are called lacunae and appear as a result of the lack of an equivalent word in a word of another language.

In foreign literature, attempts are known to fix differences in languages and cultures with the help of the term "ga" (space). In domestic science, attempts to describe such discrepancies with the help of the concept of "lacuna" are of the greatest interest.

Lacunae in their most general understanding fix what is in one local culture and what is not in another. In this regard, the question arises about the ratio of the specific and the universal in individual cultures.

Lacuna, therefore, is a concept that fixes the national-cultural specifics of the languages and cultures being compared.

To date, there are various typologies of lacunae. I.A. Sternin and his colleagues propose to isolate lacunae of several types:

- subject and abstract (according to the degree of abstractness of the content).

Subject lacunae reflect the absence of a material, physical, sensually perceived object or phenomenon. Abstract lacunae reflect the absence of an abstract concept, a mental category. For example, kvass is a subject lacuna for the English language, ingenuity is abstract.

- generic and specific (according to paradigmatic characteristics, place in the language paradigms).

Generic lacunae reflect the absence of a common name for a class of objects, specific – the absence of specific names, names of individual types of objects or phenomena.

For example, in the Russian language there is no common name for grandparents, and in English there are such names: English. Grandparents. This is a generic lacuna for the Russian language. On the other hand, in the Russian language there are no single-word designations for wrist and table clocks – these are specific lacunae for the Russian language (cf. the English watch, clock). The English do not lexically differentiate between washing and erasing – these are specific lacunae for the English language, in English there is only a generalizing word wash.

- Interlanguage and intra-language (by system language).

Interlingual lacunae are detected by comparing different languages: if one of them does not reveal the lexical equivalent of a unit of another language, then we can talk about the existence of a lacuna in it. Intra-laconic lacunae are found within the paradigms of one language – for example, the absence of a word with the opposite meaning, the absence of a unit with a certain stylistic relation, the absence of any morphological form of the word, etc.

- motivated and unmotivated (for non-linguistic conditionality).

Motivated lacunae are lacunae, which are explained by the absence of the corresponding object or phenomenon in the national culture (sandals, soup, matryoshka, balalaika, vinaigrette, kvass, cellar, street child, toastmaster, window leaf in Western European languages).

Unmotivated lacunae can not be explained by the absence of a phenomenon or object – there are corresponding objects and phenomena in culture, and there are no words for them (day, boiling water, grounding, dry bread, sharp-witted, deadwood, birthday boy, avral, leaning, namesake, big man in Western Europe languages).

- nominative and stylistic (by type of nomination).

Nominative lacunae - lacunae, reflecting the absence of denotat nomination. There may be no nomination of the subject in general, and there may be no emotional or evaluative nomination. Stylistic lacunae – the

absence of a word with a certain stylistic characteristic, is a purely linguistic characteristic of the lacunae – part-lacunae gaps (for lacuna accessories to a certain part of speech).

A verb may be in a language, but it may not have a single-root noun from it, etc. For example, the Russian-English part-time lacuna is “to applaud vigorously, approving of something” – cf. English acclaim. There is no verb in the Russian language, but there is a noun with the given meaning – an ovation.

The partial sampling method selected 38 examples of non-equivalent units from the Oxford Dictionary of English, 2005 and the Longman Exams Dictionary 2006. For each of the 38 selected non-equivalent units, a definition was found. Based on the definition, we took a similar translation from the dictionary.

1. To abseil – to descend a line - to go down on a rope (about mountaineers).

2. Adventurer – a person who seeks adventure, esp. one who seeks success or money through daring exploits – business, leading risky enterprise.

3 . To afforest – to plant trees on; convert into forested land - to plant a forest, to tree.

4. Amanuensis – a person employed to dictation or to copy manuscripts - a personal secretary writing from dictation.

5. To angle – to fish with a hook and line - to fish.

6. To annotate – to comment on, to comment on, comment on the article.

7. Appointee – appointed person

8. To aquaplane – to ride on an aquaplane – to ride an aquaplane.

9. Archery – Archery – Archery

10. Artist – a person who displays his work styles required in art, such as sensibility and imagination – a master of his craft.

11. Assessor – a person who values property for taxation – a tax official, legal advisor.

12. Attendant is a person employed to assist, guide, or provide service for others, esp. for the general public – accompanying person.

13. Babysitter is a baby sitter.

14. Backstroke – swimming backstroke.

15. Banjoist – the player on the banjo – banjo player.

16. Barmaid – a woman who serves in a pub – a waiter in a beer.

17. Barber – a male hairdresser.

18. Barnstormer – an actor of traveling in different towns giving the performances a wandering actor.

19. Batsman – a batsman who plays the bat.
 20. To bicycle – to ride a bicycle – to ride a bike.
 21. To bike – to ride a bike – ride a motorcycle.
 22. Billsticker – a person who stick the bills – poster billboard.
 23. Bitplayer – an actor who plays a walk-on part – actor, performing a bit part.
 24. Bootblack – a person who shines boots and shoes – boots cleaner.
 25. Callboy – a boy who calls actors on the stage.
 26. Cheerleader – a person who leads in formal cheers, esp. at sports events – member of the dance support group.
 27. Looking for a passenger, a taxi driver, slowly riding while waiting for a passenger.
 28. Commitor – a person who put smb in ward – a judge appointing a guardian over the mentally ill.
 29. Competitioner – a person who is going to work by competition.
 30. Shopper – a person who buys goods in a shop – an employee of a commercial enterprise who monitors prices in the assortment of other firms.
 31. Barrister is a lawyer who has the right to speak in all lawsuits.
 32. Busker is an actor who gives the performances at the street and gather money for this is a wandering actor performing on the street.
 33. It is a sport, a jump with an elastic rope.
 34. Clother – a person who sales the clothe for men is a merchant of clothing and men's clothing.
 35. Dairymen – a man who works in dairy products – a seller of dairy products.
 36. Dresser – a person who gets shop windows – decorator windows.
 37. Naturalist – a person who possesses the pet shop – a pet shop owner, a stuffed animal seller.
 38. Bailie – a municipal magistrate – city judge.
- Russian-English language lacunae

By the method of partial sampling from the dictionaries of the Oxford Dictionary of English, 2005 and the Dictionary of the Russian language Ozhegova S.I. 20 examples of Russian non-equivalent units were selected. For each of the 20 selected non-equivalent units, a definition was found. Based on the definition, we took a similar translation from the dictionary.

1. The bathhouse attendant is the one who serves bathing attendants at the bathhouse attendant.
2. Balalaechnik – balalaika player – balalaika player.
3. Bandurist – folk singer, playing the bandura – bandura player.
4. A farm laborer – a hired agricultural worker.

5. The watchman is the duty guard at the facility, the property keeper is the front-door security.

6. Vityaz – a brave valiant warrior – knight, hero.

7. A harmonic player is one who plays the accordion player.

8. Hussar – a soldier or officer of the light military unit cavalry – hussar.

9. Guslyar is a folk singer accompanying himself on the harp – psaltery player.

10. Kabatchik – owner of the tavern – tavern keeper.

11. Cossack is a man who serves in military units with his weapon and horse.

12. Kozhemyaka – master, making rawhide – tanner.

13. Fire – owner of serfs – landlord advocating serfdom.

14. A merchant is a privately owned merchant.

15. Lapotnik – the one who wove or sold bast shoes – bast-shoe.

Thus, we considered the interlingual verbal lacunarity as a process that not only complicates the interaction between different cultures in the modern world but also provides the enrichment of them through the communication.

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Аннотация. Статья посвящена межъязыковой словесной лакунарности как процессу, который не только усложняет взаимодействие между различными культурами в современном мире,

но и обеспечивает их обогащение посредством общения. В этой статье мы уделяем особое внимание межъязыковым лакунам, которые позволяют находить сходные и разные черты в семантике разных языков. В этой статье мы также представили теоретические аспекты лакунологии, основные классификации их категорий, а также ее проявления на примерах лексики русского и английского языков.

Ключевые слова: лексическая лакунарность, жизнь общества, лексика, лексическая составляющая, типологии лакун, различия в языках.

Annotation. The article is devoted to interlingual verbal lacunarity as a process that not only complicates the interaction between different cultures in the modern world but also provides the enrichment of them through the communication. In this paper, we pay special attention to interlingual lacunae that makes possible to find similar and different traits in the semantics of different languages. In this article we also presented the theoretical aspects of lacunology, the main classification of their categories, as well as its manifestation on the examples of verbal vocabulary of Russian and English languages.

Keywords: Lexical lacunarity, the life of society, vocabulary, lexical composition, typologies of lacunae, differences in languages.

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THE PROBLEM OF TRANSLATING SCIENTIFIC AND TECHNICAL TEXTS ON MARINE ENGINEERING FROM RUSSIAN INTO ENGLISH

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Introduction

Scientific and technological progress captures all aspects of the existence and development of modern society. In addition, the expansion of trade and international economic relations, increasing of the economic integration between countries around the world, the development of science and technologies, constant exchange of scientific and technical information

enhance the importance of a foreign language as an effective factor in socio-economic, scientific, technical and cultural progress.

Cadets in universities, merchant fleet officers have to deal with big amount of technical manuals and literature. The main feature of this literature is an accurate and complete presentation of the material, the almost complete absence of those expressive elements that are used in fiction and that give speech its emotional richness. Therefore, the logical aspect rather than the emotional-sensual side of the stated must be highlighted [4]. However, it is to note that for all its stylistic remoteness from a colloquial language, with the latter being rich in expressive means, scientific and technical texts include some more or less neutral phraseological combinations of a technical nature.

The purpose of this article is to review and analyze the difficulties that cadets encounter when working with scientific and technical documentation and literature, to determine the basic requirements for professional translation from Russian into English, such as equivalence, adequacy, informativeness, consistency and clarity of presentation.

Overview

Language communication is implemented in four types of language activities: listening and speaking in oral communication, reading and writing in written communication. Translation is the fifth type of language activity that is needed to provide communication between people speaking different languages. Therefore, a cadet or a merchant fleet officer with insufficient formation of linguistic and professional competence and inability to work with specialized dictionaries, will not be able to convey all the information of the original text precisely [2].

In this article, under the concept of translation, we will consider the problems cadets encounter with, while translating technical and scientific texts on marine engineering, compilation of scientific articles on their area of training, communication with other people etc.

Technical and scientific translation is the translation of texts on technical subjects, in particular, documents of different specialization, operating manuals, business contracts and other commercial proposals, certificates of products conformity and other technical proposals, scientific articles, results of scientific researches [3]. The intricacy of such translation is related to the fact that people should adhere to the scientific and technical style, excluding all habitual colloquial words and terms, i.e. it is necessary to employ the vocabulary inherent in these styles. The basis of scientific and technical texts is standardized, i.e. the choice of the cliché language variant is predetermined by the given communication conditions. For the lexical design of the texts of the scientific and technical style, the saturation of

terms of all types is characterized, which is explained by the specifics of the terms, their fundamental unambiguity, accuracy, economy, nominative and distinctive function, stylistic neutrality, great information richness compared to ordinary words. The syntactic features of the design of scientific and technical texts include the syntactic completeness of the statement, the presence of analytical constructions, and frequent use of cliché structures.

However, as practice shows, in numerous articles and texts of scientific or technical style some of these rules are neglected, which leads to a loss of integrity of the style [5]. Let us consider such cases on the example of the following sentences.

1. (orig.: Работа выполнена на тренажерах, которые имитируют работу современных длинноходных дизелей в составе пропульсивного комплекса крупнотоннажных танкеров, при различных условиях эксплуатации) [6].

The work was done/performed on simulators that mimic/imitate the work process of modern long-stroke diesel engines as part of supertanker propulsion plant at various operating conditions.

2. (orig.: В настоящее время методы прогнозирования, обычно используемые для этой цели, основаны на подходах временного ряда, которые обычно игнорируют экономическое содержание) [7].

Forecasting methods now commonly used/employed for this purpose rely on time-series approaches that generally ignore the economic content

3. (orig.: Предполагается, что строительство судов на начальном этапе реализации плана начнется этой осенью) [7].

It is assumed that the vessel construction in the initial phase of the plan implementation will begin/commence this autumn.

In the above mentioned sentences, both alternatives may be put to use, however, the last ones must be given precedence as belonging to the so-called learned words which are characterized by their accuracy, nominative and distinctive function inherent to the scientific and technical style. The list of such words is rather numerous without being restricted by verbs only, e.g. *comprise* (as an alternative to *include*), *compile* (*make, draw up*), *heterogeneous* (*non-uniform*), *homogeneous* (*uniform*), *conclusive* (*final*), *divergent* (*various*), *unequivocally* (*clearly*), *consequently* (*for that reason*), *perilously* (*dangerously*) etc.

Furthermore, in the scientific and technical literature only grammatical norms that are firmly established in written language are employed. There prevail:

– impersonal, and indefinitely personal constructions, for example: (orig.: В процессе обучения курсантов и механиков флота на

тренажѐрах следует указывать на отмеченные ошибки, искажающие важнейшие закономерности рабочих циклов в современных дизелях) It is critical to point at the noted errors that distort the most important regularities in working cycles in modern diesel engines in the process of training cadets and fleet mechanics on simulators [6];

– long compound and complex sentences, for example: (orig.: Это уравнение справедливо при переменных плотности и теплоемкости среды по длине канала. В оценочном расчете переменностью этих величин можно пренебречь.) This equation is valid for variable density and heat capacity of the medium along the length of the channel, however the variability of these values can be neglected in the estimated calculation.

– non-finite forms of the verb for example, (orig.) while translating a sentence into English «Все эти работы касаются методики обучения, рациональных приемов работы со слушателями, психологического, человеческого и других факторов, влияющих на эффективность тренажѐрной подготовки, но не рассматривают вопросы технической корректности информации, которая выдается тренажером. [6]» it is advisable to render a part of a Russian compound sentence by means of a gerund: «All these works relate to teaching methods, rational working methods with students, psychological, human and other factors affecting the effectiveness of simulator training, without considering matters of technical correctness of information that is issued by the simulator»;

It has been commonly accepted that the one of the most frequent grammatical features of scientific/technical writing is the use of the passive. This is explained, firstly, by the fact that it is not accepted in such texts to use the first person singular, secondly, most verbs that denote actions, process or reaction are transitive.

For example: in a sentence «Тренажерная подготовка должна проходить только совместно с лекционными занятиями для повышения теоретической и практической подготовки специалистов, для выработки умения анализировать сложные процессы, протекающие в элементах судовой техники [6]. «The active voice may be more adequately rendered with the verb «to hold» in the passive voice: «Training should be held only in conjunction with lectures to allow for greater efficiency of theoretical and practical training of specialists».

Therefore, in addition to the above, knowledge of a certain number of linguistic phenomena is necessary for an adequate transfer of content by the translator:

1. The concept of a firm word order in an English sentence and cases of deviation from it (inversion), e.g.: (orig.: В тренажѐре DPS 100-GFCA моделируется силовая установка танкера дедвейтом 180000т с

современным длинноходным дизелем 6L90GFCA) - The power plant with modern long-stroke diesel 6L90GFCA of tankers of 180,000 tons DWT is modeled in DPS 100-GFCA simulator.

2. Functions of formative multifunctional verbs: be, have, do, shall, will, e.g.: For instance, the verb *to be* may be used in its modal meaning of obligation in rendering some phrases from Russian into English, e.g. *следует отметить* - *it is to note*.

3. Functions of modal verbs: can, could, must, may, might e.g. the modal verb *would* can be used for rendering a repeated action in the past: Эта методика использовалась для определения граничных условий теплообмена по боковой поверхности головки поршня при расчете температурных полей поршня дизеля 12ЧН18/20 [8]. - This technique would be used to determine the boundary conditions of heat transfer along the side surface of the piston head when calculating the temperature fields of the diesel piston.

4. Knowledge of multifunctional structure words (prepositions, conjunctions) and transitions: в связи с этим (in this regard), в свою очередь (further), более того (moreover) etc., which are abundant in scientific and technical texts on engineering both in Russian and English

Despite the fact that the English and Russian languages differ in their grammatical structure, this does not prevent the achievement of an adequate translation from one language to another.

Conclusion

When translating scientific and technical texts, the majority of students encounter many difficulties. However, most of them can be eliminated by adhering to the rules of grammar and the use of appropriate vocabulary. It is necessary to replenish lexicon regularly by reading technical literature and scientific articles, watching films, communicate with native speakers, especially with colleagues since the translation is impossible without the use of sources of linguistic and technical information [1], in which the translator must be well-oriented and should employ it.

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Аннотация. В данной статье рассматриваются проблемы, возникающие при переводе научно-технических текстов по судовому машиностроению с русского на английский язык, а рядом отличительных признаков научно-технического стиля, которые предопределяют требования к корректному переводу исходного текста.

Ключевые слова: научный, технический, перевод, проблемы, язык.

Annotation. This paper considers the problems of translating scientific and technical texts on marine engineering from Russian into English, determines the basic requirements for professional translation from Russian into English, predetermined by a number of distinguishing features of technical and stylistic styles.

Keywords: scientific, technical, translation, problems, language.

HOW TO READ AUTHENTIC TEXTS

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One of the main aims for any learners of English is to be able to read authentic texts. In linguistics and education, it is considered that “authentic text” is a text written for any purpose other than teaching / learning a language. Different texts of all genres written for native speakers such as novels, scientific articles, blogs, websites, textbooks, newspapers and magazines are known as authentic texts. It is well-known fact that reading of such texts is a very useful for learners but it requires a very large vocabulary. Before reading authentic texts easily English learners will have to learn a lot. So the problem of reading authentic texts is studied in this article.

Due to the fact that students need to read the text in order to gain knowledge and use selected parts of it in their own new text (such as an essay or presentation), it’s important to define the main tasks of reading. Do you want them to gain a comprehensive understanding of the whole text, or will they use it more superficially – for example, in order to identify key words?

Depending on the purpose there are four types of reading:

- 1- **Skimming:** reading for the gist or the main idea of the text.
- 2- **Scanning:** reading to find specific information.
- 3- **Extensive reading:** reading for pleasure and general understanding.
- 4- **Intensive reading:** reading for getting the details.

Different types of reading strategies should be taken into account before, during and after reading. First of all we should control the vocabulary and the number of unknown words. Grammatical structures should be known to the students due to background knowledge. Learners mustn’t be overburdened by a large number of unknown words because if the number of unknown words is too large, they cannot participate in an authentic reading experience. The research [6] shows us that admissible percent of unknown words for comprehension is about two. You should realize that even text with known words can be difficult for understanding if

students don't have background knowledge of the topic and it may cause enormous reading problems.

Secondly, we must create different types of exercises that will help students to find and analyze the content of the text. Such tasks give learners an opportunity to practice in reading.

Also we may use context clues to assist comprehension by figuring out new words based on the context of surrounding words. It is good practice to predict about what will happen next or to use visualization. If you're listening to a story being read, draw a picture of the story line as you listen[6]. It is recommended to underline important information and make notes to be reviewed later, to write down questions for better comprehension of the text.

After reading it is desirable to give you opinion on the book's subject, write out the summary to demonstrate understanding. It is achieved by identifying and noting down the main points (the task), which they then use to form the basis of their Annotation.

Fluency should be developed. The aim of such activity for students is to become faster and more fluent readers. It can be obtained by rereading a text that the students have already read.

So, taking into account above mention information we may say that exercises aimed to develop reading comprehension can be divided into several groups depending on the purpose you want to achieve. They are:

4- **pre-reading exercises**: the students should see all the tasks before reading the text.

Pre-reading activity establishes a purpose for reading, activates prior knowledge, presents new concepts and key vocabulary, asks students what information they predict in the text, previews the text.

5- **while reading exercises** : they teach the students to extract specific information.

Students read, comprehend, visualize and build connections; they integrate the knowledge and information they bring to the text with new information in the text, pay attention to the structure of the text, read to achieve the purpose for reading, think about answers for certain questions, determine the meaning of unfamiliar words and concepts.

6- **Post reading exercises**: they are more connected with summing up the content of the text, investigation into the writer's opinion and may entail some kind of follow-up-task related to the text [8].

Students expand prior knowledge, build connections and deepen understanding.

So, it may be noted that teaching authentic reading is very important. We should remember that the aim of reading is to understand the texts. We

consider that in order to become proficient readers in English, the students need access to texts that make it possible for them to respond in an authentic way to what they have read. To read and comprehend authentic texts well, you need to increase your vocabulary constantly and read original texts as more as possible.

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Аннотация. В статье дается определение термину аутентичные тексты, показана необходимость увеличения словарного запаса, объясняется важность изучения лингвострановедения, анализируются принципы аутентичных текстов и их роль в овладении иностранным языком.

Ключевые слова: аутентичные тексты, чтение, понимание, грамматические структуры, словарь.

Annotation. The article gives the definition to the term authentic texts, shows the necessity of increasing our vocabulary, explains the importance of linguistic and cultural studies. It analyzes the principles of authentic texts and their role in mastering a foreign language.

Keywords: authentic texts, reading, comprehension, grammatical structures, vocabulary.

THE ROLE OF ACRONYMS, SLANG AND PUNCTUATION IN THE ENGLISH LANGUAGE

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Everybody knows that English language can be found worldwide: it's taught on every continent, and it has a much greater spreading than that of any other universal language, like French, Latin or Greek.

One interesting fact of this worldwide language is that today we see many local cultures. There are many differences in the use of traditional words and grammar in Nigeria, Papua New Guinea, the Caribbean and Singapore. Also we can observe an increased influence of African-American English and Spanglish in the United States. Also the internet plays an important role in changing the language. So it is very interesting to know what the face of English will be in years to come.

It is known that there are many differences between the education system of today and that of 1000 years ago. Today we have instant access to a world of information on the correct usages of language. But as we know people are constantly looking for something better and, if they find they'll take it on. We suppose that one day in the future, interpreters will be tracing back future languages to their genesis in English!

Today, English is the main language and global means of communication that unites people around the world. According to the number of speakers English is the second language because of large population of India and China. It is used in such areas of international relations as business, politics, science, medicine, education, trade and tourism. A lot of people study and speak English in Russia, Denmark, Sweden, Norway, Finland, China and Japan, Australia and Indonesia, and even in India and Africa. English is also studied throughout Europe.

So the main purpose of the paper is to study the future of the English language.

In everyday life, because of the day to day we say hundreds or even thousands of words that are homonyms. Let's define the meaning of these words. Homonyms are words that came from the Greek language. They

have identical sound and spelling but they differ in meaning. The total number of homonyms is about 19.5% of all words in the English language. The intensive development of this phenomenon in the English language is due to a number of reasons. First of all, we must say about borrowings from French and Latin. Secondly, it is the historical change of words. Thus, due to the development of the language, some words lost their original phonetic form and began to sound like others.

There are different types of homonyms:

1. Homographs. There are words that have similar spelling but different meanings. –e.g. rose (past tense of rise) and rose (flower), hail (ice storm) and hail (large numbers of something).

2. Homophones (heteronyms). There are words that are pronounced same but have different meanings – e.g. cite, sight, and site; to, too, two.

3. Homographs. Here is the opposite. Words are written the same, but read differently. –e.g. bow [bau] and bow [bəu].

4. Oronyms. There are certain types of homophones that have more than one word, or they have phrases that sound similar. – e.g. ice cream & I scream; carpet & car, pet[4].

Of course, it will be difficult for beginners to understand all homonyms. But due to the fact that English is developing we also should do everything for mastering language.

Now we want to draw your attention to smiley faces and letters and numbers which we use in our e.g. 8), :3, :p, ^_^. We call them emoticons. The word emoticon is a combination of the words emotion and icon. Emoticons are used online to convey intonation or voice inflection.

A few common emoticons include:

- :-(frown
- ;-) wink
- :(^^ crying
- >:) mischievous grin
- :-/ smirk or confused
- :-P smiling and sticking out your tongue
- :-D laughing hard
- >:-\ mad

We use the punctuation for expressing our emotions. We are sure that winking smiley faces never crossed the minds of the monks in the fifteenth century when they were writing out their parables.

As you see people are making art from punctuation.

Sometimes it's difficult to show emotions in writing, especially in the short ones, so the exclamation point helps us.

e.g. - Be careful! (call for caution). An exclamation point in this case indicates that it is worth listening to what is written.

- It's impossible! This phrase expresses surprise, amazement and other feelings.

Of course, with the help of an exclamation point, you can show positive emotions- e.g I'm so happy for you!

The next mark which is used for expressing emotions is a question mark. It is usually placed at the end of a sentence to express a question or misunderstanding. If you put a question mark together with an exclamation point, you can show your wonderment.

We use the , in our written language often when people write and when they pause in their thinking, they sometimes think (...) that they need to pause (...) in the sentence (...) or phrase.

But when your email or Internet article is full of dots (...), I don't want to guess your thoughts at the time of writing, I want to see your point of view, nothing more. Otherwise, I'll have to stop reading and think about the meaning of life. So it is advisable to use ellipsis once or twice.

We'd like to note that nowadays acronyms (e.g. i.e., LOL) and slang are widely used. It's getting harder and harder for normal people to understand the speech of our youth. An acronym was originally a pronounceable word made from the initial letters of other words. Many teachers say that acronyms help us to shorten our speech and words in good ways e.g. GMO – Genetically modified organism I only buy organic food free from GMOs [1].

The use of slang means that people belong to a certain group and others don't understand you. Thus you can connect with like-minded people who understand just what you mean by using the latest slang terms.

E.g. Ship:short for "romantic relationship," sometimes used as a verb.

"Everyone wants to ship Edward and Bella, but they say they're just good friends.

So we come to a conclusion that English is constantly evolving and each new generation gives new and interesting slang to the culture. In a digital age where everyone has computer, it's good to have an adopted set of acronyms that most people know. Thus, English is not going to turn into Weblish but we must do our best to master the language.

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Аннотация. В последние годы наблюдается значительное увеличение количества аббревиатур и сленга в иностранных языках. В статье исследуется будущее английского языка, дается определение термину омоним, описывается происхождение аббревиатур и объясняется необходимость различных символов для обозначения эмоций (смайликов) в нашей речи.

Ключевые слова: сленг, омоним, пунктуация, язык интернета, троеточие.

Annotation. In recent years, there has been a significant increase in the number of acronyms and slang in foreign languages. The paper studies the future of the English language, gives the definition to the term homonym, describes the origin of acronyms and explains the necessity of different emoticons in our speech.

Keywords: slang, homonym, punctuation, Weblish, ellipsis.

SECTION 12: RELIGIOUS STUDIES



UDC 246.3/241

RADICAL ISLAMISM. RELIGION?

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Introduction

Radical Islamism is an extreme manifestation of political Islam, which uses forceful methods of political struggle. Islam, like other religions, cannot be the root cause of the conflict. The radicalization of Islam is linked to the process of its politicization. Radicalism is characteristic not only of Islam, but also of other religions. Terrorism is an extreme form of radicalism.

From the point of view of philosophy, radicalism means a departure from tradition, historically interpreted as a tendency to reformist tendencies in solving complex socio-political and economic problems. Russian researcher V. Plastun notes: "Manifestations of radicalism are typical for periods of social crises that cause instability in politics and the economy, uncertainty and imbalance in the behavior of representatives of the lower and sometimes middle social groups. It is in many ways similar to extremism in methods of action and ways of expressing views».

Objectives of radical Islamism

First of all, radical Islam uses methods of resolving various problems in a decisive and irreversible way, leading to individual or mass terror, kidnapping and murder, etc.

The main task of radical Islamists is to convince everyone that he is in mortal danger in the face of the so-called western poison, which carries with it not the capture or invasion, as it was before, and seduction of modern materialistic and secular ideas, as well as a certain way of life.

Such a threat can be eradicated only by the monopoly of Islam, which entirely governs the state. At the same time, radicals believe that a true Muslim should turn away from any manifestation of western ideology, as well as join one of the voluntary unions. Such associations are designed to try to seize power in the state and maximize the sphere of influence by penetrating their members to elected positions in trade and professional representation in Parliament. In order to achieve their ultimate goal, the radicals first seek to compromise the current government, calling it a lackey of the west and a supporter of secular modernism alien to every Muslim. Thus, the government is declared an enemy of Islam, and all the members of the country's leadership are unfaithful. And as proof of this is that they do not apply the laws of Islam to all aspects of life in the state.

The reasons for the radicalization of Islam

It should be recalled that the resort to violence and terror was largely due to the repression of the state itself. An example of this is the persecution in Egypt of members of Muslim brotherhood in the 50s of the last century. As a result of this rash policy of Abdel Gamal Nasser, Islamic movements have become more acute. A striking example is the massacre organized by Hamas in 1982 in Syria, as well as the armed action against the Iraqi Shiite rebels 10 years later.

True face

Radical Islam categorically rejects the current world order. Its adoption would mean collusion with the West, and the peaceful resolution of existing contradictions – just an illusion. Radicals believe that international relations are conflict in themselves. The theory of Jihad, or Holy war, is based on the fact that armed clashes are and will be the rule of resolving differences until the end of the world. Therefore, militant Islamists believe that only weapons and blood shed in the name of Allah, are able to fight back the Western ideals that now dominate almost the whole world. Only after the destruction of these regimes and the unity of all Muslims, as in the Golden time of the caliphates, can peaceful relations be restored.

Conclusion

At a time when social inequality, corruption and authoritarianism are growing among the authorities every year, radical Islam (already in Central Asia) is growing stronger and gaining popularity with them. Muslims are increasingly taking part in terrorist acts. And it is a pity that this bloody

shadow falls not only on the peoples professing Islam, but also on religion as a whole. At the same time, radical Islamism has little to do with religion as Islam does not preach violence. This makes radical Islam more of a political movement or a kind of sect.

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Аннотация. Данная статья посвящена радикальному исламу, его задачам и причинам его появления. Поставлен вопрос о связи радикального ислама с мировой религией. На основе целей, задач и определений сделан вывод.

Ключевые слова: радикальный ислам, религия, секта, задачи, причины

Annotation. This article is devoted to radical Islam, its tasks and the reasons for its appearance. The question of connection of radical Islam with the world religion is raised. On the basis of goals, objectives and definitions the conclusion is made.

Keywords: radical Islam, religion, sect, objectives, reasons.

[illegible]

WHEN I THINK ABOUT THE WORLD

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Volgograd

For me world is, first of all, my family and my close people\friends, it is my home and my country. But trying to think deeper I can say that these are only my initial associations and feelings as world is a multifaceted notion. I am only a little particle in this huge world, a particle which sees and perceives this world from the position of my inner worldview. And if we look at the world wider – world is all living beings. World is us.

What is the basis of the notion WORLD? There are a lot of components in this polysemantic word. Firstly, world is not only what is inside us, it is agreement and mutual understanding between people, absence of strife, peaceful life on our planet. Secondly, it is land which is underfoot, water, sky, our planet the Earth, our Solar system, stars around us, space. So many notions are included into one word – world.

I want to unite these two meanings into one notion: world is harmony and balance of life both on the planet Earth and far beyond its limits. What does peaceful and harmonious life depend on? First of all it depends on our attitude to the surrounding world. It is us who begin to create world around us and so it is very important to be a kind and a sensitive person in order our actions brought good to all people on our planet. Holy Bible says: "Have peace between you". And it means that we must learn to live in harmony with ourselves and nature and protect the world around us, to admire its beauty, to honour traditions of our nation and respect traditions of other people. Communication between people must be based first of all

on respect to each other. It is through communication that people can get to know a lot of new and interesting things, find common interests, start being friends. Friendship can arise between people of different nationalities and this is great because if we are friends we will live in harmony and peace. Peaceful life on the Earth is the most important thing. Enmity and anger lead humankind to hatred, that is why wars occur in the world and they destroy all life on the earth, bring grief and maim the destinies of people.

Communication between people must be based on regard. I live in a hero-city Volgograd. Our city was destroyed to the ground during Great Patriotic War. Stalingrad battle became one of the bloody battles in the history of mankind. During six months of Stalingrad battle an incredible amount of German and Soviet soldiers and 1,9 million of civilians perished. These staggering figures are human lives. I've read a lot about Stalingrad battle and heard veteran's stories about this terrible battle. Pain and sorrow of the people can't be filled, feat of our people will be preserved in the memory of humankind forever. Great Patriotic War is an awful example which tells the whole world about irretrievable losses and horrors of war. We must remember and honour the heroes which fought for peaceful life on the Earth.

Children of different nations must communicate more and get to know about culture and traditions of each other. These are children who can become conductors of peace because we can find common language and start friends. Just imagine, if all children from different countries become friends will the wars be possible then? I think no. Today we are children and tomorrow we will become adults but still will be friends and create wonderful things on the planet Earth!

International camp Artek opens opportunities to get to know each other and make friends with people from other cities and countries, and that is why I want to go to Artek. Together we can dream, create something new, expand the boundaries of consciousness. And the most important thing – we can become friends and communicate in the future.

Studying foreign languages – is one of my hobbies. Besides studying foreign languages at school I also study at foreign languages' school; and last year classes in summer school were conducted by the students from England. All the children loved such format of classes. We became friends and so studying foreign languages turned out to be much more captivating. Our teacher's name was Steven and he told us a lot of interesting facts about England. When I was telling about Coventry city which is a twin city of Volgograd, Steven became interested and wanted to know more about Stalingrad battle. Together we visited Russian shrine – memorial complex "Mamaev Hill" and Museum-panorama of Stalingrad battle. Steven was

struck by the greatness of our monuments and by how we honour the feat of our people. We told Steven about our great grandfathers which were participants of the Great Patriotic War and showed the photos of the war time. When Steven was ready to go home I presented him several books about Stalingrad battle and he was very thankful. At the end of our classes we made jokes, told each other stories in English. We still continue to communicate with each other, write letters to each other, communicate in Skype and this is a wonderful example of friendship between people of different countries which also allows to study language through communication. My classmate was in Artek and he told a lot about this wonderful camp, about trips, about different contests and events, about famous people which came to Artek. He made friends with children from other cities and he had got a new hobby – chess. Together with him we've joined the chess club and now play chess at the weekends with pleasure.

Children from different cities and countries will come to Artek and I am interested to know more about them, about their customs, traditions, culture. It will help me to get to know them better, and of course I will be able to use my knowledge of foreign languages. It will be easier for us to communicate and study a language of each other. I think we will be able to realize mutual projects and to take part in different contests. Artek is a place where you can find friends for life, make your life brighter and more interesting, get new hobbies and knowledge. Besides studying foreign languages I attend musical school, I play a saxophone. I am also fond of robotics and I think I will be able to share my knowledge and experience with other children and learn a lot of new things.

International Camp Artek is a wonderful world of friendship and all good things on the Earth are based on it. New formats of communication are created in Artek, creative abilities of children are revealed and realized.

Why do I dream to go to Artek? International communication is very important for me, it will allow me to learn national traditions and culture of other people. Friendship between children of the whole world is a great stimulus to study foreign languages deeper. Artek teaches people of different nationalities and miscellaneous religions to establish kind relations with each other and it is a pledge of peace and consent between people. The most important for me is peaceful life on Earth, because it is so wonderful in different corners of the world, so we must bear good in our hearts, and it creates beauty, harmony and peace in the whole world!

Аннотация. Описаны компоненты многозначного слова «мир». Автор отмечает, что дети разных народов должны больше общаться и узнавать о культуре и традициях друг друга. Говорится о возможности реализации совместных проектов и участия в различных конкурсах.

Ключевые слова: мир, Артек, Волгоград, Мамаев курган, коммуникация, иностранный язык, культура, национальность, традиция.

Annotation. The components of the polysemantic word "world" are described. The author notes that children of different Nations should communicate and learn more about each other's culture and traditions. The possibility of implementing joint projects and participation in various competitions is mentioned.

Keywords: world, Artek, Volgograd, Mamayev Kurgan, communication, foreign language, culture, nationality, tradition.

UDC 378

STRUCTURAL MODEL OF INTERACTIVE CYCLES OF MUTUAL INFLUENCE OF ENVIRONMENT AND INDIVIDUAL FACTORS

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In the context of the transition to a digital economy, the task of developing scientific knowledge and training a qualified professional specializing in a foreign language is provided by the information and education environment, which involves improving the quality of teaching and developing the creative and intellectual potential of students, in accordance with articles 15, 16, 17 and 18 of the Law of the Russian Federation "On Education".

The educational process in the information-educational environment not only affects the quality of education, but also contributes to the involvement of the teacher in promoting the development of a highly professional personality of the student-philologist. This is confirmed by the increased level of attention to this topical topic of the following domestic scientists: Y. S. Baranovskiy, A. S. Belyaeva [1], L. N. Bobrovskaya, E. V. Danilchuk, N. Y. Kulikova [2], N. V. Borisova [3], etc., who present some aspects of the modern educational environment, as well as problems of professional competence formation in the global digital society.

Based on the research results of such scientists as A. A. Andreeva, V. I. Soldatkina [4], S. K. Gural, A. S. Lazareva [5], it can be noted that a completely new culture of education of students within the framework of the culture of e-learning culture is being formed, in which new approaches to obtaining knowledge by students are being created, which represents a new paradigm of education in Russia.

In this regard, in order to disclose the content and functionality of the environment, it is necessary to define the meaning of the word "environment".

Initially, the Old Russian word "environment" had the meaning "middle" [6]. Then, as noted in his paper B. B. Vinogradov "a part of the meaning of the word "environment" took the form of a derivative word "middle" ("middle"), and in the XIX century, to the list of meanings of the word "environment" added new ones: a set of natural and social conditions of human life and society, a set of people bound by the general social conditions" [6], etc.

In the modern approach, the use of the word "environment" in Russian has three variants of meaning: "filling substance", "surrounding conditions" and "social group". In forming a common approach to the meaning of the word, it can be noted that this environment is understood "as something that is between objects or between a subject and object; it is a kind of intermediary, carrying out certain functions" [7]. It should be noted that there is a difference between the term "environment" and the term "space". Let's analyze the most important of them. According to the researches of scientists: E.A. Rakitina, V.Yu. Lyskova [8] and others these two notions are not synonyms, but rather close in meaning, because space is "a set of conditions connected in a certain way with each other, which can influence a person". However, according to the meaning of the word "space", researchers do not imply and do not consider the possibilities of a person in this space, i.e. space can be formed independently of a person.

Therefore, the interpretation of the term "environment" implies a set of interrelated conditions that affect the person, in which he takes a direct part in the interaction with the environment. Thus, the difference is that the given "environment" and its modern interpretation assumes presence and interaction of the person in the given environment.

In his research K.A. Kalyuzhny, argues: "If we consider a man as an open non-linear system, then, using the terminology of synergetics, the concept of "environment" can be defined as follows: it is an external space in relation to the system, in interaction with which the processes of dissipation and self-organization are carried out in open systems". [9]. Therefore, it can be noted that this author does not define any space by the environment, but only by the space that influences and interacts with a person.

The analysis of the above-mentioned works made it possible to define the author's concept of "environment" as applied to an individual, including the interaction of correlating factors and the person who is influencing or anticipating them. The individual's response influences the already occurred

or current influence of the environment factor. For example, environmental influences such as the rapid development and availability of electronic devices, information capabilities and digital technologies, ensure that students make massive use of smartphones and tablets (feedback). The notion of "pre-emptive effect" can be considered as a certain behaviour or a response of an individual to a situation simulated in the future, which may occur because of or contrary to his actions. With regard to the conditions of the first impact, the individual has the opportunity to adapt and reduce the negative consequences of possible environmental influences. The conditions of the second part of the impact suggest the possibility of transformation of an individual's behavior as a result of the natural course of events, which occurs in conjunction with the necessary action on him/her. Therefore, the impact assumed by a person in the future creates a condition and reaction of the environment to this event. For example, a student has a modifying pre-emptive effect when within his or her social microenvironment (which is the social environment in which the student philologist is located). This may be the group in which he or she is being trained, the additional training team, the family and other groups. All this forms a team to work on a training project. In this way, many interactive cycles of mutual influences of environment and individual factors are formed. The structural model of interactive cycles of mutual influence of individual environment factors is presented in Figure 1.

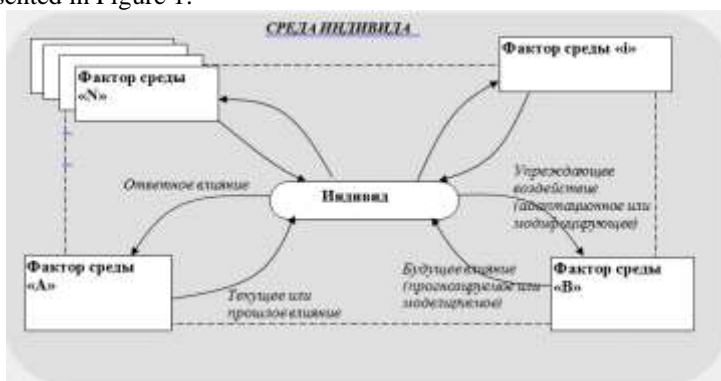


Figure 1 - Structural model of interactive cycles of mutual influence of environment and individual factors

The proposed abstract model (Figure 1) reflects only the general features, mechanism, interaction of an individual with the environment. The concept of an individual includes a person, a student (student or schoolboy), a professional, a specialist or any other person.

Conclusion.

Therefore, the environment is also a capacious concept, which can cover both the general environment in which the individual exists and its components: educational, professional, social environment, etc. At the same time, the above described conceptual mechanism of interactive cycles of mutual influences in the abstract system of "individual-environment" should be transferred to the system of "student's university" - information and educational environment of higher education" for its subsequent design and further research.

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Аннотация. В статье предложена структурная модель интерактивных циклов взаимных влияний факторов среды и индивида, отражающая общие черты, механизм и взаимодействие индивида со средой. Автором дано понятие индивида, а также среды, в которой существует индивид, и её составляющие: образовательная, профессиональная, социальная среда.

Ключевые слова: индивид, фактор среды, структурная модель, специалист, определение среды.

Annotation. The article suggests a structural model of interactive cycles of mutual influence of environmental factors and an individual, reflecting common features, mechanism and interaction of an individual with the environment. The author gives the concept of an individual, as well as the environment in which the individual exists, and its components: educational, professional, social environment.

Keywords: individual, environment factor, structural model, specialist, environment definition.

THANK YOU FOR YOUR PARTICIPATION!

Scientific edition
«Recent Achievements and Prospects of Innovations and Technologies» /
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