МИНИСТЕРСТВО НАУКИ И ВЫСШЕГО ОБРАЗОВАНИЯ
РОССИЙСКОЙ ФЕДЕРАЦИИ
КАЗАНСКИЙ НАЦИОНАЛЬНЫЙ ИССЛЕДОВАТЕЛЬСКИЙ ТЕХНИЧЕСКИЙ
УНИВЕРСИТЕТ ИМ. А.Н. ТУПОЛЕВА-КАИ (КНИТУ-КАИ)

АНГЛИЙСКИЙ ЯЗЫК В СФЕРЕ ПРОФЕССИОНАЛЬНОЙ КОММУНИКАЦИИ

V Всероссийская молодежная научная конференция

Казань 29 ноября 2019 г.

МАТЕРИАЛЫ КОНФЕРЕНЦИИ

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СЕКЦИЯ 1
ПРАВОВЫЕ, ЭКОНОМИЧЕСКИЕ И СОЦИАЛЬНЫЕ ПРОБЛЕМЫ НА СОВРЕМЕННОМ ЭТАПЕ РАЗВИТИЯ ОБЩЕСТВА

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PROBLEMS OF THE GLOBAL LANGUAGE IN THE FIELD OF COMMUNICATIONS

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In this paper we will consider:

1) The topic of teaching English

2) The issue of preserving the nationality of the language

3) New teaching methods in the context of modern technology

Problems:

1) Globalization of language. The global language is a conductor in the culture of English-speaking peoples. However, its prevalence entails negative consequences. So-called variations of the English language (Spanglish, Frenglish, Denglish, etc.) appear, which in turn affect the formation of a more simplified version of the language. Its wealth and beauty are gradually lost. Because of this, difficulties arise in teaching English, because very often teachers are native speakers of culture and language. They are trying to keep their national language in its original state. In the process of teaching, the teacher needs to convey to students a simple idea that by studying another language, he is studying the culture of another people, which must be respected. But in the modern world this principle is less and less preserved, because people who have just learned the language begin to simplify it. This is the problem of globalization, which is reflected in language learning.

2) Another problem of teaching foreign languages in the era of globalization is the methodological side: how and with what to teach. Due to the rapid growth of progress, the education system is changing rapidly. And at present, the content of teaching foreign languages asks only one question: “What to learn?”. For example, Schukin considers the content of training from the perspective of the object of instruction, the object of assimilation, and learning outcomes. And Lim, in turn, believes that the components are foreign-language communicative competence and its components (activity and emotions). Those. It is conditionally necessary to create an enabling environment for teaching language units.

This problem is relevant because English is now actively distributed as the main language for international communications. Without knowledge of which no business, diplomatic, scientific, cultural relationships are possible.

So, what we could offer to solve these problems. We live in an era of gadgets and the Internet. It is necessary to use this:

1) It is necessary to constantly develop modern communication technologies, the main mission of which is to optimize the interaction and mutual understanding of different cultures and peoples. Even if you consider the text on the Internet as a unit for learning English, then it can be motivation for people. Everyone wants to receive relevant information, and for this he will have to learn a foreign language. Also, do not forget about social networks in which everyone can practice their skill with native speakers. Thus, he will not only learn English, but will be able to get acquainted with the national culture and even help preserve the features of this language.

2) Today a new approach to teaching foreign languages is needed. The formation of foreign communicative competence of the younger generation, the education of morality, and respect for culture are dependent on the professional competence of teachers.

Conclusion: in the era of globalization, English is very simplified, because of which its wealth is lost. When learning English, everyone should respect him and the culture of his speakers.

That is why it is worth changing the approach to learning a language in order to preserve its individuality.

Foreign language proficiency is the most important condition for communication between people of different nationalities. In the modern information world, people's interest in learning foreign languages is rapidly growing. Thanks to scientific and technological progress and the changes taking place in society, the education system is being improved. Therefore, the process of teaching foreign languages in a secondary school and in higher educational institutions must comply with the requirements of the time. The world is becoming different, the process of globalization covers all spheres of society. Rapprochement and fusion of languages and cultures of different countries, a global language is born. In the second half of the 20th century, the decisive position in international and intercultural communication was won by the English language, whose influence has now become global. It is generally accepted that the American version of the English language claims to be the global language today. Each nation makes its own changes to traditional English, including pronunciation, word formation, meaning and use of vocabulary, as well as cultural characteristics of lifestyle.

Obviously, a new approach to teaching foreign languages is needed. The global language is a guide to the culture of English-speaking peoples and a means of understanding people. However, the presence of a global language entails negative consequences both for the English language itself and for languages of other nations. The study of foreign languages is closely connected with the study of cultures of speakers of various languages. Native English speakers clearly distinguish between British and American cultures. However, for most foreigners it doesn't matter which version of the language is used in communication, if only understanding is achieved. For them, cultural differences are also irrelevant. In this regard, intercultural communication is communicative disruption.

Along with this, difficulties arise for teachers of foreign languages who need to solve the problems of preserving the language and culture of the global language itself and the worldview of another foreign language. The main conditions for effective interaction between representatives of different cultures are mutual understanding, mutual respect for each other and a tolerant attitude towards different cultures. In intercultural communication, the level of intercultural communication and the depth of understanding are important. According to the «salad bowl theory», in a multinational society, individual cultures do not disappear, that is, do not fuse into a single culture, but retain their individuality, and there is a common national flavor. At the present stage of development of society, the process of intercultural communication takes on new forms. The development of electronic means of communication has led to the development of a «computer-mediated form of communication that has fundamentally changed the nature of discourse». More and more often, the idea of a global village is being voiced: "The world, entangled in electronic networks, is turning into a "global village", where space and time are abolished, and the life of each individual sweeps "at the speed of light"." In the process of interaction between participants in intercultural communication, a wide variety of electronic means of communication are widely used: e-mail, skype, voice and video, social services Facebook, Twitter, as well as platforms for creating their blogs and much more. Thus, the teaching of foreign languages in the era of globalization has its own characteristics and problems. One of the problems of teaching English for many countries is the choice of the content of training, that is, the choice of the amount of educational material sufficient for communication, in other words – "what to teach", which version of the English language and which culture to teach? Is this not a tendency to simplify educational material in the content of textbooks?

Innovations in teaching foreign languages in the era of globalization are associated with a change in the content of teaching foreign languages, a change in pedagogical technologies, teaching methods and means.

So, the main difficulties of modern language education are in the content of instruction, methods and means of instruction. These categories of teaching foreign languages in the innovative process of public life are also transforming, like the entire educational system. The content of

teaching foreign languages as a methodological category answers the question “What to learn?”. There are several approaches to determining the content of teaching foreign languages. “The content of education,” according to I.L. Bim is all that a person needs to master in the process of education. ” However, in every historical era, this concept was filled with its specific content. I.L.Bim, like other methodologists, considers the text as the main unit of the content of instruction. The text appears in learning as an object for recognition visually and by ear, as well as a product of speech production (speaking, writing). The text is able to carry any information from all areas of knowledge, which gives a diverse orientation to teaching foreign languages. Learning to read (working with text) is directly related to learning to speak. Another L.V. Shcherba in his works paid special attention to reading: “Teachers who believe that reading can only be learned to the extent of speaking the spoken language imperceptibly fall into the wrong circle: in order to learn to read books, you need to learn to speak, but it turns out that for in order to learn to speak, you need to read a lot. ” So, according to the definition of I.L. The main components of the learning content are the learning objectives, the activities of the participants in the educational process and a favorable learning environment, which largely depends on the conditions in which the educational process is carried out, that is, we are talking about a modern educational information environment.

The formation of a foreign language communicative competence and its components is the goal of teaching a foreign language in any form of training. To achieve this goal, it is necessary to create an informational and educational environment conducive to mastering the language units, the main types of speech activity, regional and general cultural knowledge, communication skills with a limited amount of language resources, and general educational and special skills.

Considering the text as the main unit of the content of teaching foreign languages, using the capabilities of the Internet, we have access to relevant, authentic information in Internet resources, which helps to increase students' motivation to learn foreign languages. Information about the latest events in the world, texts of native speakers expand the content of the textbook, which causes interest in another language and other culture. The richest information resources of the Internet with their skillful use have a positive impact on the process of assimilation of knowledge. The study of a foreign language and foreign language culture in comparison with the native language and native culture is one of the characteristics of modern language education. Therefore, teachers of foreign languages need to create situations for the network interaction of students with native speakers. Real and virtual travels contribute to a deeper study of a foreign language, foreign language culture and the knowledge of one's own culture. The virtual space today provides a large selection of online educational communities for students and schoolchildren.

Information sites of world capitals, international organizations, virtual museums, electronic libraries, electronic newspapers and magazines, etc. Accessible to each participant in the educational process and contributes to the formation of students' sociocultural competence. Answering the questions “how to teach” and “with what means” to teach a foreign language today, one cannot ignore modern information and communication technologies and opportunities (skype, video conferencing, chat rooms, forums, digital libraries, virtual museums, virtual worlds, etc.) Under the conditions of methodologically sound organization of students' activities, they allow increasing the volume of speech actions and the density of communication in a foreign language. You can also increase the density of speech practice in a foreign language due to mobile training, which is currently developing in the form of the BYOD (Bring Your Own Device) concept and “just in time” technologies.

Today, it has become familiar to people to communicate using digital devices of various kinds. And in education, traditional teaching aids are used in combination with digital tools, as a complement. However, they have great potential for achieving educational results, it is only necessary to correctly correlate their capabilities, educational goals and the organization of educational activities. The process of modernization of the education system places high demands on the teacher. He must possess at a high level not only subject knowledge and skills, but also pedagogical, information and communication technologies, as well as technologies in the field of distance learning of foreign languages. Teaching foreign languages in the era of globalization has

its own characteristics and difficulties. Preparation for real intercultural communication defines the main goal of teaching foreign languages. To achieve this goal is possible by means of the subject «Foreign Language». In the article «Learning foreign languages in the era of globalization and dialogue of cultures» M.N. Vetchinova claims that today approaches to teaching a foreign language are organized around its cultural component, and the idea of studying the culture of a people through language teaching is becoming the main educational paradigm. According to S.G. Ter-Minasova, a foreign language lesson is a crossroads of cultures, it is a fact of filing a foreign language culture, it is the practice of intercultural communication, because every foreign word reflects a foreign world and a foreign culture. One of the components of the goal of teaching foreign languages is sociocultural competence, the formation of which directly depends on the formation of linguistic and speech competencies. Learning a language, we study the culture of native speakers. The emergence of a single global language, according to S.G. Ter-Minasova is attracted by the opportunity to solve many problems of international communication, reduce the huge financial costs of international organizations for translators, facilitate the exchange of information and, therefore, accelerate and improve scientific and technological progress, trade, business, etc. However, "the prospect of a global unification of mankind, the interaction and interdependence of all people and all countries living peacefully and together in one global village, provoked the opposite reaction, namely, made all peoples recall their languages and cultures, national traditions, tastes, values, which led to the realization of the importance of maintaining national identity. " In this situation, the difficulties of teaching foreign languages are obvious. In the era of the «birth» of the global language, the issue of preserving the diversity of languages and cultures, historical values and traditions remains relevant. "Every culture, - according to V.I. Karasika, which claims to be global, contains the values and norms of the global (or metanational) culture preceding it, which it opposes itself." The task of a teacher of a foreign language is to form students' communication skills to achieve mutual understanding. Teaching foreign languages is directly related to the innovation processes taking place in the world and in society. Modern communicative technologies are being developed, the main mission of which is to optimize interaction and mutual understanding in human society. Today, a new approach to teaching foreign languages is needed. The formation of foreign language communicative competence of the younger generation, the development of morality, respect for a different culture, successful communication and mutual understanding between peoples depend on the professional competence of school teachers and university teachers, their skills.

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SYSTEM-BASED AND SITUATIONAL DYNAMICS OF TECHNOCRATIZATION OF MAN AND SOCIETY IN HISTORICAL ASPECT

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In order to study the problem of technocratization of man and society and its dynamics it is necessary to define this phenomenon. Technocratization (from the Greek - τεχνη - art, craft; κρατια - power) is social, political, scientific and economic process of distribution, implementation, use and multiplication of technical tools and devices designed to facilitate or simplify human activities. [1]

What is technology and why it is so much important to humanity? Engineering equipment is the tools and any artificial devices created by mankind to simplify physical and mental labor, and used to create new, more advanced technologies for the study of nature. The term engineering equipment means any technical products that have not previously existed in nature. Engineering incorporates the knowledge and experience of previous generations, which naturally increases its value for the mankind along with the traditions, religion and patterns of behavior imparted from generation to generation.

Engineering as a cultural phenomenon has a connection with science, politics and morality, etc. Ancient Greeks believed that technology imitates nature and acts like natural processes, but is designed and controlled by man.

In contrast to Greeks, the Italian philosopher and inventor Leonardo Da Vinci viewed technology as an extension of nature (but not as science). In his opinion, engineering technology is something that can be designed and constructed and represents the limit of the possibilities of the surrounding nature.

The 20th century is considered to be a new stage in the relationship between science and engineering technology.

All processes which occur in nature and society are bi-directional: the first is the direction to sophistication, complication, development and progress; the second direction is to regression and destruction. Therefore, there are two main concepts associated with the problems of engineering technology - a scientific and technical ‘*pessimism*’ (= ‘anti-technicism’) and scientific and technical ‘*optimism*’ (= ‘technicism’). The ‘anti-technicists’ argue that the race for new advanced technologies is dangerous and unpredictable, as in specific situations, technological progress can threaten the health and even the lives of people. Technological progress separates people from their natural habitat, from their origin. A person becomes just a consumer and thus moves away from the spiritual interests of existence. Such changes are viewed as a mockery at nature. People create future that is extremely difficult to foresee. Technology creates favorable conditions for the people, whose interests are too far from the authenticity of culture. In Russia, Nikolai Alexandrovich Berdyaev began to promote ‘pessimism’. In his work "The meaning of History" Berdyaev speaks about the turning point of engineering technology in the life of humanity. The appearance of ‘the machine’ is "the greatest revolution that history has ever known and the crisis of the human race." Berdyaev considers the situation as the end of traditional humanism and the loss of its values. Berdyaev defines three stages of human development:

1) Natural-organic stage.
2) Cultural stage.
3) Technical-machine stage. [2]

Those who vote for ‘technisizm’ believe in the importance of advanced technologies for the sake of humanity; the future well-being of the planet, in their opinion, is directly dependent on inventions and achievements in this field. ‘Technicists’ foresee the appearance of some negative consequences of the progress, but they see the solution of this problem in the creation of even more advanced technologies. Engineering technology is designed to help people, to expand their opportunities; it simplifies the possibility of self-study, creates suitable conditions for self-realization. Karl Theodor Jasper said, "Engineering technology is a means of simplifying of human existence."[3]Martin Heidegger views it as a way of self-discovery of life. In Russia, the idea of technological optimism was developed by Peter Engelmeyer. One of the branches of ‘technological optimism’ is the technocracy. From this point of view absolutely all problems of mankind are solved only with the help of technology. They neglect the importance of social needs of people, deny the role of art, theater, literature in the comprehensive development of an individual, placing technological progress and related social items at the first place.

Analysis of modern society and the rapid development of science and technology lead to the appearance of the following questions. Do all the new knowledge and achievements of the society lead to its future development and prosperity or to its decline and destruction? Are these processes consistent and naturally determined or accidental? Is it possible to control the situations that occur in nature and society? The questions and the answers to them have been analyzed by different philosophers at different times. Thus, in the “Critique of pure reason” Kant formulates the third antinomy: freedom and causality, where he formulates the ‘thesis’ and the ‘antithesis’. The ‘thesis’ claims that ‘there is reason for causality in nature and freedom’ . The ‘antithesis’ claims that ‘there is no freedom and everything in the world happens only according to the laws of nature. [4]

Spengler, analyzing social processes, wrote the famous book "the Decline of Europe", where he described the last stage of development of society. Society, having lost its culture and having reached the level of civilization, comes to its natural destruction and collapse.

Dialectical materialism, developed by Marx and Engels, dialectically connects the polar categories: necessity and chance, cause and effect, possibility and reality, etc. It is said that freedom is a conscious necessity. [5]

This problem is analyzed in an original manner by modern philosophers Solodukho N. M. and Sabirzyanov A. M. in their work "Situational approach in the philosophical and ecological context" where the system approach and situational approach are discussed. If the system approach has a strictly deterministic and naturally-determined character, the situational approach includes not only deterministic processes, but also nondeterministic, unexpected ones. The researchers conclude that the situational approach is broader than the system approach. [6]

Analyzing modern society in the framework of situational approach and its crises in different spheres, such as economic, political, environmental, social, etc., we can conclude that they have different-level character of systematic and situational events. So at the economic level, science and technology lead only to the aggravation of the crisis. If in early times man took from the environment the most necessary things for his living and carefully treated nature by establishing traditions of archaic religion, today man uses natural resources in industrial scale, taking more than can be easily renewed by nature itself. And some natural resources are not renewable at all. This leads to imbalance between the production, consumption and distribution of resources, and therefore, to economic and political military crisis. Profits from the extraction and processing of resources are distributed unevenly, there is an unidirectional concentration of management, a monopoly is created in all spheres of influence by society including education, medicine and production. Thus we get the combination of two spheres: natural (original) – systematic and social (artificial) - situational. There is the similar combination of system and situational events in society, as the person is the combination of intellectual, emotional and spiritual aspects.

In the 21st century, the impact of technological progress on people is immense. All our life is connected with engineering technology. We cook on gas stoves, drive cars to work, and spend our free time watching TV. Human consciousness is completely immersed either in the production of technical items or in its use. The technocratization of society becomes inevitable. A person wants to

manage all spheres of life, and to control all the situations and events. No doubt that technical progress helps to achieve this. But sometimes some situations get out of control and one can face the negative consequences, ranging from bad habits associated with digital addiction and ending with various technical disasters.

According to the situational approach, events can occur when systems meet, at the time of the origin of a system or at the time of its destruction. It is enough for a person to observe nature to understand that all events in this world are stable, naturally predetermined and have a harmonious character. In perfect systems, each element acts for the benefit of the entire structure. Such a system cannot work properly without any of its components. From an early age, humanity created new and new systems, thereby creating the background for dynamics. But everything in our life has its own downsides. There are processes that disrupt these systems, bringing them out of balance, destabilizing them, and making one system absorb another. In our time, there are many systems that violate our world. The development of medicine, chemistry and other sciences, make it unnecessary for a person to look for a partner of the opposite sex for propagation. Human can be grown in test tubes experimentally. Man was able to learn to clone animals and will soon be able to learn to clone their own kind. That will almost eliminate the need to create a family as a necessary component of procreation. There is a tendency in Europe and America for the "same-sex marriages." In the countries of the post-Soviet-period this trend has not yet been observed. There is a huge number of families not able to bring descendants, which, according to scientists, will do no good for the mankind.

Thus, as a result of analyses of everything mentioned above it can be concluded that science, engineering and technology do not only contribute to the simplification of existing production processes and develop new fields of activity (aerospace, Internet, etc.), but destruct social structures, reducing the desire for people to communicate with each other and reduce the overall level of development of consciousness, allowing people to explore the scientific literature and experience of past generations. Technocratization of man and society is both systemic and situational in its nature. Its purpose is to create controllable situations which can lead to positive development. Engineering technology is neutral itself. It becomes a destructive tool only in hands of people with a specific worldview.

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DEVELOPMENT OF THE VOLUNTEER MOVEMENT

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Volunteering is described as an unpaid activity where someone gives their time to help a not-for-profit organization or an individual who they are not related to.

One of the better-known benefits of volunteering is the impact on the community. Unpaid volunteers are often the glue that holds a community together. Volunteering allows you to connect to your community and makes it a better place. However, volunteering is a two-way street, and it can benefit you and your family as much as the cause you choose to help. Dedicating your time as a volunteer helps you make new friends, expand your network, and boost your social skills. [1]

On December 5, the Russian Volunteer Forum summed up the results of the nominal year.

According to the organizing committee, in 2018 the number of volunteers in Russia increased from 7 million to 14 million, 90% of the population now have a desire to participate in community service (compared to 60% last year), and the number of search queries has tripled (compared to with 11 months of 2017), now there are more than 700 thousand.

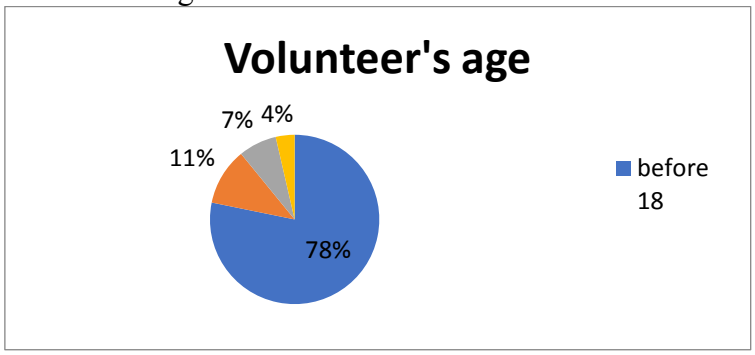
Russian Public Opinion Research Center (VTsIOM) found out that the most popular form of volunteering in Russia is landscaping. 72% of respondents participated in beautification. The same VTsIOM clarifies that 7-8% of the country's population are constantly participating in volunteer activities.

Recently, a culture of volunteering has developed. It became obvious that a volunteer is not a free labor force; it’s not just someone who has nothing to do, but a person who acts at the call of his heart to help others.

Volunteering gives such opportunities as

1. Stress reduction. In 2015 there are two works,that help to other reduces stress exposure.
2. Addiction risk reduction. “Oxford Handbook of Prosocial Behavior” published information that teenagers and student-volunteers tend to avoid alcohol and drug use,also the level of poor grades is declining.
3. Cardiovascular Risk Reduction. Research, that was carried out in American school in 2013, showed that students, who volunteer, lost weight and improved blood cholesterol compared to their peers.
4. Life extension. All of the above improvements accumulate as you grow older.
5. Production of the hormone of happiness. When we help others without expecting anything in return, our brain releases dopamine, serotonin and other hormones that cause an internal feeling of warmth and joy.

Volunteers’ age:



Based on our own research we make the conclusion that volunteers are often students because they have free time and wish. It is because adult people are busy at their jobs and children. [3]

Student volunteers play an essential role in modern society. Volunteering at Kazan National Research technical University named after A. N. Tupolev is an excellent opportunity for students to meet and exchange ideas with individuals who share your interest.

The "KAIST" Voluntary Movement distributes information, looking for people in university to volunteer event, implements personal projects. Also there is "Kind Wednesdays", where everyone can take part. "Kind Wednesdays" refers trips to pensions, shelters, children's rehabilitation centers, and collection and processing of waste paper and other materials (tin and glass cans).

We have own experience of volunteering: We started to do something last spring because of free English lessons and liked it. These actions let try something new and meet a lot of people. We took part in marathon, visited pension, handed over waste paper, bought animal feed, sang in the choir about KAZAN ARENA in honor of May 9, and greeted the press at a basketball game.

Studying this topic, we decided to knowopinion of another people. We asked about 80 peopleof all ages. There were these questions: Why do people work as volunteer? Why don't people work as volunteer?

We assumed people would answer the first question - it is a personal gain, to want to change the world, to have a lot of free time, but answers were-it is interesting; it gives happiness; people like to help others; a person can't help himself, so what is why he helps others; new dating (connections); like to make events; it's very interesting and useful experience

Another question is why people don't work as volunteer if it gives so much good emotions. It turned out that some of them don't know what it is; or they don't want to work for free. Some people are old and they want someone to help them or they are busy at their children; have little time; don't see point and so on.

Volunteering is important as it offers essential help to worthwhile causes, people in need, and the wider community. Indeed, many organizations and charities rely on the generosity of volunteers as often they're only part-funded through government or local councils, and cannot afford to pay salaries for all their staff. In fact, many companies depend almost solely upon teams of volunteers to help them thrive and do their work. [2]

Of course, there are the benefits of being a volunteer. For instance, the benefits to the receiver and the wider community are usually part of the reason why you decide to volunteer in the first place. In fact, volunteering is beneficial to the doer for a whole host or reasons, including stress reduction, combating depression and providing a sense of purpose. Physical health, new friends and avoiding loneliness, a sense of purpose and deeper self-confidence. In turn, all of these things will help to boost your overall happiness: a win-win situation for all involved. [2]

Having analyzed all the mentioned above, we can find out that the volunteer movement is just beginning to develop in Russia, but now we have already seen the enormous work and contribution of volunteers to our world. We believe that people's awareness only increases over time, which has a good effect on our environment. Volunteering helps not only the world, but also the people who live in it, as well as the volunteer himself, for example, to get positive emotions, satisfaction, a kind of prevention for the body.

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GAME METHODS FOR TEACHING ENGLISH TO PRESCHOLERS

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The topic we are working on is called “Game methods as a means of forming the lexical skills of preschool children in English classes.

The purpose of our research is determination of the effectiveness of the use of outdoor games for the development of lexical skills of preschool children in English classes.

The research requires to solve next problems:

1. Analyze the current state of the research problem in psychology and pedagogy.
2. To determine the features of the use of outdoor games as a learning tool.
3. Consider the principles of selection of outdoor games for use in English classes in a preschool educational institution.
4. Develop English lesson plans using outdoor games.

There are some principles that contribute to a good learning of foreign languages at an early stage:

• Education during the first two years should be conducted only orally, without reading and writing, in order to avoid many difficulties at the beginning of training, so that English graphics do not contrast with Russian and do not make difficulties of learning to read and write in their native language.

• The topics for spoken language should be based on children's experiences.

• Visibility is one of the ways to help combine material, and support for building their own statements of children.

• Translation into the native language is the main way of semantization and control.

• Teaching of dialogical and monological forms of speech is carried out in parallel.

• In the absence of support for reading and writing, the sequence of material during the first half of the year should be carried out from lesson to lesson with a subsequent amplitude of repeatability at least once a week.

• The activity of students in the lesson is ensured by the following methods: choral and frontal work, teachers encouraging children's speech activity, introducing elements of the game (songs, exercises, outdoor games using a foreign language, which relieve fatigue and make it necessary to switch children's voluntary attention to involuntary).

What is the best age to start learning a foreign language? According to the author of the book “ How to Teach Children to Speak English”, Sholpo I.L., it is best to start learning a foreign language at the age of five. Training for four-year-olds, in her opinion, is possible, but unproductive. Four-year-olds absorb material much more slowly than five-year-olds. [2] Their reactions are spontaneous, emotions are breaking over the edge, attention is constantly shifting from one subject to another. In addition, four-year-olds still do not speak their native language well enough: they have not developed the ability to communicate, and the regulatory function of speech and internal speech have not been formed. [1] The role-playing game, which is of the greatest importance when teaching a foreign language to preschoolers, has not reached the developed forms.

E.A. Arkin identifies five years of age as the most suitable for the start of any educational activity. At this age, the child is capable of more or less prolonged concentration of attention, he has the ability to purposeful activity, he masters a sufficient vocabulary and stock of speech models to satisfy his communicative needs. Five-year-olds have a funny feeling, role-playing games are

developed, complex. [2] Obviously, for a conscious mastery of the language, prerequisites are created, as a rule, by the age of five.

The leading activity of children in preschool age is a game. A child lives in a society of various games. Children imitate adults during development. This factor must be taken into consideration when teaching preschool children a foreign language and offering them various games.

The outdoor game is the most important educational institution that promotes both the development of physical and mental abilities, as well as the development of moral forms, rules of behavior, and ethical values of society.

There are a huge number of variations of teaching preschoolers using a game technique. One of which is an outdoor game.

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CULTURAL PECULIARITIES OF THE WAR-TIME NEW YEAR POSTCARDS

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In the Soviet era, long before the invention of the World Wide Web, messengers and other digital means of communication, postcards used to be the leading channel of connection. Tremendous piles of festival cards circulated across the gigantic country, involving almost everybody into the exciting process of reciprocal greetings. As an artistic form, a postcard proves to be a ‘younger sibling’ of a placard. It unmistakably possesses the sufficient extent of the poster power of persuasion; however, its fashion of visual influence is much more personal and lenient than that of a broadsheet. A greeting card addresses the recipient both as a citizen and a human being, appealing with equal success to civilian and private feelings.

Soviet sociocultural discourse tends to be chiefly visual. Vladimir Lenin viewed cinematography as the most important of the arts, and the Soviet urban environment literally teemed with a wide range of the visual incarnations of ideological concepts. Pompous architecture, numerous sculptures, colorful mosaic panels, transparencies and banners with sounding mottos practically wrapped a person into a permanent anticipation of ‘the bright future of communism’. Resorting commonly to all the available instruments of visual propaganda and being aware of its lasting efficiency, Soviet governmental bodies never disregarded festival postcards as well. Therefore, the latter would reflect the challenges and the glorious achievements of the Soviet nation. That is why, for instance, a lovely Snowman on a New Year card cheerfully inspects the construction of the Baikal-Amur Mainline, and a likeable Ded Moroz (Svavic Santa Claus) busily flies a space rocket. Russian philosopher Olga Shaburova describes this peculiarity through an antithesis of the categories of ‘heroic’ and ‘lyric’, which, to a different degree, are always present on the Soviet cards [2]. Apart from the self-evident communicative function, congratulatory cards, according to the theory of the Russian researcher Larisa Butilskaya, have another meaningful

functions, such as regulatory, fatic, emotionally-expressive, aesthetic, suggestive-magic, and axiological ones [1].

It is no exaggeration to say, that for the whole mankind World War II became the most life-changing, striking and fateful event of the twentieth century. It smashed up states and nations, exterminated people, ruined great monuments and subtle hopes, it tore families apart. It interfered into every sphere of human activities, murdering, distorting, defacing it, and turning it dramatically inside out. The entire war-affected, wounded country was literally breathing the formula 'Everything for the front! Everything for the victory!', taking unexampled efforts to defeat the bloodthirsty foe. Postcards, these tiny pieces of cardboard, are seemingly incommensurate with the battle, labor and moral exploits of the Soviet people. Surprisingly enough, however, they had also contributed considerably to the desired outcome of the war. Never, even at the toughest, the dreariest moments of the war-time period, had the postcards production been suspended. The balance of the abovementioned categories of 'heroic' and 'lyric', that might be observed on the postals in question, is of particular interest for the theory of cultural studies. Contrary to expected assumptions concerning the ultimate prevalence of 'heroic' subjects and decorum, wartime festival cards, especially the New Year ones, demonstrate the obvious gravitation to the 'lyric field', promoting humane and family values rather that militant ones. Instead of formidable fighting vehicles and pieces of armament, artists willingly portray children, modest feminine characters, homelike scenes and atmosphere of rural coziness. Even the true military plots, featuring warriors and battlefields, are executed in an astonishing manner – they are all softened, either through the use of gentle, tender color spectrum, or the reference to the fairytale motives. The image of home, whether obvious or implied, is, perhaps, the semantic center point of the festival cards, printed during the Great patriotic War. The understanding of its continuing existence encouraged and inspired the combatants, revitalized and invigorated them. Amazingly, not only the postcards served as a tangible reminder about inaccessible and desired home, but also they virtually delivered the *portion* of it. Thus, the aforesaid axiological function was performed: the soldiers felt and even touched what they were fighting for. Another function, which is no less important, is a suggestive-magic one. *'In these dark nights, only this faith / Kept me safe from a bullet'* – sang Mark Bernes in the legendary 'Dark night'. *'By your waiting for me, dear, / You had saved my life!'* – wrote Konstantin Simonov in the celebrated verse. In the same fashion, postcards, conducting faith and fidelity of relatives, became survival-programming tools, instilling confidence and vitality.

There is one curious idiom in English: 'an answer on a postcard'. It, according to the Farlex Dictionary of Idioms, might describe 'a brief, concise answer, reply, or opinion, especially one meant as a quick response to a general question', or 'an answer that is considered obvious or self-evident'. During the Great Patriotic War, however, those sincere, naïve and heartfelt answers on postcards became both – the weapon of war and a precursor of peace, and their role, of course, should not be underestimated.

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MUTUAL INFLUENCE OF RUSSIAN AND ENGLISH CULTURES

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Introduction

The development of current information and communications technologies and socialization of society give grounds for concluding that all cultures have a mutual influence on each other. We know how English influences our life and culture. We actively use borrowings and Anglicisms. English is introduced in all layers of our society. We use such words as "джинсы", "окей", "фитнес", "чил", "флекс" etc. in our speech. All these words have an English origin. However, how have the Russian culture and language influenced English-speaking people? We can find such words as “sputnik” (after the name of unmanned artificial earth satellites, especially Sputnik 1 launched by the Soviet Union on Oct. 4, 1957); “sable” (borrowed from a Slavic source); “tundra” and “taiga”, “babushka”, "dacha" and “tsar” in the English language.

History

Russian-English mutual cultural penetration has always taken a special place in world history. Although Russia was separated from western countries since the Mongol invasion [1], their relationship was resumed in the 20th century. Now both cultures influence each other. Thus, some Russian public opinion polls showed that in the early 2000s 60% of people in Russia thought that the country had its own unique culture, but 14% of respondents thought that western countries and the USA in particular had influenced our country greatly [2]. This level of confidence to western culture stays unchangeable during 1991-2014 [3]. However, politics of both countries has shattered such confidence over the last 5 years; the level of mistrust has raised [4].

The aim of this work is to show the importance of the influence of ‘Russian culture’. Now, when we know Russian people’s opinion, it will be interesting to find out the point of view of the western world representatives.

Russian classics

Russian literature is the only unhindered guide in the desire of the West to comprehend the secrets of the Russian soul, its culture and identity. For decades, Leo Tolstoy, Fyodor Dostoevsky, Anton Chekhov, Ivan Turgenev, and Alexander Solzhenitsyn have remained perhaps the most popular Russian writers among American readers. Their works can be found on bookshelves in line with iconic pieces of world literature. The names of famous Russian writers are familiar to many Americans since school days. This knowledge of names is often the main reason why American students choose Russian literature courses for the study. Moreover, interest in Russian literature is widespread not only among students of literature courses but also among historians, anthropologists, and political scientists. Writers create heroes who personify people types that can be found both in Russia and in the US. Now the film adaptation of Russian classics is very popular abroad.The UK and the US have presented their adaptations of *Anna Karenina* by Leo Tolstoy, *The Double* by Fyodor Dostoevsky, *Eugene Onegin* by Alexander Pushkin, *Lolita* by Vladimir Nabokov.

Oxxxymiron

The rap battle between Oxymiron and Disaster took place on October 16, 2017, at the Los Globos club in Los Angeles as part of the 7th International tournament. The battle was sponsored by Canadian rap battle league Kings of the dots[5]. The battle of Oxymiron and Dizasterwas attended by 80% of Russian-speaking spectators and 20% of North Americans. In the Russian media, the battle was widely covered, while it was left unnoticed in the western sources. However,

the video with this event has 13.3 million views and half a million likes[6]. Miron Fedorov was the first Russian who came to the USA and showed the true people ‘across the sea’ in the "Russian hackers" era.

Dizzy Dizaster

Ben Moody lives in the USA, Connecticut, and works in IT. The common American, who has met with the popular Russian streamer (JesusAVGN[7]) online on his stream channel and became the friend of all Russian community of that popular twitchchannel. He started to learn Russian words and Russian internet entertainment (such as memes, funny videos, braking news, and games). After that, Russiansfound their soul mate in him, made the huge album with pictures/arts/letters for him and invited him to visit the country.

PewDiePie

In 2017 a large number of videos and references to Russian lifestyle appeared on the channel of the most popular You-Tube blogger: PewDiePie(the real name is Felix Arvid Ulf Chellberg; number of followers on YouTube is 57 million at this moment[8]). He began to do reviews onold Russian memes (funny stories in the pictures/videos/text) and even sell t-shirts and hoodies with prints in Cyrillic [9]. In the result, the world’s media outlets, including The Wall Street Journal, one of the most influential American newspapers, suddenly attacked the super-successful Chelberg at the beginning of 2017. After a series of exposes, almost all major advertisers, including Disney, Maker Studios and even YouTube itself, refused to cooperate with the world's most popular blogger: PewDiePie videos stopped falling into the main page of YouTube and the contract with the paid YouTube service was broken. In order not to lose all his income and stay afloat, Chelberg had to change the figure of fun to a more neutral one, and a year later he managed to find the ideal variant. There definitely will be no sanctions for jokes about Russia: rather, on the contrary, advertisers and moderators of the service will support the Swedish comedian, because everyone has long been aware of the attitude towards Russians in the West.

Moreover, a video from Russia is not only an occasion to laugh, but also an opportunity to learn some new details about the “mysterious Russian soul” for foreigners. The very first PewDiePie`s observation has reached 8 million views. Besides, other videos from the channel have the same results. There is a huge number of comments in Russian upon these videos. Media representatives estimated 62 million YouTube viewers in Russian and that number grows [11]. It means that PewDiePie`s work is potentially worth his efforts.

Bald and bankrupt

British journalist and traveler Ben has an unusual vlog, he travels to cities of Russia and the CIS and takes pictures of local life. He tries to escape tourist places and show cities from the inside, communicating with residents. Ben goes beyondbig Russian cities and shoots vlogs from the outside of metropolitan areas. "I want to travel all over Russia and know what it is. I want to see it with my own eyes, and find out how people live" - the blogger says.His videosareposted regularly and get 0.5-1 million views on YouTube [12]. Russian mass media have released several news stories about him[13].

Conclusion

Taking all the aforesaid into consideration, we can tell that Russian culture affects English culture and language. English-speaking people read Russian books, watch Russian blogs, and listen to Russian music. It all helps to unite people of both cultures. In addition, the understanding of this fact inspires to study various types of cultures. Thus, the influence of Russian culture on English is evident and further study is needed.

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УДК: 394.91

FEATURING “EVIL EMPIRE”: RUSSIAN FEDERATION THROUGH THE LENS OF THE WESTERN MEDIA

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The term “Evil empire”, coined by Ronald Raegan at the height of the cold war might seem to be practically old-fashioned and rusty, making reference to the outdated geopolitical environment and implying the processes which have nothing to do with the present-day state of affairs. This idea appears to be credible enough unless one burdens oneself with getting acquainted with the mood and tone of the most recent publications in the Western media, capable of heavily perplexing and baffling the gullible readers and even of puzzling the versed and mature ones. Within the confines of our survey we have made an attempt of producing a comprehensive analysis of the way in which Russia is being commonly portrayed in the English-speaking media. An in-depth yet laconic consideration of the most eye-grabbing and influential papers is stated below. This contemplation allows drawing essential conclusions both on the policies exercised by the Western statesmen and the visions advocated and promoted by the Western journalists. In his full-dressed paper that goes under a clamorous title ‘Russia is slowly killing me’ Marc Bennets claims peremptorily, that in Russia, where law-enforcement bodies call the shots and repressions keep gathering pace, ‘a social media post could now land you in jail’ [1]. Further on, in the article, which, judging by its caption, promises being an extensive survey on the domestic social trends, Mr. Bennets deliberates a personal case of an 18-year-old youngster from Barnaul, Daniil Markin. The journalist alleges, that Markin, having either reposted or saved a handful of images to his account on Vkontakte, is outrageously accused of hate speech, and ridiculously added to the list of extremists for the same reason. Expressing his civilian concerns, Marc Bennets describes the ongoing situation in Russia as a ‘long-running crackdown on freedom of speech’ [ibid.] and emphatically likens the national security forces to okhranka – a czarist era secret police agency. In another two-page unsigned

spread, published in ‘The Economist’ on September the 7th this year, the unauthorized reporter mentions the ‘repression machine’ as something undoubtedly existing in Russia on default; though, he outlines jubilantly, that ‘it doesn’t work as well as it used to’[3]. He also resorts to a recognizable strategy: the item is centered around the personality of some 21-year-old student, Egor Zhukov, who, predictably, was outrageously arrested for the fictitious misdeeds he did not commit. Not only was he charged with the fabricated indictments, such as involvement in ‘mass disturbances’ but also a Muscovite was misidentified in a video used by the police. He is said to have spent a month in unlawful detention after the siloviki ominously took him into custody late at night. Enjoying his anonymity-associated bravery, the writer goes as far as to say that ‘ordinary Russians are no longer prepared to put up with being terrorized – and this shift in the public mood makes it harder for the Kremlin to terrorize them’ [3]. The other entry, with a no less derogatory name ‘Subsidies, stagnation and repression’, devoted to what the Western journalists unanimously call ‘annexation of Crimea’ expectedly portrays Russia in a habitual detrimental way. After asserting, that ‘Russia’s conquest remains a strange limbo’ [2], the author quickly moves on to far-reaching assumptions, outlining that ‘the region suffers the same problems as the rest of Russia: corruption and mismanagement, inflation and falling salaries, repression and restrictions’[ibid.]. The photo, illustrating the material, depicting a kid playing with a toy tank, is evidently meant to prove the idea of the Russian overt obsession with militarism. Apart from the examples, considered above, there are, unfortunately, many other writings of the same nature. Drawing on this data, one should rightfully conclude that the Russian Federation is being featured in an ultimately malevolent fashion, distorting the existing political environment of the state. This manner of ‘laying on colors too thickly’ is apparently purposeful and repeatedly makes use of a range of verbal maneuvers which are listed below:

a) clickbait – the newsmen frequently apply the sensational and misleading captions, like, for instance ‘Russia is slowly killing me’; b) false personalization, which is basically unverifiable, but creates the air of accuracy and precision, usually while retelling the dramatic stories of the ‘victims of oppressive regime’, designed to make trustful readers sympathize with them and ‘swallow’ the rest of the information; c) make-a-mountain-out-of-a-molehill method, allowing to introduce a singular case as a large-scale tendency and leading to groundless generalizations; d) the use of emotionally colored language, appealing to feelings rather than the ratio of the audience.

In her celebrated TED talk ‘A danger of a single story’ activist and writer Ch. Achidie once noted, that stories, as well as their number, content and quality, definitely matter, indicating the source of power. The implications of the tendency of wrongful depiction of Russia are yet unclear, but they will unmistakably influence the world climate for the years to come.

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УДК: 81’27

SLANG INFLUENCE ON THE YOUTH’S PROFESSIONAL ACTIVITIES

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It is common for youth to use slang to express themselves to one another. To many, slang might seem inappropriate or "ghetto." However, for others, slang is the only way we like to communicate - it's a part of our culture .Even though slang is widespread, some people think it is an inappropriate distortion of the English language. Teachers, parents, the older generation do not be easy on this trend. During the conversation they may misunderstand or not understand at all what we are saying about. In fact, there is something to worry about…according to recent studies, in young people`s speech degree of using slang exceeds 50%. Young people are quite active in creating slang.

For many years, there has been an active discussion between supporters and opponents of youth slang in society and in the scientific community. All this served as a logical impetus for the organization of the study in this area. Its purpose is to find out what constitutes youth slang, whether slang is a struggle between different generations, how slang affects the professional activity of youth

The research method includes: analysis of specialized literature on the topic, questionnaire of students, conversations with youth.

Slang terms are often only understood by people in a certain group, using slang is, above all, a way to show that you belong. You show that you're one of the crowd by using terms that others don't understand, and you can connect with like-minded people who understand just what you mean by using the latest slang terms. Does it mean that there is only kind of slang – “youth”. Adults use slang very often, they just use another kind. In every professional area peoples have group of words, terms, meanings understandable only for themselves. It’s what is slang about. Also, after a little questionnaire of people after 30 they said that they had their own slang, and for another generation the same. Some of them may not to call this thing slang, but it is. The reasons, why youth uses slang are different, there is a statistics:25% use it with a conscious purpose (to offend, not to use foul language, to speak with certain group of people). About 20% can’t find synonyms to change slang terms. 12,5% use it like a habit. 12,5% use it to short the words. 12% use it just for fun .10% can’t explain the reason (I’m just talking and that’s it) and 10% don’t use slang at all.

Also some of student said(about 70%) that they already had encountered with professional slang during study. Slang helped them to memorize, makes easy to understand and to creates associations. You can use professional slang instead difficult long terms, it would increase productivity and reduce time. So we can say that slang is not struggle between generations , between professional and student. Slang will help us in our daily life if we don’t abuse it.

Over time slang terms either die out from lack of use as groups move on to new terminology, or they may become so popular that they are absorbed into the common language. In this case, everyone understands the terms, and they aren't likely to be considered inappropriate or poor grammar any longer. This is how language grows and evolves over time, as new words are added to the dictionary while old ones fall into disuse and disappear.

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PERSONAL TIME MANAGEMENT

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Lots of people believe in idea that by saving bits of time here and there, add it up, we will finally get time to everything we want to do. Which is true. But after studying Laura Vanderkam books about time management I think this idea has it completely backward:

“We don't build the lives we want by saving time”.

“We build the lives we want, and then time saves itself”.

Here's what I mean. In her books Laura did a time diary project looking at 1,000 days in the lives of extremely busy people. They had demanding jobs, their own businesses, kids to care for, maybe parents to care for, busy, busy people. She had them keep track of their time for a week so she could add up how much they worked and slept, and she interviewed them about their strategies, for her book.

One of the women goes out on a Wednesday night for something. She comes home to find that her water heater has broken, and there is now water all over her basement. You know it is a hugely damaging, frightening, sopping mess. So she's dealing with the immediate aftermath that night, next day she's got plumbers coming in, day after that, professional cleaning crew dealing with the ruined carpet.

All this is being recorded on her time log. Winds up taking seven hours of her week. Seven hours. That's like finding an extra hour in the day. But I'm sure if you had asked her at the start of the week, "Could you find seven hours to train for a triathlon?". "Could you find seven hours to mentor seven worthy people?" I'm sure she would've said what most of us would've said, which is, "No, can't you see how busy I am?"

Yet when she had to find seven hours because there is water all over her basement, she found seven hours. And what this shows us is that time is highly elastic. We cannot make more time, but time will stretch to accommodate what we choose to put into it.

And the key to time management is treating our priorities as the equivalent of that broken water heater.

I came to a conclusion that everything I do, every minute I spend, is my choice." And rather than say, "I don't have time to do x, y or z," I’d say, "I don't do x, y or z because it's not a priority." "I don't have time," often means "It's not a priority."

Using this language reminds us that time is a choice.

I do think that the numbers I am about to tell you are empowering. There are 168 hours in a week.

Twenty-four times seven is 168 hours. That is a lot of time. If you are working a full-time job, so 40 hours a week, sleeping eight hours a night, so 56 hours a week - that leaves 72 hours for other things. That is a lot of time.

Anyway, in 168 hours a week, I think we can find time for what matters to you. If you want to spend more time with your kids, you want to study more for a test you're taking, you want to exercise for three hours and volunteer for two, you can. And that's even if you're working way more than full-time hours. So we have plenty of time, which is great, I truly believe this. There is time. Even if we are busy, we have time for what matters. And when we focus on what matters, we can build the lives we want in the time we've got.

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УДК 349.3

THE MAIN SOCIAL PROBLEMS OF A MODERN URBAN RESIDENT OF RUSSIA

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In the age of information technology and rapidly developing science, it is very important not to forget about some important aspects that inhibit progress. Social problems in the country do not allow people to enjoy all the benefits of our time and do not give the opportunity to implement useful and progressive ideas. Unfortunately, in our country, at the moment, this issue is very acute and insufficient efforts are made to resolve it, while the condition for the prosperity of the state is the well-being of its citizens. The aim of this work is to consider the most pressing social problems of Russians and analyze their significance for the population according to the results of social surveys. We analyze the data obtained to assess the positive or negative dynamics of the anxious mood of Russian citizens.

The main social problem in Russia is poverty. Only a narrow circle of people has an income that allows them to access all the desired services for a full and comfortable life, while more than 75% of the population is below the poverty line. People do not live, but survive. One of the reasons for the poverty in a country so rich in resources is the economic policy of the power class. The minimum wage in Russia is ten times less than in developed countries. From this value, benefits, pensions, and benefits are calculated. As the result, most able-bodied adults are unable to provide for themselves and their families [1].

Partly from the previous problem, the following two follow: alcohol and drug addiction. According to a survey conducted by the Public Opinion Foundation (FOM), every twentieth adult man drinks alcohol 2-3 times a week. Every fifth crime is the result of alcohol or drug intoxication. The level of drug use in the country, especially among young people, is also a matter of great concern.According to the UN Office on Drugs and Crime for 2018, 3% (about 5 million) of Russians systematically use PVA and 8% (about 13 million) do it periodically, which puts Russia in 15th place in the world in absolute and relative mortality of the population from drugs (deaths per 1 million inhabitants). Moreover, drug addiction indirectly causes a more active spread of tuberculosis, HIV and various hepatitis, while the illegal distribution of intoxicants leads to an increase in crime.

The abovementioned problems become especially acute when you realize that they lead to a gradual degradation of the population and a slowly growing extinction. Russia is the only developed country dying out in peacetime. According to the world health organization for 2019, Russia takes only 142nd place in the world in terms of average life expectancy from 222 countries for which the data were studied and analyzed. Due to social problems, the institution of the family suffers greatly. Many families are falling apart, unable to cope with piled up difficulties. And the worst

thing is that, first of all, children suffer from the indifference of the elite class: the percentage of orphans and single-parent families is growing. Children deprived of family comfort become tougher and heartless, which continue to exacerbate the above mentioned problems.

All these problems allow corruption to exist. Huge amounts of money that could smooth the life of society and reduce social inequality disappear somewhere in the hands of corrupt officials and intermediaries. The monopolization of power and the lack of competitors in the ruling party is one of the most important problems in modern Russia, claims Dr. N.Popov, Doctor of Historical Sciences.

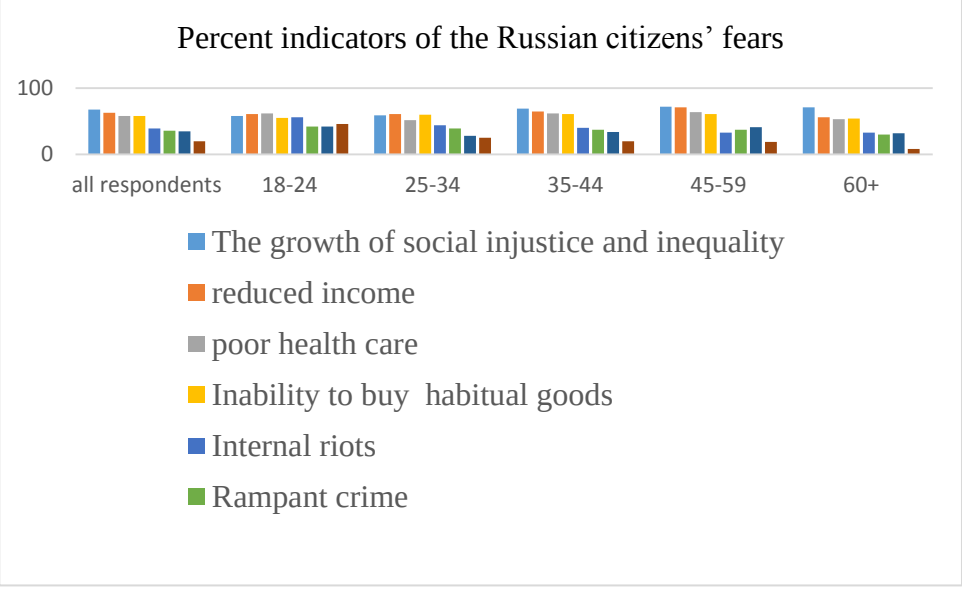
According to the results of The All-Russian Public Opinion Research Centre polls for the autumn of 2019 (see Table 1), the most frightening events for Russians can be observed: an increase in social injustice –68%, a decrease in income – 63%, poor quality of free medical service – 58%, rampant crime –36% [2].

Table 1. Results of VTsIOM polls for the autumn of 2019

	All respondents	18-24	25-34	35-44	45-59	60+
The growth of social injustice, and inequality	68	58	59	69	72	71
Income reduction	63	61	61	65	71	56
Poor quality of medical service	58	62	52	62	64	53
Inability to buy habitual goods	58	55	60	61	61	54
Internal riots	39	56	44	40	33	33
Rampant crime	36	42	39	37	37	30
Job loss	35	42	28	34	41	32
Foreign policy conflicts	20	46	25	20	19	8

The survey involved more than 1800 respondents across Russia over the age of 18 years. The results shown in the diagram (see Figure 1) confirm the above-mentioned problems.

Figure 1. Percent indicators of the Russian citizens' fears (by age groups). Results of VTsIOM polls for the autumn of 2019



The main concern of able-bodied youth under 25 is job search and lower incomes; in addition, there is great doubt about the quality of free medical care. The fears of the elderly population regarding the growth of social injustice are also quite logical. Pensions for most citizens over 60 years old are quite scarce(14,168 rubles according to the results, provided by the Federal State Statistics for the first half of 2019), which does not allow pensioners to retire on a well-deserved

rest without fear of falling below the poverty line. We see growing dissatisfaction with the actions of the ruling elite. Problems exist for more than a decade, becoming increasingly serious every year; this negative dynamics provokes indignation of the population.

Unfortunately, if we compare the data obtained from the All-Russian Public Opinion Research Centre polls ten years ago (see Table 2), we will see that the main concerns remained almost unchanged.

Table 2. Results of VTsIOM polls for the autumn of 2009

	Which of the above problems do you consider most important for yourself and for the country as a whole?	for yourself	for the country
1	inflation, rising prices for goods and services	66	61
2	unemployment	42	61
3	alcoholism, drug addiction	25	53
4	corruption and bureaucracy	24	41
5	low standard of living	41	32
6	high crime rate	26	31
7	quality of medical care	39	31
8	pension provision	34	29
9	situation in the field of housing and communal services	29	24
10	economic crisis	27	23
11	youth situation	23	23
12	salary payment delays	24	20
13	demographic situation (birth rate, mortality)	5	17
14	the influence of the oligarchs on the economic and political life of the country	6	16
15	position of Russia in the world	7	16
16	national security	7	15
17	educational situation	19	14
18	democracy and human rights	10	13
19	terrorism	9	13
20	level of morality	14	12
21	situation in the army	9	12
22	ecology and environment	14	12
23	relations with the CIS countries	4	10
24	interethnic and interfaith relations	3	9
25	implementation of national projects	3	5
26	fascism, extremism	2	4
27	the change of power in the country and the problem of continuity	1	3
28	energetical security	1	2
29	administrative reform	2	2
0	difficult to answer	2	1

Note: no more than seven answers are allowed to the closed questions [3].

People have become even more concerned about the quality of free medicine and social injustice. The received data was commented by the Strategic Development Director of VTsIOM Stepan Lvov: “The study revealed two problem groups, within which specific fears are formed – these are young people under the age of 25 and citizens of pre-retirement age. The anxieties of “pre-pensioners” arise from insecurity in saving both the income itself and its source. Hence, they have a very high level of anxiety that they will be treated unfairly. This point can be rationally explained – the transition to retirement age raises everyone’s concern about maintaining their own status.

But most of all, we were surprised by the fears of the youth. For them, the issue of maintaining a workplace is also of acute concern – this problem is certainly relevant for this group. We were very alarmed that they were imagining scenarios of an "apocalyptic" nature — riots, the likelihood of war, and rampant crime. How to explain this? The issue requires serious study and discussion. " [2] In general, more than half of the respondents speak of serious problems. Inflation, rising prices and unemployment remain the main problems of the modern urban resident of Russia.

Solving social problems requires widespread comprehensive discussions and debate. It is necessary to find a compromise and smooth out the flagrant social inequality. Or at least create comfortable conditions for life in all social layers of our society.

The main areas of social policy should be the protection of living standards by introducing various forms of compensation with rising prices and indexation, providing assistance to the poorest families, issuance of unemployment assistance and ensuring a policy of social insurance, setting a minimum wage for employees; also an active policy aimed at providing qualifications is required. It is necessary to solve the problems of unemployment, medicine, economics, and ecology and to strengthen the institution of the family.

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УДК: 371.72/78

THE IMPACT OF SCHOOL WORK ON STUDENT HEALTH

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As Socrates said: "Health is not everything, but everything without health is nothing."

This problem of overload at school is especially relevant today, because the future is in our children. In the modern world, the global problem of our country is health, and in particular the health of school children and students. Of particular concern is the fact that in the lines in the hospital we observe a picture: when most of the schoolchildren are standing, not grandmothers, as we were used to seeing. Numerous statistics of the Ministry of Health indicate that in our country the unfavorable dynamics of children's health.

I have decided to delve into the situation and so I designed and conducted a survey among the pupils of my former school. They were asked the following question: "What diseases do you suffer from?" The results are as follows:

• A high percentage of gastrointestinal diseases can be explained by improper meals in the canteens and poor diet in general. It turned out that the majority of those who study from 8 in the morning suffer because children have a choice: either sleep longer or eat. Obviously, they will choose snoozing. Of course, you can have lunch in the dining room, but the prices in the dining room are simply colossal.

• A high percentage of diseases is associated with poor eyesight. This can be explained by the fact that children are constantly exposed to writing and working with a computer. Now is the age of technology and all the time children spend at the computer. Undoubtedly, children do not observe the correct posture when writing, and how they look at the notebook (at what angle). Even if you go

into one of the classrooms now, you can see how the children write, reclining, while the teachers do not make any comments.

• The nervous system suffers no less. Both in children and in parents. Because when schoolchildren begin to take exams, they are overloaded with studies so much that they don't think about anything at all, and their parents are worried with the children. Often, schoolchildren suffer from the teacher's attitude to the child, but still do not say so, but the teacher will have favorites, so-called "teacher's pets". From this, other children begin to feel inferior and discriminated.

We can see, there are three prevailing diseases that need to be eradicated as soon as possible, otherwise it may end badly for the future of our children.

• Diseases of the musculoskeletal system

• Circulatory disease

• Digestive Disease

You know, when I was still in school in the 11th grade, we underwent a medical examination. I decided to ask my classmates who the doctors had diagnosed. There were 27 people in the class, of which 13 were girls. Even though the majority had average eyesight, 4 girls had poor eyesight of less than -2, and one classmate could hardly see at all with eyesight at -12. Nevertheless, all of them have to deal with the fact that our education consists of an electronic system, so this only exacerbates the situation.

The boys in my class were less susceptible to illnesses, because they played sports. However, because of school overload, future masters of sports had to quit sports, now these guys are suffering from the fact that they started to gain weight and constantly experience headaches.

As for me, I have problems with my back and I had to stand in the lessons because I was in a lot of pain and my back hurt terribly. However, my teacher thought that I was simulating and constantly tried to humiliate me in front of the whole class. It affected my psyche.

In this report I want to convey what I would suggest teachers, and especially the ministry of education should do, to draw up some rules.

• Stuffy, poorly ventilated classrooms reduce the student's performance.

• The impact of the workload and overloading of homework. School teachers should give moderate homework, because children have more than one subject to learn.

• Collect pupils into classes according to the norms and numbers. Some children feel uncomfortable in a crowded class, when starting first grade, so it is worth considering the psychological aspects of how they behave and communicate. It is harmful to team up such children with hyperactive children.

To conclude, I would like to urge you students to take good care of your health, because experience shows that it is hard to restore it.

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УДК: 504.05

ECO-FRIENDLY FUNERAL

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Research on the problem of ecology of existing types of burial originated only in the late of 20th century and 2000s. In Russia, due to a number of reasons, such an important environmental problem is not raised at all. Today, only bloggers, whose social networks are dedicated to ecology, speak about eco-friendly funerals in our country.

I conducted a survey among one hundred students of the 1st year of KNRTU KAI and it showed frightening results. 54% of students don't know or have not heard about the concept of eco-friendly funeral. Why are these results bad?

Let's take a look at a 2017 research by scientists at the Czech University of natural Sciences. The author of the research, Professor Ladislav Smidzhda came to the conclusion: in the burial sides, the concentration of nutrients — iron, sulfur, zinc, calcium, phosphorus — may be too high for optimal absorption by plants and microorganisms.

"Chemical traces of decomposed bodies are clearly visible in the soil. They persist for a long time, for many centuries and millennia. The effect will be more pronounced as more and more people are buried in the same place", — said Smidzhda. According to the scientist, in the future, traditional burial will lead to a big environmental problem.

The concept of "eco-friendly funeral" came to Russia from the West, sometimes you can find such a formulation as "green burial". For the first time, the American journalist Jessica Mitford[1] spoke about the non-ecological nature of the funeral business in the United States. She wrote the book "The American way of death", after the release of which people drew attention to the fact that traditional methods of burial are unsafe for nature.

From the encyclopedia it follows that natural burial - is the interment of the body of a dead person in the soil in a manner that does not inhibit decomposition but allows the body to recycle naturally. It is an alternative to other contemporary traditional Western burial methods.

What do we mean when we say "traditional burial methods"? In the context of our material — funeral in coffins. Today it is the most environmentally friendly and expensive method. According to the website of the city service for funeral Affairs of Moscow, the average cost of such a burial is 45 thousand 350 rubles.

Why is the method not environmentally friendly? The main danger is formaldehyde[2], on the basis of which embalming liquids and varnishes for coffin processing are made. It is a heavy substance that absorbs into the soil and stays there for many years. According to a study by the International Agency for research on cancer, in 2017, formaldehyde was recognized as a carcinogen because it causes cancer.

58% of KAI students surveyed believe that cremation is the most environmentally friendly method of burial. On the one hand, it's true. One of the most environmentally friendly types of cremation is resomation. The body is placed in a solution of calcium hydroxide and subjected to heat treatment, during which complete decomposition occurs. Unlike classical cremation, this method is absolutely safe for the environment: complete absence of carbon monoxide emissions and minimal energy costs[3].

It is believed that after cremation, the ashes are either scattered or stored in an urn. But there are much more interesting ways to complete the process. For example, why not become a "home" for fish and other marine life? This will help the service "eternal reefs — "eternal reef": on the seabed falls artificial reef of concrete, including human remains.

If you are afraid of water, you can become a beautiful tree. Bourne, which is composed entirely of biodegradable materials that will turn human remains in a pre-selected breed. At such funerals it is not necessary to carry out cremation. "Capsule Mundi" - eco-capsule, which in 2003 was developed by Anna Chitelli and Raul Bretzel, designers from Italy. It is placed in the human body in the fetal position. A tree seed will be planted on top of it. The authors of the idea believe that in the future cemeteries will be like a forest.

The tree doesn't suit either? The American company Casio offers a biodegradable funeral suit containing fungal spores. "Infinity mushrooms" will not only accelerate the decomposition of the body, but also destroy 90% of the toxins that it secretes. For example, bisphenol A is a toxin that disrupts the human nervous system. It is found in 93% of people over the age of six.

In Russia, the most common traditional funeral. Unfortunately, almost all of the above methods are not available in Kazan and in the country as a whole. According to the city service for funeral Affairs of Moscow in October 2019, in our country, not a single procedure of resomation was carried out. The situation with cremation is better: in 22 cities of Russia there are crematoriums. In Kazan they are not, the nearest is in Nizhny Novgorod.

The lack of necessary funeral services, their high cost, ignorance, views and worldview of people are the reasons why eco-friendly funerals are not common in Russia. Non-ecological cemeteries are becoming more and more, especially in cities without operating crematoria. This means that the area of land poisoned by formaldehyde and ethanol is growing.

The problem of non-ecology of existing burials will not greatly affect our generation. But if we do not start to address the issue of the availability of eco-friendly funerals in Russia and the world, the next generations will live on the territory of a huge cemetery.

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УДК 316.35

THE IMPACT OF THE INTERNET ON STUDENTS' MIND

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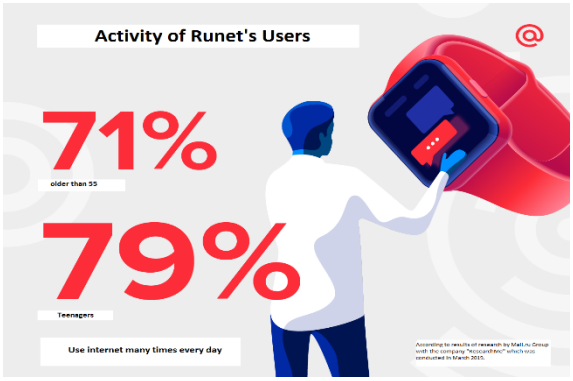
In today's world where everything is just one click away social networking sites have become the need of the present world. Internet certainly has immensely impacted the life of everyone and it goes without saying that the youth makes the major proportion of the internet population. Too much use of social networking sites is making individuals dumb. Thus, today's youth are engaged in many activities. Social networking is a medium through which we can learn things broadcast our knowledge, experience, and views. We can either misuse this or use it for a better life. Everything depends upon us and the choice is ours. These networking sites are changing the mindsets of the youths of this generation.

But, how has this turned into more? We have become so immune to being able to contact someone with just the tap of a screen, that we can have an entire conversation with someone in the same room as us without saying one word. We'd rather snapchat a picture to one of our friends than to actually go see them. We have officially been labeled as the "dumbest generation" by author mark bauerlein, due to our heavy use of technology. I am very aware that my generation

doesn’t use technology for much more than social media, which in many ways is the same as misusing technology. Although social life is a very powerful temptation, the only way it impacts us is socially unless we allow it to do otherwise. Teenagers are simply impacted by what they allow to influence their life.



According to this statistic we can understand that the Internet is an inalienable part of young generation's life including student's life. We begin to considerate this question with advantages and disadvantages of the Internet for understanding why students use it so much.

Advantages: 1. Fast access to any information

No one can argue with that, because nowadays you need just write your question in search engine and you get access to thousands sites with ready answers, but this may be cause of another problem this advantage has disadvantage, because of the level of education falls.

2. Communication

This advantage also has a problem, one side people are able to communicate on long distance, with messages, but the problem is that communication in real life getting less popular, people are facing difficulties to be in society. Therefore, this is disadvantage too.

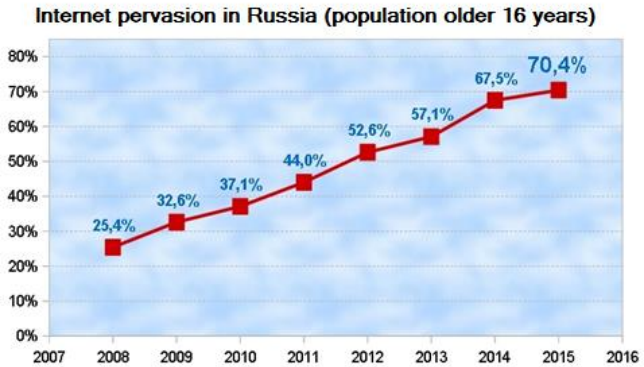
3. The Internet features

Nowadays we can find answer on any question in the Internet, but we also should understand that high volume of information is cause of such problems as impossibility of learning all information, what the Internet, contains and need to avoid false information. Therefore, nowadays students get a lot of information, what they make not full use.

Disadvantages:

1. We begin less communicate in real life
2. Level of education is falling
3. Disinformation[6]

Of the foregoing we can conclude that the Internet has advantages and disadvantages. Therefore, the Internet influences on student's mind, in spite of disadvantages students continue use internet. To approve our reasoning and conclusions we have to see statistic results.



This graphic can show us, that the number of the Internet users is growing each year. Also we can say that much of these users are students.

JAN 2019

SIMILARWEB'S TOP WEBSITES

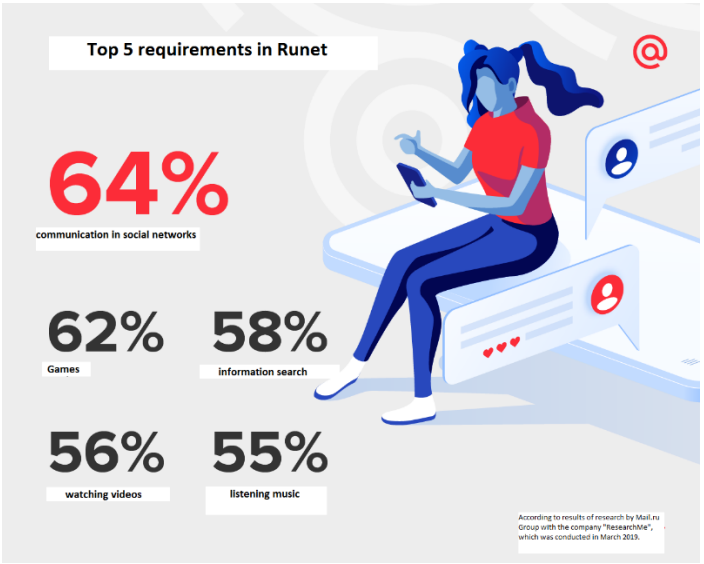
RANKING OF WEBSITES BY AVERAGE MONTHLY TRAFFIC

#	WEBSITE	CATEGORY	MONTHLY TRAFFIC	TIME PER VISIT	PAGES PER VISIT
01	YANDEX.RU	SEARCH	2,633,800,000	10M 53S	9.3
02	VK.COM	SOCIAL	1,645,000,000	16M 28S	22.1
03	YOUTUBE.COM	TV & VIDEO	1,466,100,000	19M 34S	7.8
04	MAIL.RU	EMAIL	1,309,700,000	07M 43S	6.8
05	GOOGLE.RU	SEARCH	1,229,500,000	08M 05S	5.9
06	GOOGLE.COM	SEARCH	1,112,100,000	07M 29S	6.5
07	OK.RU	SOCIAL	776,500,000	12M 27S	14.8
08	NEWS.YANDEX.RU	NEWS	293,700,000	03M 19S	2.7
09	AVITO.RU	SHOPPING	288,900,000	11M 01S	13.2
10	WIKIPEDIA.ORG	REFERENCE	250,300,000	04M 01S	2.9

Hootsuite we are social

[4]

We would like to show statistic by SimilarWeb, because this is the largest company of analytics. According to it the most popular site in Russia is yandex.ru and little less popular is vk.com. Therefore, much of the Internet users in Russia have accounts in social networks. According to these data we will show the statistics of the Internet needs and draw conclusions.



This statistics approve reasoning of the foregoing conclusions. On the top of the needs is communication (in Russia). This is explaining, why social network vk.com on the leading positions in visiting and the target audience is students.

We have conducted a survey among group 5201 and KAI volleyball team, to compare usual students and athletes. The survey contains three questions on five-point scale and one question with answers ("yes" or "no"). Group 5201 and KAI volleyball team both contain 20 students.

According to survey we can affirm, that the Internet really influences on students' mind, but we must notice that athletes depend on it less. The explanation is obvious. Athletes have less free time than usual students, because they have regular trainings and competitions. The conclusion is students without hobby or work spend all their free time in the Internet.

According to all statistics and survey, the Internet becomes the part of our life and it impacts on students mind. It has not only disadvantages, but it can impact on students mind positively, so student can choose how the Internet will influence on his worldview.

Group 5201	**Volleyball team**
How important is the Internet for you?	
5 - 12 people	5 – 6 people
4 – 6 people	4 – 8 people
3 – 2 people	3 – 5 people
2 – 0 people	2 – 1 people
1 – 0 people	1 – 0 people
How detrimental is the impact of the Internet for you?	
5 – 2people	5 – 5 people
4 – 4 people	4 – 3 people
3 – 6 people	3 – 5 people
2 – 3 people	2 – 7 people
1 – 3 people	1 – 0 people
How much do you think you addict to the Internet?	
5 – 4 people	5 – 2 people
4 – 10 people	4 – 7 people
3 – 5 people	3 – 9 people
2 – 0 people	2 – 2 people
1 – 1 people	1 – 0 people
Could you live without the Internet?	
Yes – 8 people	Yes – 11 people
No – 12 people	No – 9 people

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УДК: 504

THE YOUTH AND ENVIRONMENTAL PROBLEMS

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Today I want to address the issue of ecology and understand how young people relate to this.

In my study, I want to understand what is the attitude of youth to ecology these days, what are the ways to preserve nature and why it is necessary to monitor the ecology.

To understand the statistics, I interviewed young people aged 18 to 21 years old. They were my groupmates and students of other groups. Thanks to the survey, I realized that most of the students think that the ecology of our planet is at stake. All respondents believe that environmental problems should be addressed by both the government and the public. 41,2 percent of students several times took part in environmental events. We can increase this figure, if we talk more about ecology, we need to advertise it, as half of respondents would like to participate, but there is not enough information about this. There are containers for separate collection of garbage in many buildings of our university. Many people use them according to the rules, but 23.5 percent of respondents believe that in the future all sorted garbage will still be in one heap.

In fact, ways to help ecology are much closer than it seems, and young people have many opportunities for this. In recent years, the topic of preserving our ecology is gaining significant momentum.[1] Many well-known companies are also interested in this and support many environmental organizations. For example, Yandex Taxi introduced a new tariff two weeks ago. Its name is ‘Eco’. The difference from the usual tariff is that the car does not come on ordinary fuel, it comes on methane. Methane is an ecological fuel. Its price is lower than gasoline. But there are also disadvantages of this tariff: the price of the trip is higher than at the usual rate due to the small number of vehicles using natural gas. But I hope this is due to the fact that this phenomenon is only gaining momentum and in the future the price will be much lower. The second disadvantage is that in the trunk of the car there is quite a bit of space due to installed additional equipment. There is a great future behind this, but demand is needed for this, now people can contribute to the conservation of the environment simply by choosing a different fare in a taxi.

The H&M clothing store has a program: you can turn in your old clothes and get a 15% discount on new. In Shopping center "Mega" Kazan ecological company regularly collects garbage separately. You can take part both as a participant and as a volunteer. You can also hand over plastic bottles there in MEGA and get a coupon for free coffee.

In conclusion, the young men are ready to protect our planet from environmental challenges. But in our country we lack of conditions and information for solving these problems. [4]

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УДК: 141.3

ETHICAL AND LEGAL ISSUES OF INTRODUCING ARTIFICIAL INTELLIGENCE

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Technical progress speed is currently increasing and we should take it into account while trying to think about our future. For instance, during the few past decades, people have gained more knowledge than ever before. One can suppose the volume of scientific knowledge will double more than once during the century.

The power of technical progress is downplayed in forecasts very often. New York Times stated flying machines were wasting of time. It happened in 1903, the week before the Wright brothers' successful flight.

Many scientists try to forecast the moment when technological progress will stop to speed up and its possible effects. The most popular theory of further humanity`s development is technological singularity theory. The author and communicator of this theory is Ray Kurzweil, a Director of Engineering at Google. He claims that any development, biological evolution or computation power gain, tends to increase exponentially. It is due to the fact that any development gain will be used by design tools to increase their processing power.

Such way of technological development may become the cause of a technological singularity that emerges as a concept of the superiority of a new, alternative mind over human intelligence.[2] Kurzweil suggests that the moment of singularity will come in this century, but constantly moves the date. In his opinion, the forerunner of the singularity will be a rather powerful artificial intelligence (AI) that will probably be able to compete with human intelligence.

Not so long ago, the main hope of the artificial intelligence developers was machine learning, in other words, "weak" artificial intelligence. Unlike "strong" artificial intelligence, the weak one is not capable of self-identification and does not have basic knowledge and ideas about the world; now it is used to simplify the solution of certain problems. For instance, it is used for recognition of speech and even smells with help of modern gas analyzers.

The result of the programmers' work became visible already in 2017, when the AlphaZero algorithm developed by Google was recognized as the world's strongest chess player. It was able to master three games - chess, go and shogi without human interference. However, experts claim that such algorithms can only work in strictly limited conditions, for example, within the applicable game rules, so it is too early to project success on the real world because of its unpredictability. According to the developers, games, where participants know the information about the situation only partially will become the next challenge for AlphaZero.

It is incontestable, that invention which was introduced without reference to current economic, social and political situation will not be approved by society or will even provoke a bunch of ethical and social disputes.

Nowadays, the most well-known application of artificial intelligence is self-driving cars. According to Olga Uskova, a founder and president of Cognitive Technologies, one of the leading software development companies in Russia, also engaged into artificial intelligence studies, such vehicles try to solve a very difficult problem in any life or death situation. A car must prioritize its passengers' or other road users' lives.

Thus, if artificial intelligence is able to make decisions, we need to find a person responsible for these decisions and possible errors. Some activists propose equating a bearer of artificial intelligence with property. However, artificial intelligence differs from property in that it can carry

out actions without human control. In this regard, there were suggestions to apply regulations governing such type of property as animals, but these standards are designed for pets that usually do not harm humans. Consideration of an artificial intelligence bearer as a wild animal could lead to the introduction of more stringent regulations, and therefore to slow up the adoption of artificial intelligence technologies.

Most lawyers think that vehicle owners should be responsible, because it complies with current legislation. However, the relevance of such decision is doubtful. In other words, an owner will be responsible until he\she has the right to use or refuse self-driving capabilities. It is assumed that when a driver activates autopilot, he\she understands all the risks associated with the possible technical imperfections of a self-driving car. However, this should not exclude liability of a manufacturer or equipment and data supplier to the owner.

We should not neglect the fact that weak artificial intelligence bearers are now commercial product. Not all algorithms are being developed to work for the benefit of society, many of them are aimed to obtain profit.

In our opinion, the eligibility in this situation should be consistent with accepted morals.

Of course, the understanding of morals by artificial intelligence should be mentioned here. If the understanding of morals is an inherency for a person, it is just a system parameter for a machine. Moreover, it`s impossible to describe this parameter technically, as required by algorithms. Ethical standard may vary depending on the political situation. Perhaps, when "strong" artificial intelligence appears, the determination of morals will stop to be a problem.

In addition, the aim of using artificial intelligence may be unethical. It is possible to use machines to commit crimes, or for other purposes offending against morals. For example, Google corporation has begun to develop a software for a pilot project to control military drones, which could possibly lead to the emergence of a fully autonomous weapon. On the other hand, the use of autonomous weapon by all parties to a conflict could reduce the number of casualties, turning military conflicts into a technology contention.

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УДК: 329

IS RADICAL LIBERALISM OUR BRIGHT FUTURE OR AN UNATTAINABLE DYSTOPIA?

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Just a few years ago, the question of the viability of right-liberal ideologies was not raised, but now the situation is radically changing, a dispute arises between adherents of authoritarian and anti-authoritarian ideologies. We need to determine whether minarchism as a whole and libertarianism in particular are a necessary course for the development of modern capitalist countries.

To achieve this goal, we will carefully examine anarcho-capitalism - the most radical form of the right-liberal ideology, as well as a more moderate form - libertarianism. We will identify the pros and cons of this policy, as well as analyze the modern vector of development of some right-liberal countries in order to track the trends in the transition to libertarian ideology.

In order to understand how one political ideology differs from another, we will use an instrument known as a political compass [1] with two perpendicular axes. The OX axis corresponds to a predisposition to the desire of people to have private property (far left - there is no private property, far right - there is no state property). The OY axis corresponds to the state's predisposition to control a person's life (the very upper — the complete control of the state over human life, the very lower — the absence of the state as a social institution). Anarcho-capitalism in this system occupies the right-bottom corner.

What conclusions can we draw about the moral, ethical and economic principles of libertarian politics regarding the position of this ideology on a political compass? The right provision says that the private sector and free market and economic relations prevail in the economic policy of the state. The state follows the ideology of minarchism, or is absent as a social institution (under anarcho-capitalism). The lower position on political coordinates speaks of liberal ideology, non-interference of the state in the private life of people.

Meanwhile, libertarianism and anarcho-capitalism are still difficult for the population to understand ideologies. Social relations, where capitalist principles are deduced in the first place, rejects those who have never encountered right-liberal movements. But, oddly enough, anarcho-capitalism implies that freedom for man, which does not give any other authoritarian ideology. An example of this is a completely wild situation for us - selling ourselves into slavery. Oddly enough, this is a statement of the legal right of a person to dispose of his property, there is a clear logic: if I own something, I can dispose of it at my discretion, and sell it, and vice versa, if I can not do something to dispose, then I don't own it. [2] The so-called "civilized slavery" under the contract is the main sign of human freedom under the conditions of the policy of anarcho-capitalism.

The principle of complete economic freedom of a person and the principle of economic non-interference of the state is the main thesis of any liberal policy, from here we can make a number of advantages of this political ideology in comparison with others:

1. Freedom. The state under conditions of anarcho-capitalism is considered in the context of the theory of "Stationary Bandit." It states that the state appeared when, many centuries ago, an aggressive tribe seized a more peaceful, and, instead of robbing everything at once, it began to charge tribute and establish its supremacy over the resources and people of a weak tribe. At the same time, part of the funds remained with the population, allowing it to develop and in the future to give even more money for the benefit of the "Stationary Bandit". Having freed itself from this "bandit", society becomes physically and economically free, which spurs it to develop at an even faster pace.

2. Justice. The more a person works, getting paid for his work and then spending it wisely, the better he will live in the foreseeable future.

3. Honesty. The transfer of former state organizations (courts, police, army) to the private sector will force these enterprises to take care of their "Reputational resource." In conditions of "wild" competition, the owner will be forced to provide quality goods in order to use his services.

4. Integrity. People gather in contractual jurisdictions, where everyone agrees with the generally created laws, as a result of which there will be no reason to violate them. If a person does not agree, he can terminate the contract, pay the agreed penalty and change jurisdiction. For libertarianism, the contract is put at the forefront, the condition of which both parties undertake to fulfill.

In addition to the pros, of course, there are also disadvantages, such as:

1. The possible emergence of monopolies that will not pay attention to the "reputation resource", as a result of which the quality of the services provided will drop. It is possible to increase the level of authoritarianism in the jurisdiction where this corporation dominates.

2. Disclaimer. It is enough for a person to say that he is against private court of that jurisdiction, as a result he can't be judged because it violates his rights.

However, all negative sides will destroy if there will be a contract describing all possible scenarios which will include its termination and the amount of the penalty, in case of violation.

The closest to libertarianism countries is countries which give their citizen a lots of freedom both physical and economical. The countries which change state machine to private:

1. Legalization of lung drugs - albeit for recreational purposes, is large step to libertarianism. [4]

2. Legalization of weapons - right which confirmed by the second amendment of the US constitution. This is probably the largest example of US liberalization, from the only beginning.

3. Jury trial. And although, unfortunately, private courts do not exist now, the jury is the most libertarian, because in essence, jurors are independent and pass judgment based on their moral principles.

Turning our eyes to perhaps the closest place on earth to libertarianism - the state of California, we were able to observe part of what is inherent in right-liberal political ideologies. Moreover, the example of California as an area with a large number of corporations involved in the development of new technologies, indicates that free economic relations do not harm scientific and technological progress. Hence, we can safely assert that society in the future of libertarianism, or anarcho-capitalism, does not face stagnation or regression, even despite the enormous influence of capitalist relations. There is no danger in the totality of personal human inviolability and free economic relations, which means that the radical development course of the capitalist countries as a whole is justified.

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СЕКЦИЯ 2
ИННОВАЦИИ В НАУКЕ И СОВРЕМЕННОЕ ОБЩЕСТВО

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УДК 621

LOTUS EFFECT

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This article discusses the lotus effect (LE), its application in various industries, as well as the relationship of LE with nanotechnology. The authors prove the use of LE in the modern world.

Lotus is one of the most beautiful water plants on our planet, a stunning beauty, having no rivals in the waters of the whole world. The blooming of the lotus flower is unique in itself, because it grows from mud, but is absolutely clean, beautiful, fresh and dry. Undoubtedly, lotus can be attributed to plants to which a man has long assigned a certain status, because the history of this plant is amazing.

Since ancient times, the lotus has been considered a symbol of purity, because even in dirty water its leaves and flowers remain pure. Any moisture that enters the lotus petals is collected in drops, which cannot remain on the surface and quickly slide down, taking with them the particles of sludge encountered along the way, and the particles of dirt are distributed on the outside of the drop of water, do not penetrate into it. Lotus is hydrophobic – this is a physical property of a molecule that does not want contact with water [1], (Fig. 1).

Fig. 1. EL: drops roll on the surface of the sheet, capturing foreign particles.

Leaf contamination leads to disruption of biological processes occurring in the plant. This is due to the fact that the surface of any petal is an already formed system that itself regulates the temperature, controls photosynthesis, etc. Based on this, we can conclude that, using LE, the plant protects itself from parasitization of spores and pollution.

Scientists studied this effect of self-cleaning and found that plants can protect themselves not only from water, pollution, but also from various microorganisms. Not only plants, but also some insects, such as butterflies, dragonflies (more precisely, the wings of these insects) have the self-cleaning effect.

The phenomenon of self-cleaning leaves was subsequently called lotus effect. This effect was discovered by German botanists Wilhelm Barthlott and Christoph Nineuys in the mid 70's. Scientists attributed this effect to the fact that the surface of plants has a special nanostructured state. Thus, LE is based on the known physicochemical phenomena; this effect can technically be reproduced for various materials and coatings. It has developed so well that even honey and glue flow from a lotus leaf.

Now let us give a scientific explanation of what LE is. LE is the effect of the very low surface wettability observed on leaves and petals of Lotus (Nelumbo) genus plants [3] (Fig. 2).

Fig. 2 Dew drops on the lotus surface.

How does LE work? Thanks to the latest tools, in particular microscopes, it was possible to reveal the secret of the lotus. It turned out that the whole thing is in cutin – a substance that is formed by wax and consists of higher fatty acids and esters. The substance itself is located on the entire surface of flowers and leaves in the form of so-called “spikes” which form such an unusual nanostructure.

The presence of LE can be observed in many plants: a tulip, a reed, cabbage, nasturtium.

Eucalyptus is also inherent in LE. Rainwater for arid Australia is highly valuable, it does not stop, and it is washed off from the leaves, picking up pollution.

If you scrape off a waxy material from a sheet that covers the plant itself and apply it to a glass plate, then its particles begin to independently form tubercles and nanoscale columns. So the wax surface is a real godsend for nanotechnologists.

Often, natural phenomena are used by scientists for their development. So the effect of self-cleaning has found application in various fields of industry. For example, often based on the water-repellent effect, self-cleaning coatings are developed for ceramics and metal. Also, this effect is used in the automobile industry when applying coatings [2] (fig. 3).

Fig. 3 LE in automobile industry.

LE has found its application not only in the automobile industry. Today, many materials with hydrophobic properties have already been created, for example, water-repellent paints for facades, coatings for trains, anti-fog glass, waterproof clothing. The development of nanotechnologies and the continuous study of their capabilities can bring the mankind many more successful inventions in future.

Many innovative projects using LE will also be carried out in the field of building materials. Among the paints and varnishes paints with LE have already appeared, thanks to which we can paint the exterior of the house and no longer worry about the fact that dirt will accumulate on its walls. Glasses of houses could also become more perfect, thanks to the existence of such technology.

It will be correct to say it is universal and, in fact, the lotus effect can be used on different types of surfaces, which quite possibly will be created from durable or elastic materials.

In general, nowadays, nanotechnology allows us to do without water during the cleaning of the car, thanks to LE.

Thanks to nanotechnology and LE, it is possible to extend the life of ordinary buildings. Water rolls on its own and cleans the nanocoated walls from dirt.

In conclusion, it must be said that LE is a very useful effect that mankind has borrowed from nature. This is an absolutely unique property that can be used in everyday life, medicine and in different spheres of industry. In the future, the use of LE will definitely extend to other areas of human activities.

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УДК 621.316.925

MATHEMATICAL MODEL OF CURRENT TRANSFORMER BASED ON THE FERROMAGNETIC THEORY OG JILES-ATHERTON

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Current transformer (CT) is an important power system measuring instrument for relay protection. The main requirement of a current transformer is the ability to accurately reflect the primary current waveform. The most commonly used current transformer in energy system of the Russian Federation is an electromagnetic current transformer. CT is based on the principle of electromagnetic induction: alternating magnetic flux in the presence of a loop of wire induces a voltage across that loop.

Because of the CT core's hysteresis and its non-linear characteristics, the secondary current during fault may contain large harmonics and decaying DC components that may cause CT to have sever saturation. Consequently, current transformer saturation leads to distortion of the secondary current curve. Various relay protection terminals use outputs of current transformer as inputs, therefore relay protection algorithms can misoperate. The study of current transformer saturation in transient model caused by the saturation is very important.

First of all, it is necessary to build mathematical model of current transformer, which would take into account the phenomenon of hysteresis of current transformer magnetization curve.

In the simplest form CT's equivalent scheme appears as follows:

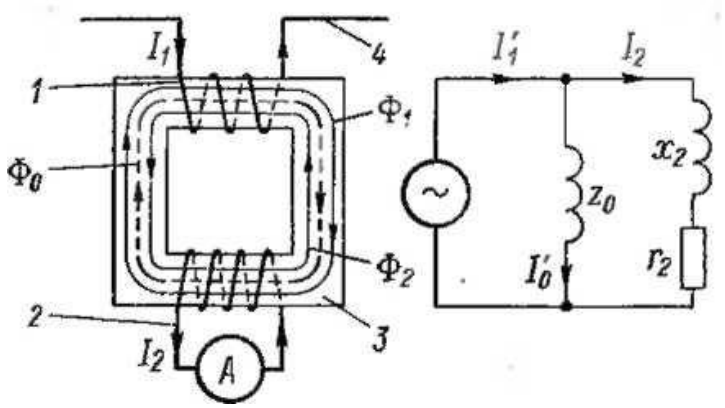

Figure 1 – CT and Simplified CT equivalent circuit.

In figure i_1' - primary current, A; i_2 - secondary current, A; i_0 - excitation current, A.

Mathematical model of CT is described by a system of equation:

$$\begin{cases} H = \dfrac{w_1 \cdot i_1 - w_2 \cdot i_2}{l}, \\ w_2 \cdot S \cdot \dfrac{dB}{dt} = R_2 \cdot i_2 + L_2 \cdot \dfrac{di_2}{dt}, \\ B = f(H), \end{cases} \tag{1.1}$$

where w_1, w_2 - number of primary and secondary windings of a CT; l - length of the magnetic field line in the core, m; S - cross-sectional area of the magnetic core, m^2; B - magnetic flux density; H - magnetic field intensity, A/m;

Magnetization curve is set according to the Jiles-Atherton model of ferromagnetic hysteresis [1]. Mangetization of current transformer is described by differential equation:

$$\frac{dM}{dH} = \frac{\delta_m}{(1+c)} \frac{(M_{an} - M_{irr})}{\delta k/\mu_0 - \alpha(M_{an} - M_{irr})} + \frac{c}{(1+c)} \frac{dM_{an}}{dH}, \tag{1.2}$$

where c - the Jiles-Atherton parameters; k - domain pinning parameter; δ_m - coefficient of k -adjustment; M_{an} - anhysteretic magnetization; M_{irr} - irreversible magnetization component; H - magnetic field intensity, A/m;

Simulation of saturation current transformer was performed inMatlab®Simuling using Matlab-function to solve differential equation (1.2). Results of modeling (distorted secondary current with superimposed primary current) are described in Figure 2.

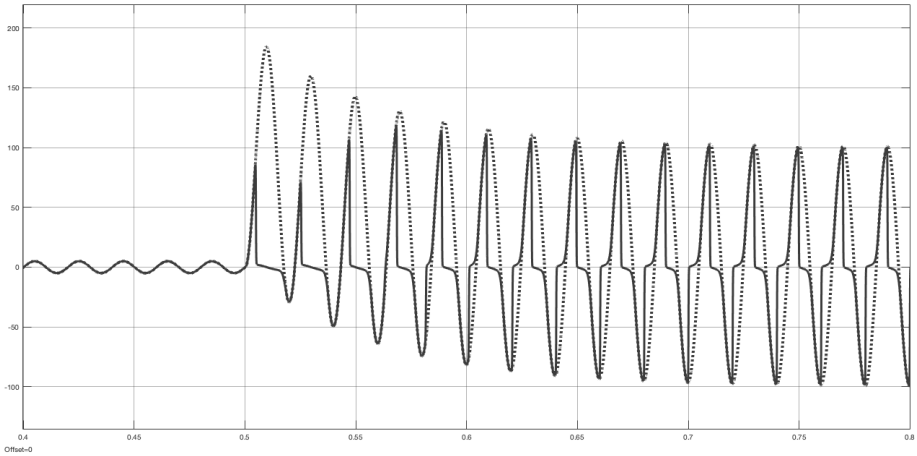

Figure 2 – Primary and distorted secondary current for case $I_{MAX}/I_{RATED} = 10$, $T_A = 10$

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УДК 629.7.03

CONSTRUCTION FEATURES OF GAS-TURBINE ENGINES

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In the modern world, currently a large number of engines exist and are widely used. So the gas-turbine engine (GTE), i.e. the engine that includes a compressor, a combustion chamber and a gas turbine, is not an exception. The gas turbine engine has found its application in many sectors of the technical industry (marine, land and aircraft). As for aviation, gas turbine engines have almost completely replaced their predecessors - piston engines, and currently occupy a leading position. If you compare this type of engines with other types of power plants, you can also see that it is widely used in the sphere of energetics, industry and transport. And this is ensured by high energy efficiency, compactness and relatively low weight.

Due to the design and thermodynamic cycle features, gas turbine can provide high specific parameters. Despite the fact that the gas turbine engine cycle consists of the same basic processes as the cycle of reciprocating internal combustion engines, it still has a significant difference. So, in reciprocating internal combustion engines, all processes occur sequentially in the same engine element - the cylinder. And in gas turbine engines, all processes occur simultaneously and continuously in different parts of the engine. Due to this difference between a gas turbine engine and a piston engine, a gas turbine engine doesn`t have a continuity of operation of various engine elements, as opposed to a piston engine. And the average speed and mass flow of the working fluid in a gas turbine engine will exceed these figures in a piston engine by 50-100 times. This factor allows to perform high power in a fairly small size of gas turbine engines.

Aircraft gas-turbine engines according to the method of creating traction effort belong to the class of jet engines. Among the jet engines, two main groups stand out.

The first group includes rocket engines (RE), which create traction due to the working fluid located on board the aircraft. Today, liquid propellant rocket engines and solid propellant rocket engines are the most widely used. Liquid propellant rocket engines use two-component liquid fuel consisting of an oxidizing agent and fuel, which are based in different containers, while solid propellant fuel is used in solid propellant rocket engines, which contains fuel and oxidizing agent and is completely located in the combustion chamber. In general, rocket engines are used in rockets for various purposes, but can also be used for flights in airless space, because they don`t need any environment to create traction.

The second group of aviation gas turbine engines includes air jet engines (AJE), for which atmospheric air is the main component of the working fluid, and the oxygen that is contained in the air is used as an oxidizing agent. Due to the fact that the air environment is involved, there is a significant supply of working fluid on board the aircraft, but also this allows to increase the

economy and range of flying. If we talk about the classification of the AJE, they are divided into two main subgroups: uncompressed AJE, including direct-flow and pulsating engines and gas-turbine AJE, which got its name due to the presence of a turbocompressor unit, which includes a gas turbine, which serves as the main source of mechanical energy. In the direct-flow engine, the air is compressed due to the high-speed pressure. Engines of this type can be used for flights at supersonic speeds at M> 2-3 and hypersonic speeds at M> 6-7. However, the AJE have the disadvantage that they don`t have a starting thrust. This organic flaw of the ramjet engine can be corrected by switching to a pulsating process of air supply and burning fuel at a constant volume. This process is implemented in pulsating AJE. There air compression occurs without the use of a compressor and high-speed pressure. Separate types of jet engines can be structurally combined with each other or with rocket engines in a single propulsion system. These combined engines can integrate the positive qualities of the original engines.

Direct reaction engines are engines in which all the useful work of the cycle is spent on accelerating the working fluid. Such engines include rocket engines of all types, direct-flow and pulsating air-jet engines, combined engines, and from the group of gas-turbine engines - turbojet engines and double-circuit turbojet engines [2]. Otherwise, if most of the useful work performed by the cycle in the form of mechanical work on the motor shaft is transferred to a special propulsion device, for example, to a propeller, then such an engine will be called an indirect reaction engine. Examples of indirect reaction engines include a turboprop engine and a helicopter engine. At present, one of the most prevalent types of engines is a dual-circuit turbojet engine with a high degree of dual-circuit or in another way a turbofan engine. This type of engine is cost-effective and this is due to the fact that, unlike a conventional turbofan engine, the jet energy, which manifests itself in the form of pressure and high temperature, is not lost at the engine outlet, but is converted into rotation of the fan blades, which creates additional thrust, thereby an increase in engine efficiency. In a turbofan engine with a high degree of dual-circuit, a fan can create up to 70-80% of all engine thrust. Since the aviation industry is one of the most technologically advanced today, quite stringent requirements apply to all elements and installations of aircraft. Consider the basic requirements for promising turbofan engines:

1. Reliability: an operating time of shutdown in flight of at least 200 thousand hours.
2. Environmental friendliness: noise reduction not less than ~ 20EPN dB compared to the standards. Reduction of emissions of harmful substances (NOx by ~ 50-70%).
3. Profitability: increase of profitability by 10-15% in comparison with turbofan engines of the 4th generation.
4. Operational manufacturability: decrease in the complexity of maintenance by ~ 2 times. [1]

Talking about the requirements that are claimed to modern turbofan engines, it is necessary to identify the main areas of advanced technologies in the field of turbofan development. These include:

1. Development of the design and technology of a lightweight broad-chordate blade for a low-noise fan with an efficiency level of at least 92%.
2. Development of a technology for creating a highly reliable low-stage low-pressure turbine.
3. Development of technology for creating sound-absorbing structures from composite materials and metals.
4. Development of technology for creating gears from new heat-resistant steels.
5. Creation of technology and equipment for kinematometric diagnostics of the technical condition of gears.
6. Development of technologies to prevent the destruction of engine parts from multi-cycle fatigue.
7. Development of technologies for ensuring and confirming the resource of the main engine parts taking into account modern requirements of international airworthiness standards.
8. Development of technologies and design solutions for fans of dual-circuit engines that ensure safety during the destruction of rotor parts.

The prospects for the development of aviation in the modern world virtually have no boundaries. Together with it, the gas turbine engines will have to go a further development path with the creation of new technologies and the use of fundamentally new systems. Modern gas turbine engine is a complex system. Therefore, to simplify and illustrate the calculations, you need to use 3D modeling. Also, to improve manufacturability, the use of modern materials is necessary (heat-resistant steels or titanium (for compressor)). For current aircraft manufacturers, increasing cycle parameters (temperature and pressure) is of great importance to improve engine performance.

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УДК 621

PROMISING DIRECTIONS FOR IMPROVING PERSONAL PROTECTIVE EQUIPMENT FOR VISUAL ORGANS

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Information about the state of the external environment for the most part comes through the organs of vision. Determining your position by means of vision allows you to more accurately navigate in the environment, as well as make any complex coordination processes. With this organ, a person receives most of the information about the state of the environment in which he is.

Today, the emergence of new industries, new types of substances and materials, new methods of processing materials is commonplace. The introduction of new and little-studied changes is fraught with the appearance of production factors that can harm a person.

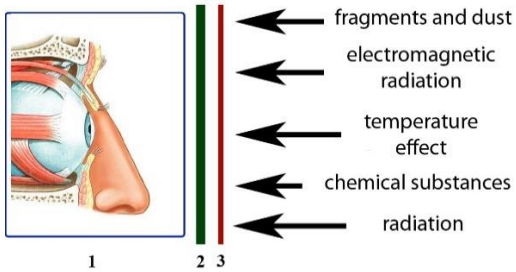
This research is aimed at studying the design of personal protective equipment (PPE) for visual organs and the development of a more advanced design.

There is a basic classification of production factors. They can be divided into two types: harmful production factors and hazardous production factors.

Harmful production factor is a factor in the production environment or the labor process, which impact under certain conditions on the worker`s body can immediately or subsequently lead to illness, including fatal, affect the health of the victim`s offspring, or in certain specific cases, if it is a dangerous production factor, cause injury [1].

Hazardous production factor is a factor in the production environment or the labor process, which impact under certain conditions on the body of a worker can lead to injury, including fatal [1].

In fact, the protection of the eyeball is to isolate it from the harmful and hazardous PF (figure 1). This protection can be provided under the conditions as follows: tightness, protection against significant mechanical impact, protective coating against radiation.



1 - sealed enclosure, 2 - protection against mechanical damage, 3 - radiation protection

Figure 1 - Schematic diagram of human vision protection

At the moment, there are two different ways to protecting visual organs: goggles that protect the organs of vision and a small area of the skin, and facial protective shields that protect the visual organs and the whole face.

When analyzing the protective means, the advantages and disadvantages (table 1) of these structural solutions have been determined, on the basis of which a betterdesign has been proposed.

Table 1. Advantages and disadvantages of goggles and face shields

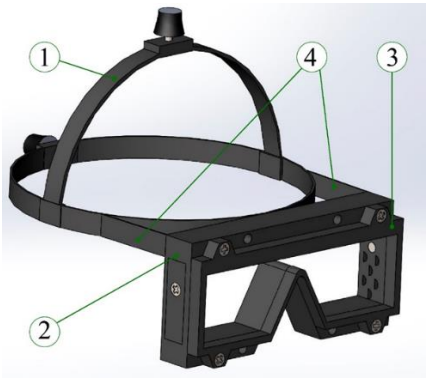
PPE for the organs of vision	**Advantages**	**Disadvantages**
Protective glasses	- lightweight; - compactness; - reliability (if ordinary safety glasses are considered without additional devices); - the ability to create an isolated space due to the shape of the case of glasses.	- inability to protect facial skin from harmful and hazardous PF; - relatively low reliability of fixation on the head (in comparison with protective face shields).
Protective face shields	- reliability; - the possibility of additional protection of the skin from harmful and hazardous PF; - reliable fixation due to precise adjustment of the headband.	- relatively heavy (compared to goggles).

The development of a new design of the personal protective equipment began with the creation of a basic element capable of performing all the functions that are assigned to it. These features are the advantages of the personal protective equipment available nowadays.

From the available data, it can be concluded that the basis of the developed means for individual protection of visual organs should be lightweight as much as possible without reducing the necessary level of protection. They also should be firmly fixed on the head of a worker. For reliable fixation, a head mount is used, which is typical for the design of front protective shields. Reliable fixation is due to adjusting the length of the fronto-occipital and parietal tape by means of regulators.

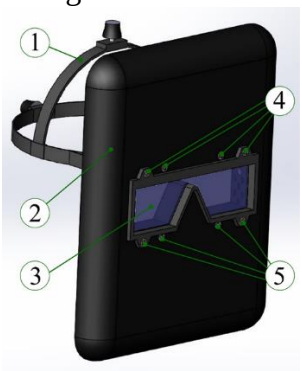
An integral part of this headband is the case of goggles, represented by a mask with one protective glass. Structurally, the possibility of changing the protective glass is presented. The glass is firmly fixed in the grooves with O-rings. These rubber sealing rings fix the protective glass tightly and do not allow fine dust and gases to pass through.

As a result, the following design has been obtained: the case of goggles and the headband are a monolithic structure, and the cap is screwed to the case with four screws (Figure 2).



1 - headband, 2 - case of goggles, 3 - cap, 4 - stiffeners
Figure 2 - General view of the base with a cover

Additional protection of the skin of the face is carried out by installing a removable shield. The shield is securely fixed with the set screws. A general view of the protective equipment with the installed protective shield is shown in figure 3.



1 - headband, 2 - shield, 3 - protective glass, 4 - upper row of fixing screws, 5 - lower row of fixing screws.
Figure 3 - General view of one of the possible versions of the shield

Isolation of the space under the glasses is achieved by creating an obturator in the case of protective glasses.

If it is necessary to carry out natural ventilation, there are ventilation openings on the sides of the goggle housing that can be opened. The vents are covered with a cap that is fixed to the screw.

When working in a dusty environment, this PPE allows you to work in conjunction with filter half masks, anti-noise headphones or ear plugs. Difficulties may arise when using head protection, such as helmets.

When creating the body elements of this PPE, plastic is used that can provide the specified protective properties. In this construction, it makes sense to create a protective shield from one material, which is more resistant to temperature influences and chemicals, and the corps from the material, which is lighter, but slightly less durable.

Fluoroplast-4MB and polyamide-6 are perfect for these purposes. The characteristics of fluoroplast-4MB, which is used for a protective shield and polyamide-6 used for the corps are as follows:

- Fluoroplast-4MB is of high chemical resistance and high strength, which is necessary for the PPE. Good strength of this plastic remains in a wide temperature range (from minus 190 to plus 250 ℃). The plastic has dielectric properties and is highly resistant to UV rays [2];

- polyamide 6 (polycaproamide, polycaprolactam) is a material with high mechanical strength. It has a wide range of mechanical characteristics depending on modifiers and fillers. It combines high impact resistance with rigidity and resistance to creep. However, with increasing humidity, stiffness, strength and hardness sharply decrease, while shock resistance increases. It is resistant to automobile fuel, lubricants, hydrocarbons, oil products [2].

In conclusion it should be noted that this means of protection makes sense to be produced only in large quantities. However, if there is an urgent need for them, the question remains open.

This PPE is definitely useful in workshops involved in single production. In such workshops a large number of various technological processes are concentrated, which are the sources of various harmful and dangerous production factors.

To date, the manufacture of highly targeted personal protective equipment for visual organs, which are able to protect against one or two production factors has been put on stream. The costs for such products are cheaper in comparison with the universal personal protective equipment for visual organs.

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УДК 336.717

PROS AND CONS OF PAYPASS TECHNOLOGY

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The word ‘innovation’ means a kind of a novelty or any implemented new technology, which provides a qualitative increase in the effectiveness of processes or products demanded by the market. It is the final result of human intellectual activity, their imagination, creative process, discoveries, inventions and practical rationalization. [1]

Plastic card with contactless payment technology is one example of modern innovations. This product has gone through the whole stages of its improvement.

At first there were ordinary cards with a magnetic stripe. Then a cardboard with a chip appeared. Then it came a new stage of contactless cards that could transmit a signal remotely. Payment for goods and services has taken a big step forward in the development of technology. Paying has become even safer, because the client kept the card in his hands all the time. Initial testing of new products took place in the States. After this, PayPass payment terminals appeared in McDonald's fast food establishments - in America, Canada, Japan and the Philippines. Gradually, large banks began to join the contactless payment system, and payment terminals spread throughout many countries.

In Russia, a new system came in September 2008 with the start of the usage of a MasterCard with a PayPass. Initially, the first who tested the system was Moscow restaurant called "Five Stars".

The first bank to issue PayPass cards in Russia was the ‘Moscow Industrial’. They provided teachers and students of educational institutions with such a novelty. It is interesting that for students such a card has become not only a kind of a "wallet", it can work as a student card, and even a record book. Further distribution of PayPass cards to other organizations in the country is expected. This is not surprising, as Russia is a country of student youth, who are the majority of buyers and therefore contactless payment technology is most suitable.

The PayPass service is actively used in places where people do not stay for a long time. These are fast food establishments, pharmacies, train stations, airports, cinemas. Contactless payment terminals are vending machines, toll roads, turnstiles, gas stations, supermarkets and cafes.

Contactless payment technology is a comfortable method, it saves the time of buyers and users of various services, it is a high-level service, that allows not spending time on paying and receiving change. Cards with PayPass and PayWave functions are universal; they can be successfully used in any terminals and ATMs of all countries of the world. Chips that support contactless payment technology are even integrated into smartphones, which is very convenient - you just bring your phone to the reader and everything is paid.

According to the EMVCo (Europay + MasterCard + VISA) standard, a typical cycle for conducting EMV transactions consists of 12 stages: 1. Choosing an application; 2. Initialization of application processing; 3. Reading application data; 4. The issuer's authentication offline; 5. Processing restrictions; 6. Cardholder authentication; 7. Verification of risk management parameters on the side of the item; 8. Analysis of the paragraph; 9. Checking risk management parameters on the side of the card; 10. Analysis of card actions; 11. If required, then authorization of transactions online; 12. Completion of a transaction.

These operations require intensive computation.

Large retail chains tend to save every second. The payment system Visa has proposed the technology of contactless card service. Customers are given a valuable advantage of NFC (Network File System). Now the card may become completely redundant as data for payment is translated to the phone with NFC. Contactless transaction processing time required is 500 milliseconds, within which an ATM and the card get acquainted, discuss the “problem” and make the right decision.

To make the implementation of a contactless transaction real, the developers proposed reduction of the 12 steps of the transaction: to remove the unnecessary steps, and to compile the rest of them.

1. When preparing for a contactless transaction, the terminal already knows the amount to be paid and can determine the possibility of conducting a transaction via the contactless interface, taking into account the limits allowed by the acquirer.

2.1. A customer brings a proximity card or NFC-enabled phone to the reader. The reader asks the card for a list of applications that support PPSE (Proximity Payment Systems Environment). If the application is found, then it is automatically selected for payment by Application ID (AID). If the application is not found, then the transaction is completed.

2.2. The terminal sends the most important ‘Get-Processing-Option’ command to the card. (application processing is initialized). Based on the analysis of the TTQ record, the amount and currency of the data transaction, the card decides on the method of authenticating the client, taking into account the rules of risk management.

3. Based on the information received from the card, the terminal authenticates the card holder. Options may be the following: no authentication; authentication by signature; authentication by Pin Code.

4. If necessary, the terminal generates an authorization request and sends it to the issuer.

The technologies described above can be implemented not only in a microchip implanted in a piece of plastic, but in mobile phones. From the point of view of the payment system, the interaction of the participants does not differ from the usual payment by card.[2]

Cards with the PayPass chip are protected by a built-in mechanism that makes unwanted purchases impossible; for payment, it must be in a tight interface contact with the terminal. It remains in the hands and under the control of the buyer throughout the whole procedure, that is, it is protected from fraudsters. But there is also negative experience in using these technologies. The results of the studies showed the possibility of scanning the chip on a PayPass card using inexpensive scanners directly in the crowd. But protective methods greatly complicate the possibility of its cloning. In addition, the need to contact the card at a very close distance makes access to it inconvenient and practically impossible.

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УДК 621

TECHNOLOGY, OPERATIONAL PRINCIPLE AND USE OF LASER-PROPULSION ROCKET ENGINE

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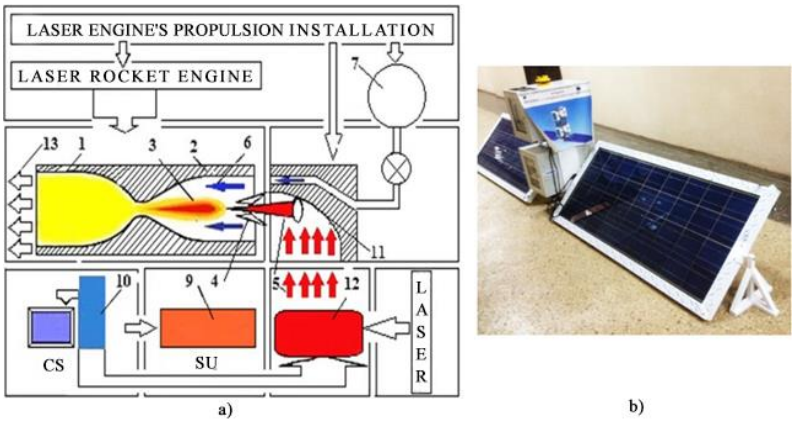
Difficulty of using today's rocket engines of interplanetary vehicles is the important problem of modern space technology, because of the number of disadvantages:

- inability of using energy-efficient types of petrol in vacuum;
- hypergolic petrol propellants are heavy, what makes liquid rocket engines' using unreasonable and economically unprofitable;
- lower density impulse;
- dependence – subsidence of liquid rocket engine's fuel requires extra equipment, that lows overall reliability of engine at all;
- nowadays LRE has achieved energetic petrol limit, therefore it is theoretically impossible fundamentally increase density impulse.

One of the solutions is usage of alternative rocket engines such as laser-propulsion rocket engine, that makes density impulse much bigger than expected from classic chemical rockets.

Operational principle



a) b)

a) LPRE's scheme (1 – conal nozzle; 2 – absorption chamber; 3 – optical discharging; 4 – quartz window; 5 – impulse laser radiation; 6 – motion of laser gas; 7 – tank of mass carrier; 9 – impulse laser supply unit; 10 – controlling system; 11 – detector and concentrator of laser radiation; 12 – impulse laser; 13 - discharge escape of lasing gas); b) experimental model of orbit space laser installation.

Lasing gas as mass carrier (6) is supplied into absorption chamber (2). High-frequency laser impulses make an optical discharging in short time (at a temperature of 10^6K), leading to a mass carrier's momentary autoflammability without usage of oxidants and catalysts. The mass carrier widens and is directed to nozzle (1) through critical section, that brings to increasing of pressure of the gas and after to gas blast through nozzle exit.

Usage of LPRE

LPRE has a number of advantages in comparison to LRE:

- useful load increasing, because of oxidants and catalysts' absence;
- ability of using more low-mass and energy-efficient types of petrol, that makes density impulse and COP (coefficient of performance) increase;
- simpler and more reliable scheme of installation;
- ability of setting up beyond space ship helps decrease spacecraft's weight

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ELECTRIC BUS

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An electric bus is an autonomous general-purpose trackless mechanical vehicle designed to transport people on roads and moving along an established route using a traction electric drive, the energy for which is stored its battery. An electric bus of medium or large capacity, by the design principle and the electric equipment used, is in many ways similar to a trolley bus, and in the general concept it resembles an electric car, with the exception of the dimensions, capacity and power of the electric drive. As a drive and at the same time a source of electricity for the electric bus, in the "classic" version, a large-capacity battery is used, which may be located in the niches, under the body, in the rear compartment, etc. The driving wheels of the electric bus are driven by a traction motor (or several ones), which operate via an electrical control system (including power cables, contact or contactless switching devices and devices, etc.). Also, as an engine, it is better to use the electric motor wheels (which although have significant drawbacks, allow to exclude "classic" transmission devices: cardan, differential, half shafts, etc.).

Today, there are already several models of electric buses that use electric portal bridges. The world leader in electric bridge manufacturing is ZF Friedrichshafen AG. Its final development is the AVE 130 bridge, which is used in electric buses manufactured by such plants as NefAZ, LiAZ, KamAZ, etc. Traction electric motors of such electric buses are three-phase AC induction motors [1].

In this paper, we develop a mathematical model of a three-phase asynchronous AC motor in MATLAB.

A virtual model of IM, allowing to analyze the processes of acceleration and braking, collected in MATLAB is presented in Figure 1.

The setup of the circuit represents of the setting the voltage level of the sources, frequency and phase shifts, as well as in choosing the parameters of the IM in accordance with the data shown in table 1. The pulse generator is set to an amplitude of 1 V, a period of 3 s and a pulse duration of 50% of the duration period [2]. The measurement is carried out using oscilloscopes, the first of which is connected to the phases A and B of the IM motor via a voltage meter, and the second and

third the ones to the bus selector unit [3]. Also, using the step signal generator, we set the initial and final values of the signal.

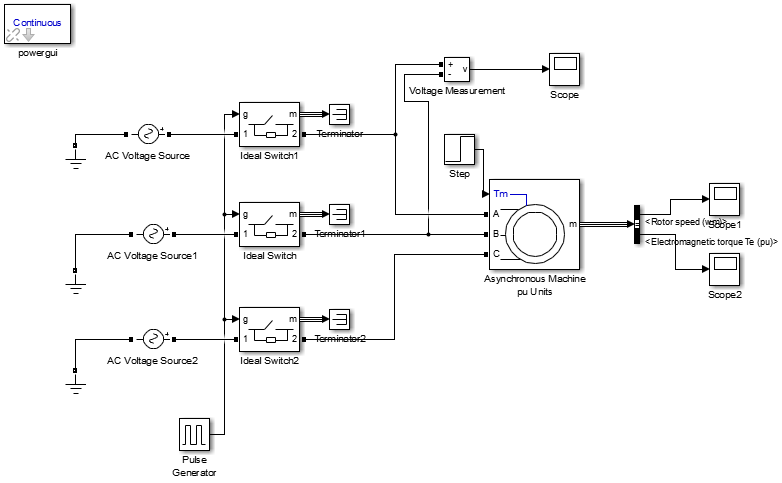

Figure 1.

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УДК 001.896

INNOVATIVE TRENDS IN OUR SOCIETY

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The main objective of the research is to analyze the impact of different modern innovations on society.

Innovation is an implemented novelty that provides a qualitative increase in the efficiency of processes or products, demanded by the market. It is the final result of human intellectual activity, imagination, creative process, discoveries, inventions and practical rationalization. An example of innovation is the introduction to the market of products (goods and services) with new consumer properties or a qualitative increase in the efficiency of production systems. Innovations, being a powerful engine of social progress, have many positive effects, but, nevertheless, they are also negative aspects in environmental and social terms. Innovation forces society to change the way of life. And the greater their effect, the stronger and more noticeable the changes caused by them are. Therefore, the role of innovation must be considered in all its diversity.

Currently, the world does not stand still, it is constantly developing. Today, people cannot imagine their lives without a phone, computer, car, household appliances, namely, without

innovations that have become quite common to us. Innovation has a huge impact on the economy. It is even impossible to grasp the scope of their application. There are the most basic aspects of influence of innovation:

1. Innovation affects the quality of products, there are completely new or improved products that are able to fully meet the needs of the person.

2. Innovations contribute to economic growth, creating new industries, and a single market (for example, the Internet).

3. Thanks to innovations the number of highly-skilled professionals increases.

4. The impact of innovation on people's living standards improves human living conditions.

5. Innovation helps to reduce production costs. New technologies are being invented that allow to reduce the amount of electricity and water consumption.

6. Innovation affects the competitiveness of an individual or organization. Competitive advantage lies in the ability to find new markets, produce new goods and invent new ways of manufacturing goods. If a firm has an innovation that is in demand in the market, it will be its competitive advantage until new ones with greater advantages are created.

Every year, Popular Science magazine selects the best innovations in science and technology. These discoveries determine our future. Let’s make an overview of the list of the best innovations compiled from the technical news magazine BitCryptoNews:

- Unmanned transport. The Unmanned buses have started running in Japan in early 2019. The vehicle called Apolong has already been released in the amount of 100 pieces. Renault this year unveiled its EZ-ULTIMO driverless supercar created in futuristic style.

- Aircraft. The first electric aircraft has been successfully tested in Finland and will be used for pilot training. The cost of flying with an electric motor is 10 times less in comparison to a fuel engine. The engineers of the company Airbus went even further - they produced a solar-powered aircraft. The aircraft stayed in the air for as much as 26 days. In addition to this, Boeing produces more modern aircrafts, such as the Dreamliner, and thanks to innovations, harmful exhaust gases do not enter the cabin, and the humidity level in the cabin tends to be 15%. Earlier in Boeing, it was at about 4%.

- The naval vessel “Sea Hunter” may be too large for a human crew, but it doesn't need one. It is the first vessel designed by the armed forces to autonomously patrol the sea and search for submarines, which is an important and difficult task even for a vessel with a team of skilled sailors. Thanks to special navigation algorithms, the 40-meter ship moves according to all Maritime Navigation Rules and is able to avoid collisions with other vessels. If the two-year tests are successful, the U.S. Navy may consider developing drone ships for other purposes, such as deactivating unexploded mines.

- Innovations in everyday life. The trend of new inventions in 2018 in the world of technology for the home was the addition of the prefix "smart". For example, a ‘smart home garden’ from the SproutsIO. This system is a pot and a lamp. Indications of soil moisture, temperature, nutrients are automatically adjusted depending on the vegetable or fruit planted in the pot. ‘Smart garden’ allows you to grow plants 3 times faster.

- Person identification. Scenes from movies, in which the computer itself recognizes the person on the video, became real long time ago. In Russia, such a system detected the criminal, and then gave a signal to the police. Villains can hide their faces from video cameras, but for the Chinese authorities it is not a problem. Special developments in the field of artificial intelligence have made it possible to distinguish people by the way they walk and the shape of body.

- Voice assistants. Advanced versions can now make phone calls and make restaurant reservations or coordinate parcel deliveries.

Innovation affects the quality of products, there are completely new or improved products that are able to fully meet the needs of the person. Innovations have many positive effects, they force society to change the way of life. Innovations also help to reduce production costs, new technologies are invented that allow to reduce the amount of electricity and water consumption.

In connection with the above, it can be concluded that innovations have a good impact on society.

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УДК 621

THE USAGE OF COMPOSITE MATERIALS IN AVIATION INDUSTRY

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Nowadays the usage of composite materials is becoming more and more common, as it provides much benefit to the life cycle of a product. Aviation industry is not an exception.

All composite materials consist of a matrix and rigid reinforcing filler. Typically, the reinforcing filler in polymer composites are carbon or glass fibers, and the matrix is a polymer material, typically synthetic resin. Most often thermosetting resins are used. When heated, they form a three-dimensional polymer grid, which makes the matrix rigid and chemically stable. These materials can be used to produce lightweight components with a higher level of strength which is much better than of metal ones. Their application is relevant wherever lightness and strength are of great importance, primarily in aviation, as fuel consumption directly depends on the weight of the aircraft.

Not all the parts can be made of composite materials. The aircraft fuselage, its wings, tail assembly and interior fittings can be made of composites. In general, lighter carbon fiber is more often used in aircraft industry with a fiberglass mostly used for unloaded parts and the nose cone. Fiberglass is heavier than carbon fiber and less durable, but it is much cheaper. The nose cone of the aircraft is made of fiberglass since this part has to pass radio waves through, and carbon fiber conducts electricity and creates interference. It is impossible to replace engine parts with composite materials, because polymers do not withstand temperature. Landing gears are not made of composites, because they have a high impact load; the same as the movable elements of the wing.

Composite materials are constantly being upgraded and improved. The strength and lightness of the material strongly depend on the component design and the type of filler. Engineers regularly improve characteristics of carbon fibers by changing the types of filler and upgrading molding technology.

New polymers are created to achieve heat-resistance. There is a certain limitation in the creation of new polymer matrices as you need to use the materials, which are already in large-scale production and are relatively inexpensive. The composite industry in Russia is quite small, and it is irrational to launch a new production of highly specialized reagents.

The heat resistance of the material is determined solely by the properties of the matrix - all known polymers withstand significantly lower temperatures than carbon or glass fiber. Fiberglass melts at a temperature of about 600 °C, and aviation epoxy resins - at 180 °C, the maximum of glass

transition temperature of epoxy matrices described in the scientific literature is about 240 °C, but this material is not in mass production.

High-temperature resistant composites are needed for engine parts, exhaust pipes, high-temperature electrical insulation, heat shields of spacecrafts, interior of submarines – these are places where it is very difficult to extinguish fire. Modern aircraft industry considers the possibility of returning to passenger supersonic aviation that means high speeds. And the questions of better skin heat resistance and fuel economy becomes very important. New polymers are needed for all these applications.

One of the most suitable heat-resistant binders was the well-known phthalonitrile. The problem is that the higher the heat resistance of the final material, the more «demanding» are the base monomers used. Due to scientific chemical research a new monomer was obtained by chemical modification of the original structure of phthalonitrile, and a new phthalonitrile binder was developed, which can be easily processed for future usage. The material retains heat-resistance up to 450°C, but is long-term stable in air at 350 °C, as it oxidizes at higher temperatures. Phthalonitriles were not invented but modified so that it gave an opportunity to produce them cheaply, to process them easily and not let them lose desirable properties.

The properties of the composite material are determined not only by the matrix and filler used, but also by the technology of their production. Due to the usage of fiber strengthening goes only in one direction - along the fiber. To achieve good strength, the composite is organized in layers, interchanging the direction of the fiber to make strength equal in length and width. To strengthen the material in the third direction, the layers can be vertically stitched with additional fibers. By specifying the direction of the fibers in the material, we determine its properties. Every component is individual, and each type of a composite has its own layout depending on the direction of load. How to organize the fiber layout for an exact component must be professionally calculated on the base of properties of fiber and matrix by structural engineers.

The most common way of composite material production is an autoclave method. An alternative to autoclaves is vacuum infusion technology. Dry material is put in a special package, vacuum helps to spread polymer binder through the tubes to saturate the fabric, and then the item is hardened at high temperatures. A vacuum infusion bag can be made of any size, and this technology allows the production of very large elements that cannot be made by any other composite material production methods. Vacuum infusion is used to create the wing elements of the Russian aircraft MS-21 with the length of 25 meters, which have not been done by anyone in the world.

The use of composites allows to reduce the number of elements in a certain unit, therefore, making it easier and faster to assemble the aircraft. Unlike metals, composites are not the subject to fatigue. At the same time, polymer composites have a number of disadvantages: composite materials are still much more expensive than metals, and their use pays its way back only with long-life cycle.

The weak point of polymer composites is the resistance to impact. After any impact produced on a composite-made element micro-cracks occur that steadily leads to delamination. In order to increase the impact resistance of a polymer composite, special combinations of binders are being developed. Thermoplastic matrices are introduced into common composites.

If a composite-made element breaks, it must be completely replaced with a new one. There are special repair techniques, but they are not very reliable. In aviation repair is rarely used as after it, the item can rarely be successfully qualified. To monitor the appearance of cracks, complex diagnostic procedures are needed. For example, fiber-optic sensors can be integrated in the composite and the integrity of the material structure can be determined in an online manner.

In addition, carbon fibers burn, and thus emit toxic substances that can make people suffocate with smoke. That is why the interiors are made of plastics which are less flammable and which include special additive-flame retardants.

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УДК 621.3

PRINCIPLE OF OPERATION AND APPLICATION AREA OF ELECTROMAGNETIC RELAY

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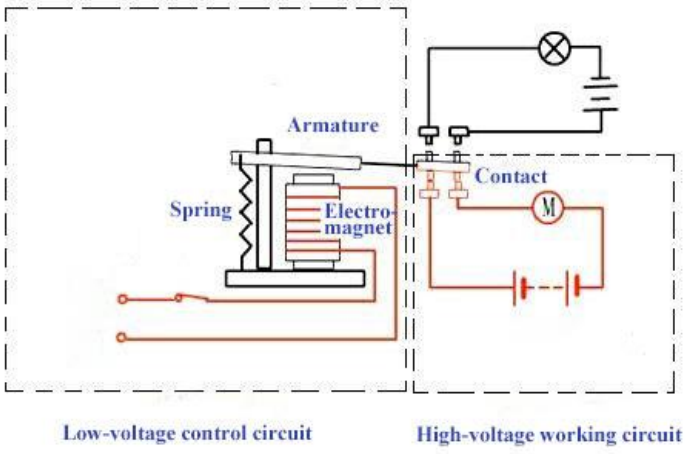
As the title implies the report describes a principle of operation and application area of electromagnetic relay. A simple device, which is now called a relay, was included in the original 1840 telegraph patent of Samuel Morse. The mechanism described acted as a digital amplifier, repeating the telegraph signal, and thus allowing signals to be propagated as far as desired. The word "*relay"* appears in the context of electromagnetic operations from 1860. A relay is an electrically operated switch. It consists of a set of input terminals for a single or multiple control signals, and a set of operating contact terminals. The switch may have any number of contacts in multiple contact forms, such as make contacts, break contacts, or combinations thereof. Relays are used where it is necessary to control a circuit by an independent low-power signal, or where several circuits must be controlled by one signal. For the past century there has been a rapid rise in the use of electromagnetic relays. [1]

Electromagnetic relays are among the most widely used types of relay. They consist of electromagnet, armature, spring, movable contact and stationary contact. Usually an electromagnetic relays have two circuits, low-voltage control circuit and high-voltage working circuit. The low-voltage control circuit includes an electromagnetic relay coil, a low-voltage power supply and a switch. The high-voltage working circuit includes a high-voltage power supply, a motor and the contacts of the electromagnetic relay. The working principle of electromagnetic relays is not complicated (pic.1), and it operates mainly according to the principle of electromagnetic induction. Switching on the power in the low-voltage control circuit, the current goes through the coil of the electromagnet to generate a magnetic field. Then the armature generates a suction force to making the movable contact and stationary contact touching. Thus the working circuit is powered on and the motor begins to work. When switching off the power in the low-voltage control circuit, the current in the coil will disappear and the armature under the action of the spring will separate the movable contact and stationary contact. The working circuit is disconnected and the motor stops working. [2]



Pic.1. Working principle of electromagnetic relay

Electromagnetic relays are electrically and physically separate from the circuits they control. Another distinct advantage of relays is their ability to switch circuits. This ability eventually has given rise to more powerful and faster electronics, including the modern computer and microprocessor. Like any other device, an electromagnetic relay has its disadvantages. Their operation can be effecteddue to aging of the components and dust, pollution resulting in spurious trips.Operation speed for relays is limited by the mechanical inertia of the component.

Electromagnetic relays have many applications in the field of radioelectronics and radiotechnics. This type of relay is employed for the protection of various ac and dc equipments. These relays are used to open or close circuits and even perform mechanical functions, used as auxiliary relays in the contact systems of protective relay scheme.

In conclusion, I want to note that the switching capabilities of the relay are what eventually led to the modern information age. The simple on or off status of the most basic relay has been at the core of communications since the advent of the telegraph and is now responsible for the speed and accuracy of modern electronic devices. Relays are one of the fundamental parts of nearly all electronic components and are found in sizes ranging from microscopic to those capable of moving heavy machine parts. [3]

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УДК 62

PROJECTOR AS AN ALTERNATIVE OF MONITOR

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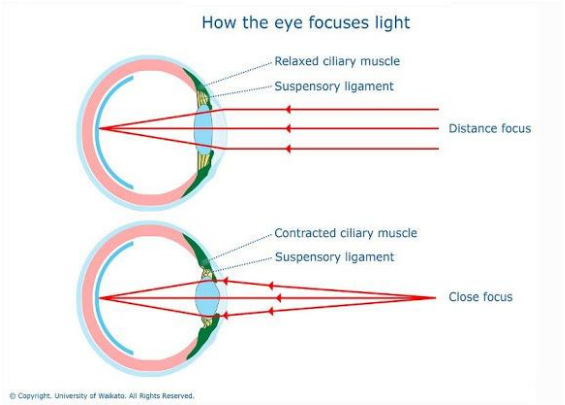
Nowadays PC is one of the most necessary things of people. We are practically ‘tied’ to monitors. I haven’t attached importance to this before. But now I have to work on PC nearly every day during the all day. And my vision began to be worse. Spending less time on PC is, of course, a good idea, but I wanted to find another better idea. Why can’t we use projector instead of conventional monitor? Will the projector affect vision less? In this research I’m going to tell you about this device as alternative of monitor.

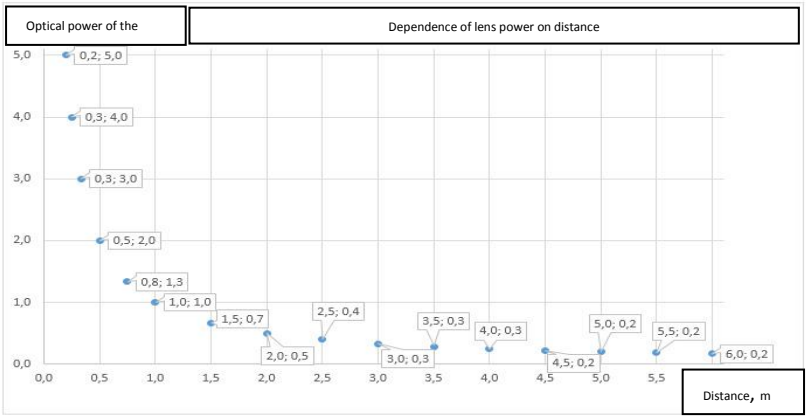
I was interested in projector for good reason. According my guess projector spoils vision far less than monitor because we see picture which if reflected from surface. In fact we look at the wall which is highlighted by flashlight. In case of the monitor this ‘flashlight’ shines right in the eyes. But what about practice?

First of all, I want to tell you a little bit about focusing of our eyes. Focusing on close situated objects is always eye muscle tension. And the main task of muscles is to increase optical power of lens of the eye, so they are stretched to do that. We often look at closed objects and eyes strain so

much that we can feel accommodation spasm(false myopia). You can make sure of it. Just stand on distance of 30- 40 cm to window, look at window frame, and then move your gaze out the street. You will feel your eyes ‘’rest’’.



Sometimes you can find this schedule in the reports of ophthalmologists. Optical power of lens equals to 1 divided by the distance. If you look at infinity your eyes rest. In case of focusing of close objects eye must change form of lens.



You have to strain eyes for 1 m located objects 2 times more than for 2 m located objects.

And In this situation projector has an advantage. We can move over from the screen on a long distance, so it will affect vision far less.

There is an important question in the research. Have all projectors the same principle of operation? Nowadays there are two major species of projectors: 3 LCD and DLP.

Every picture consists of combinations of green, red and blue. In three-matrix projectors (3LCD) picture is created in device and we see complete picture on the screen. 3LCD technology provides the same brightness for all colors because all colors are projected at the same time on the screen.

Color brightness of DLP projectors can be worse than in 3LCD. There is only one matrix so it can’t project three basic colors at the same time. It shows colors in course. And when one color is projected other colors aren’t showed. That’s why color brightness becomes less. And we can see an effect called ‘’rainbow effect’’ (stratification of colors).

The Far Eastern State Medical University did research about visual effects of 3LCD and DLP projectors. Researchers explored physiological parameters such as visual acuity, critical flicker

frequency, field of view for achromatic vision. Students-volunteers were looking on the presentation on 3LCD and DLP projectors during 60 minutes. According the research DLP projectors caused changes of vision system. Visual acuity and field of view for achromatic vision were declined. And 3LCD didn't cause significant changes.

Result of research show that projectors are great alternative of conventional monitors. But not all projectors are equally useful.

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УДК 504.06

OVERVIEW OF APPROACHES TO COMBAT PLASTIC

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Plastic accompanies us everywhere and helps in almost all spheres of life. There are many examples of the usefulness of this material. The harm of plastic to the environment and humans, as the most convenient, but the most environmentally friendly type of packaging is because it does not decompose in natural conditions and accumulates in huge quantities. A really striking example of the excessive use of plastic is the packaging of fruits and vegetables.

The problem of plastic pollution would not have grown to its present colossal proportions if, after the use of plastic products, humanity had disposed of them properly. However, the complexity of the whole situation is compounded by the facts related to the nature of the material itself.

In addition to ways to combat plastic pollution by various corporations and at the state level, direct recycling for reuse, there is an increasing need to dispose of the accumulated huge amount of plastic. One promising solution is an engineering approach to the problem in conjunction with living organisms that can do it safely and efficiently.

Therefore, Wei-Min Wu from Stanford University (USA) and his colleagues from universities in China made a number of discoveries by experimenting with the larvae of various omnivorous insects. In these experiments, the scientists fed the arthropods small pieces of foam and other polymers, observing whether their larvae ate and whether they could eat a "clean" diet based on polyethylene, foam and other components of plastic garbage. Much to the surprise of scientists, they were able to quickly find two similar species of insects: Tenebrio molitor and Plodia interpunctella. The first of them, thanks to bacteria from the genus Exiguobacterium, can eat about 40 milligrams of polystyrene per day, which is about the weight of one small tablet. Tenebrio molitor do not digest the polymer completely, but the foam residues in their excrement, as scientists have found, can be decomposed with the help of other bacteria. Plodia interpunctella were able to eat several milligrams of polyethylene film substance using a tandem of bacteria from the genera Enterobacter and Bacillus.

The polyurethane degradation activity of pestalotiopsis microspore was detected in two different strains of the fungus isolated from plant stems in the Yasuni National forest in the Ecuadorian Amazon rainforest by a team of student researchers led by Professor of molecular biochemistry Scott Strobel as part of the annual expedition and Yale University rainforest laboratory. This is the first type of fungus that can exist on polyurethane under anaerobic conditions. This makes the fungus a potential candidate for bioremediation projects involving large

amounts of plastic. Originally identified in the fallen foliage of Hedera helix in Buenos Aires, it also causes leaf spots in the bushes of Hypericum 'Hidcote' (Hypericum patulum) in Japan.

During the screening of soil, water and silt samples taken from the recycling site of PET bottles in Sakai (Japan), a team of specialists from Keio University of Japan discovered the bacteria Ideonellasakaiensis. The organisms in the samples were tested for their ability to exist on PET film as the main carbon source.

The proposed mechanism of pet destruction by Ideonellasakaiensis bacteria is as follows. Initially, the extracellular enzyme that hydrolyzes PET decomposes PET to mono (2-hydroxyethyl) terephthalic acid (main product) and terephthalic acid (by-product). This Ideonellasahariensis enzyme has only 51 % amino acid sequence similarity to another enzyme capable of hydrolyzing PET hydrolase bacteria ThermobifidafuscaMono (2-hydroxyethyl) terephthalic acid is hydrolyzed by the corresponding enzyme (putative lipoprotein) to terephthalic acid and ethylene glycol. Terephthalic acid is delivering to the cell through a special Transporter protein and is successively catabolizing by two enzymes to protocatechic acid.Then a special 3,4-dioxygenase [en] destroys the aromatic ring of protocatechuic acid. Under the action of bacterial enzymes, the pet film was significantly destroying and completely decomposing for 6 weeks at a temperature of 30 °C.

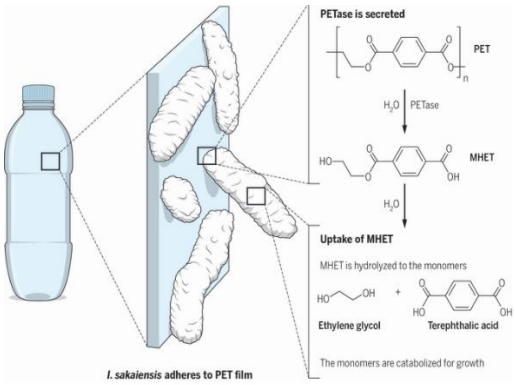

Figure 1. Mechanism of destruction of plastic Ideonellasakaiensis cells

Various studies are under way to find alternatives to polymer materials, and some progress has already been made. Therefore, Eben Bayer and Gavin McIntyre developed a mushroom-based insulation material that can self-replicate within 5 days. The material Greensulate uses fast-growing fungal mycelium-analogue of the root system of plants. Mycelium for its growth uses energy, which is contained in the remains of crops. This is how the composite is formed. When the finished product is heated, the mycelium of the fungus is inactivated, and as a result, a durable and lightweight material is obtained. Now the development is implemented by Ecovative, USA.

To sum up, plastic is a multifaceted and extremely urgent problem of our time. To stop plastic pollution, the world needs to work together: consumers can make informed choices, businesses can make responsible production, and governments can promote anti-pollution policies. Promotion and study of engineering approaches to the problem will significantly accelerate the entire process of cleaning the planet from the effects of harmful effects of plastic.

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УДК 671.121.4

TECHNOLOGY OF MANUFACTURING SILVER EARRINGS “FEATHER OF THE FIREBIRD”

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Earrings can be considered one of the most popular jewelry. This jewelry is enjoyed by both women and men. This type of jewelry will never go out of fashion, will not lose its popularity and demand. Earrings are able to say a lot about their owner, emphasize his or her beauty and originality, reflect owner`s attitude and mood.

The first earrings appeared 7 thousand years ago in ancient Asia. Initially, they were worn only by men, but gradually earrings became part of the women's toilet [1].

After analyzing the modern market and trends in jewelry fashion, it was decided to develop silver earrings with jewelry inserts of sapphires and cubic zirconias in a classic style. Earrings are in the shape of a peacock feather, attached to the ear with an English clasp. The product consists of two parts. The first part is a trefoil with sapphire stone inserts. The second part is a movable pendant consisting of three separate parts.A combination of silver and blue is used, which is contrasting, expressive and harmonious.

To create the earrings, it was decided to use an alloy of silver with copper — СрМ925, which contains 92.5% pure silver and 7.5% alloying components. Silver 925 alloy is called sterling silver, such an alloy has a silver-white color, high corrosion resistance, malleability, ductility, high thermal and electrical conductivity, the highest reflectivity (95%), polishability, gloss, as well as it is perfectly machinable [2].

Sapphires and cubic zirconias were used as decorative inserts.

To manufacture the earrings, the technology of artistic casting was used. This method provides high precision cast product, low surface roughness, minimal subsequent machining. The process is carried out quickly enough.

The manufacturing technology of earrings consists of 8 sequential operations. The first operation is the construction of a 3D model and optimal geometry. During the second operation, a wax model kit is made, using a 3D printer, a wax herringbone is also formed. At the next stage, a plaster mold, i.e. flask is made and the casting process is carried out. The next operations include separating structural elements from gates, surface treatment of castings and assembling the elements into the product.

After the product had been assembled, a tumbling operation was performed, due to which the surface roughness was reduced. After mechanical surface treatment, 274 jewelry inserts were fixed in the product. Stones were fixed with a beading tool. The finishing operation was polishing, during which the surface of the product was brought to a mirror shine.

Subjected to the above sequence, the product will be manufactured efficiently and with minimal time loss. Figures 1-2 show a photo of the finished product made according to the developed technology.

Figure 1 - the finished product.

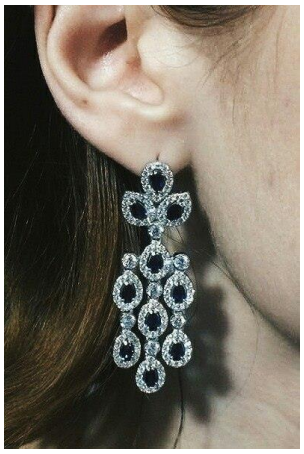

Figure 2 - the product on the model.

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УДК 621.313.3

WINDING OF THE ELECTRIC MACHINE OF THE BUTTERFLY EXECUTION WITH THE INCREASED ENERGY EFFICIENCY

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This paper presents a winding scheme with twelve stator coils of an end-face AC machine. It is compared with a traditional winding with six coils according to the composition of the spatial harmonics of the magnetomotive force. The advantage of the proposed winding due to the lack of even spatial harmonics of the MDS is shown.

Synchronous electric machines with excitation from permanent magnets and with a magnetic gearbox have end-face [1]. The rotor-inductor is a disk with permanent magnets which has the form of sectors and is magnetized axially with alternating polarity. The stator magnetic circuit has the form of a ring with six teeth, on which the coils of phases A, B and C are placed (two per phase). The step of each coil in the teeth is 1. Currents of phases form a symmetric three-phase system of a direct sequence. This type of winding is used in a traditional synchronous electric motor with magnetic reduction.

The advantage of such winding is the simplicity of the design and execution of the coils, as well as the ability to replace a separate coil without removing the other ones. The disadvantage of the winding is the presence of even spatial harmonics in the law of distribution of MDS along the air gap. The higher spatial harmonics of the MDS create similar harmonics of magnetic induction, which cause increased energy losses in the steel due to hysteresis and eddy currents.

To improve the energy characteristics of a magnetic reduction electric motor, it is proposed to use an improved winding.

New winding with 12 coils has the stator magnetic wire formed of a ring with twelve teeth, on which coils of phases A, B and C are placed (two per phase) and coils with the opposite switch –A, –B and –C (two per phase). The pitch of each coil in the teeth is 2.

The table shows the amplitudes of spatial harmonics for a traditional winding with six coils and the proposed winding with twelve coils.

k	1	2	3	4	5	6	7	8	9	10	11	12
$A_{тk}$	16,54	8,270	0	4,135	3,308	0	2,363	2,068	0	1,654	1,504	0
$A_{пk}$	16,54	0	0	0	3,308	0	2,363	0	0	0	1,504	0

k	13	14	15	16	17	18	19	20	21	22	23	24
$A_{тk}$	1,272	1,181	0	1,034	0,973	0	0,871	0,827	0	0,752	0,719	0
$A_{пk}$	1,272	0	0	0	0,973	0	0,871	0	0	0	0,719	0

It is seen that the spatial harmonics of the MDS, multiples of three, are absent in both windings. The new winding lacks even harmonics. Odd harmonics, not multiple of three, in both windings coincide.

The rms value of the higher spatial harmonics of the MDS of the traditional and proposed windings are important

$E_{тh} = 7{,}951;$

$E_{пh} = 3{,}635.$

It can be seen that the current value of the higher spatial harmonics of the MDS of the proposed winding is 54.28% less.

The proposed winding has a more complex frontal shape, but the outer diameter of the winding, and, therefore, the entire machine, is smaller.

The higher spatial harmonics of the MDS create similar harmonics of magnetic induction and cause additional magnetic losses in the steel of the stator and rotor. Therefore, the proposed winding has significant advantages in terms of efficiency.

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УДК 620

APPLICATION OF GRAPHENE NANOTUBES IN AIRCRAFT

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In recent years, air crashes have become more frequent in the world, the reason of which is the state of aircraft. Therefore, aircraft manufacturing enterprises are actively working to increase the reliability of aircraft and helicopters. Reliability requirements in civil aviation should be expressed in

values of at least 99.9999%. In this regard, the question of finding new materials for aircraft becomes relevant. Large companies such as Airbus and Boeing have been developing and launching aircraft using composite materials for the past 10 years. This allows you to significantly reduce the weight of the aircraft while maintaining, and sometimes even increasing its reliability. A new solution could be the use of graphene nanotubes.

What are graphene nanotubes? A carbon (graphene) nanotube is an allotropic modification of carbon, which is a hollow cylindrical structure with the diameters from tenths to several tens of nanometers and a length of one micrometer to several centimeters, consisting of one or more graphene planes rolled into a tube [1].

It is the most durable and most thermally conductive and electrically conductive material known to science. These basic physical properties exceed the performance of traditional materials (polymers and alloys) hundreds of times. Graphene nanotubes (Figure 1) act on the vast majority of materials in the world - alloys, ceramics, polymers, composites. 1% of graphene nanotubes of the total mass of the variable material can significantly improve the above characteristics.

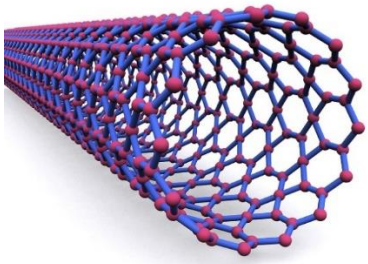

Figure 1 - Graphene nanotube

When developing the Boeing 787 Dreamliner, the American company Boeing used carbon fiber, the content of which can reach 80% (Figure 2). The company conducted preliminary studies and tests on the possibility of using single-walled carbon nanotubes in a composite of wings for several years, but the project was considered to be expensive and time consuming. Today, Dreamliner does not use nanotubes.

Figure 2 - Boeing 787 Dreamliner

However, this issue has become relevant again after the Russian scientist Predtechensky created the Graphetron reactor, unique in its characteristics and unparalleled in the world [2]. There synthesis goes exponentially. When the reactor is doubled, productivity grows by four, three - by nine, ten times - by one hundred. At the same time, the cost of this process is significantly reduced, which makes such a process of material production quick and efficient.

Single-walled carbon nanotubes are not able to replace carbon fiber, nanotubes change its basic characteristics, such as specific strength, resistance to aging. This is because composite parts are subject to aging due to the high resin content. The resin cracks under the influence of ultraviolet radiation, the intensity of which increases at high altitudes. Such changes in aircraft design can lead to serious damage.

Another problem that nanotubes can solve is icing of airplanes. In this case, it becomes possible to make a composite aircraft with nanotubes, which will warm up and prevent the formation of an ice crust of dangerous thickness. Moreover, such a process will require a low level of energy [3].

On the other hand, in an already created and flying aircraft, it is difficult to replace the materials included in the design of the product. Usually this process takes several years. In this situation, the main

thing is not the question of reliability, but the question of reducing the weight of the aircraft. Efficient fuel consumption, reduced operating costs are the main reasons why it is worth facilitating the cabin of an aircraft by using nanotubes as the main material.

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УДК 620

CALCULATION AND SELECTION OF OPTIMAL PROTECTION DEVICES FOR HELICOPTER ELECTRIC NETWORK

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High requirements for the latest developments in the aircraft industry: operating costs, environmental friendliness and fuel efficiency, create before the developer a list of problems that require the search for new approaches to build aircraft power supply systems.

A promising direction in creating competitive domestic aircraft and helicopters is the transition to the concept of an aircraft with a greater degree of electrification (More Electrical Aircraft).

By "more electrified aircraft" is meant a helicopter with an increased amount of equipment powered by electric energy [1].

With an increase in the share of electrical equipment of the aircrafts, power consumption also increases. To create a power supply system with increased loads, it is necessary to apply the latest techniques in the field of designing power supply systems. The most important parameters in the design of such systems are their effectiveness and reliability. In this regard, the selection of optimal protection devices is necessary.

The initial data for the calculation are load currents, lengths of sections and allowable voltage losses from the source to all consumers.

The sequence of calculation of an open, arbitrarily branched network is as follows:

1. One of the directions for the trunk is selected, concentrating all the loads at the points of this trunk. The criterion for choosing the main direction can be either the maximum allowable voltage loss or the maximum sum of the products of currents in the sections by the length of the sections for the selected direction.
2. The resulting open network with several concentrated loads is calculated by three methods (Sk = const, jk = const and V = Vmin) and the optimal sections of the main sections are selected.
3. The voltage loss in the sections of the highway from the supply point to the points of application of concentrated loads is calculated.
4. The permissible branch voltage loss relative to the selected trunk is determined.
5. It is checked that, at the selected cross sections, the voltage loss in all directions of the source network should be no more than acceptable values [2].

Using this methodology, the helicopter port side wires were calculated from voltage losses in an open network with branching at the end of the line.

The calculation results are presented in table 1. As the most optimal option, the wires were selected during the calculation at a constant current density.

Table 1. Network parameters of the port side of the helicopter and calculation results.

Network settings (ΔU =1,5 B.), A		I_1=5	I_2=2,7	I_3=25	I_4=3,6	I_5=4,5	I_6=2,3	I_7=0,8	I_8=1	I_9 =11	I_{10}=5,4
Plot		AB	BC	BD	BE	BF	FG	FH	FJ	FK	BL
s, mm^2	s=const	2,5									
	j=const	16	1	0,35	6	2,5	0,75	1	0,5	0,35	0,35
	v=min	4	1,5	1	4	2,5	1	1,5	1	0,35	0,5
	Thermal calculation	4	0,35	0,35	0,35	0,35	0,35	0,35	0,35	0,35	0,35

The protection devices in the primary distribution networks should be selected taking into account the long-term maximum current strength of the line, the number of channels of the split line and taking into account the uneven distribution of currents in the wires of the split lines.

The nominal current strength of the apparatus for protecting split lines of a primary distributed network is determined by the formula

$$I_{H\alpha} \geq \frac{\alpha I_{Л}}{n-k},$$

where $I_{H\alpha}$ – is the nominal current strength of the split line protection apparatus, A; $I_{Л}$ – line current strength, A; α –coefficient of uneven current distribution; n – is the number of channels of the split line; k – is the number of backup channels.

For consumer feeders that do not have a large starting current, the rated current of the protection devices must be equal to the current strength of the consumer or have the closest value to it: $I_{H\alpha} \geq I_{n.con}$, where $I_{n.con}$ is the nominal current consumer, A [3].

The number of onboard equipment of helicopters consuming electricity will increase every year, respectively, the need for calculations of the power supply system will also grow. Therefore, the relevance of the perfection of the calculation and selection of network protection devices, their improvement is growing.

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NEURAL NETWORKS AND THEIR APPLICATIONS

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Our world is quietly being reshaped by machine learning. We no longer need to teach computers how to perform complex tasks like image recognition or text translation: instead, we build systems that let them learn how to do it themselves.

The most powerful form of machine learning being used today is called “deep learning”. It builds a complex mathematical structure called a neural network based on vast quantities of data.

It's generally true that a human being's brain is actually more powerful than a computer - that's mainly because a person can perform a wide range of tasks better than machines.

Historically, one of those areas has been perception, the process by which things out there in the world - sounds and images - can turn into concepts in the mind. [1] This is essential for our own brains, and it's also pretty useful on a computer.

Let's think for a moment about what a model for processing visual information would need to do. The basic task of perception is to take an image and say, "That's a bird," which is a very simple thing for us to do for our brains. But for a computer, this was an impossible task just a few years ago. The classical computing paradigm is not one in which this task is easy to do.

So what's going on between the pixels, between the image of the bird and the word "bird," is essentially a set of neurons connected to each other in a neural network. This neural network could be biological, inside our visual cortices, or, nowadays, we start to model such neural networks on the computer.

So the pixels we can think about as a first layer of neurons, and that's exactly how it works in the eye -- that's the neurons in the retina. And those feed forward into one layer after another layer, after another layer of neurons, all connected by synapses of different weights. The behaviour of this network is characterized by the strengths of all of those synapses. Those characterize the computational properties of this network. And at the end of the day, we have a neuron or a small group of neurons that light up, saying, "bird".

Of course, it`s not an easy task to teach a neural network to recognize bird or any other object on a picture. It can be done exactly the same way that we do our own learning — by a long string of iterations — we have many, many images as children and we get told, "This is a bird; this is not a bird." And over time, through iteration, we solve for those neural connections.

There are 2 popular learning algorithms used in Neural Networks:

Gradient Descent — This is the simplest training algorithm used in case of supervised training model. In case, the actual output is different from target output, the difference or error is find out. The gradient descent algorithm changes the weights of the network in such a manner to minimize this error.

Back propagation — It is an extension of gradient based delta learning rule. Here, after finding an error (the difference between desired and target), the error is propagated backward from output layer to the input layer via hidden layer. It is used in case of multilayer neural network

Neural networks have a wide range of applications. There`s just several examples of them:

Character Recognition — The idea of character recognition has become very important as handheld devices like the Palm Pilot are becoming increasingly popular. Neural networks can be used to recognize handwritten characters.

Image Compression — Neural networks can receive and process vast amounts of information at once, making them useful in image compression. With the Internet explosion and more sites

using more images on their sites, using neural networks for image compression is worth a look.

Music — Even something as difficult as composing music is manageable thing for a well-taught neural network. If there`s enough input data for learning, neural networks can even mimic a specific human composer`s pieces.

Computing began as an exercise in designing intelligent machinery. It was very much modelled after the idea of how could we make machines intelligent. From the beginning, we modelled them after our minds. And they give us both the ability to understand our own minds better and to extend them.

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УДК 611.127

AN EXAMPLE OF MOBILE TELEMEDICINE SYSTEM'S PROJECT.

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The statistics says that cardiovascular disease is the biggest reason (about 47% of all deaths at 2019) why people die in the Russian Federation [1]. Many of those deaths happened because of the fact that patients lived far from the hospitals, there was no monitoring of those persons' health, and so, doctors did not know enough information about them. So, the practice of cardiovascular disease's control is very relevant today.

But how cardiovascular disease's control could be realized practically? One of the solutions in this field is mobile telemedicine. It is very relevant for the following groups of people:

1. Invalids, persons with serious injuries and also for the people which lives far from the hospitals.
2. Ordinary citizens. Telemedicine's presence will solve some problems: waiting in lines and bureaucracy.
3. Medical personal.

Mobile telemedicine system could include in itself:

- Electrodes: an equipment for electrocardiosignal's (ECS's) registration. They could be wired [2] or wireless [3].
- Analog processing: ECS's filtering from noises following ECS's gaining. The reason why we need these processes is comfortable ECS's analysis in the future.
- Analog-to-Digital Converter. It is necessary because it is easier to analyze ECS's arrhythmias in digital format.
- Digital processing: special program or app which could analyze and save ECS in digital format (MIT-BIH, .dat, .mat) and can show the results of analysis as well.

All of these components could be easily realized using the smartphone with cardio flash driver (wired electrodes) or with special attachment plate (wireless electrodes) at the patient's side. This smartphone must have an internet-access. Doctor's side also has a smartphone with internet-access.

Also we need an encrypted telemedicine cloud server. It could be estimated as a feedback between patient and doctor. After the ECS's diagnostic the result transmits to the encrypted cloud server where doctor can easily check the data.

Patient's smartphone and doctor's equipment are automatically synchronized with the telemedicine cloud for the opportunities to make operative actions if something happens to patient. The data transmits on cloud server by GPRS/EDGE technology because ECS's data is measured in kilobytes.

If patient has a dangerous arrhythmia (for example, myocardial infarction) doctors must send the ambulance to patient as soon as possible. That is why at doctor's smartphone we need a notifications which could be configured on the dangerous arrhythmias by scripting in a program language.

An overall project of mobile telemedicine system is presented at Fig. 1.

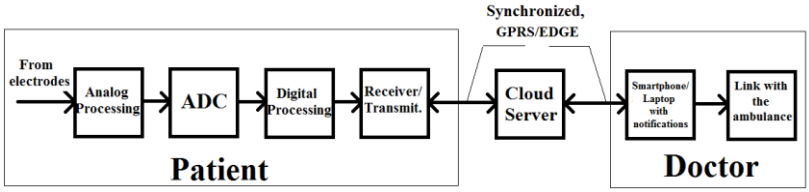

Fig. 1. Mobile telemedicine system.

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УДК 611.127

THE RESEARCH OF THE ELECTROCARDIOSIGNAL'S FIRST STANDARD LEAD WITH THE PURPOSE OF VENTRICULAR LATE POTENTIALS' DETECTION USING THE LOW FREQUENCIES TO HIGH FREQUENCIES RATIO AS A CRITERION IN THE MOBILE TELEMEDICINE SYSTEM.

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Ventricular late potentials (VLPs) are low amplitude signals (their amplitude is less than 30 mkV). They are locating at the end of QRS-complex or at the first third of ST-segment in the electrocardiosignal (ECG). A problem of ventricular late potentials' detection is very relevant in the medicine and in the digital signal processing. VLPs' presence means that the patient has a high probability (about 70%) of arrhythmia's (myocardial infarction) development in the future.

Standard approach of VLPs' detection in ECG is Simson's method. That approach includes ECG's registration at the orthogonal leads X,Y,Z, averaging QRS-complexes, their filtering and the analysis of threshold parameters [1]. Disadvantages of Simson's method:

1. A lot of averaging cases which making the analysis' time much longer.

2. Hard realization of program because of the averaging processes.
3. Non-comfortable registration of ECG.

That is why we present an alternative approach. It based on getting an ECG I standard lead's phase spectrum using the fast Fourier transform. Our approach aims to eliminate the disadvantages of Simson's method. For this work we took ECGs from open-access source Physionet: PTB Diagnostic ECG Database. We used MATLAB program complex for algorithm's realization and Microsoft Excel for statistical analysis. Since earlier research we increased the statistics of ECGs [2].

As a criterion of VLPs' detection we propose a parameter K which is the Low Frequencies to High Frequencies ratio:

$$K = \sqrt{\frac{\sum_{i=0}^{f_t} \varphi_i^2}{\sum_{i=f_t+1}^{f_h} \varphi_i^2}},$$

where φ_i- phase spectrum's element; f_t – threshold requency; f_h - highest frequency of the ECG I standard lead's phase spectrum.

We divided ECGs on two classes: ECGs with VLPs (VLPs+) and ECGs without VLPs (VLPs-). Then we research the dependence $K(f_t)$. The biggest difference between VLPs+ and VLPs- registered at f = 92,5 Hz and equals 0,353. We also analyzed threshold parameter K using the probability density functions. The biggest efficiency is registered at the f = 90 Hz and f = 92,5 Hz. Those are threshold frequencies. We determined Ks at those frequencies: at f = 90 Hz threshold K = 2,28 and at f = 92,5 Hz threshold K = 2,42 (Fig. 1,2).

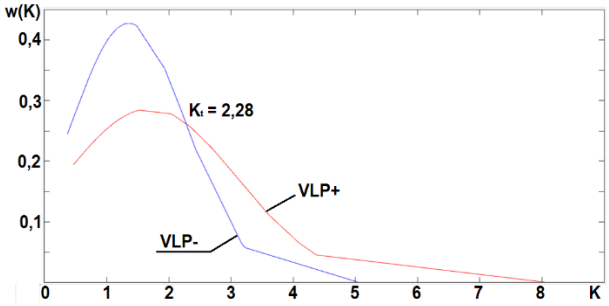

Fig. 1. Probability density functions at f = 90 Hz.

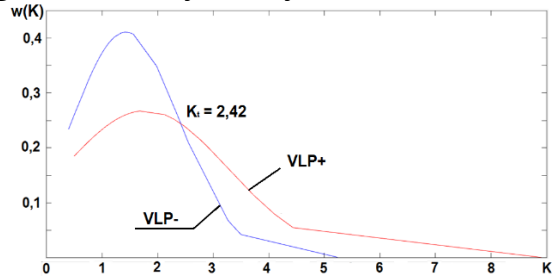

Fig. 2. Probability density functions at f = 92,5 Hz.

Overall results (novelties):

1. We designed a criterion of VLPs' detection at ECG I standard lead.
2. We determined the main threshold parameters: f = 90 Hz (K = 2,28); f = 92,5 Hz (K = 2,42).

Those results could be applied in the mobile telemedicine system. We are planning to increase the samples' statistics with the purpose of getting a more accurate and relevant results.

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Материалы конференции. – Казань: Изд-во КНИТУ-КАИ, 2018, с. 227-229

УДК 629.03

APPLICATION OF A SYNCHRONOUS ELECTRIC MOTOR WITH IMPROVED MASS AND OVERALL CHARACTERISTICS FOR A HELICOPTER TAIL ROTOR ELECTRIC DRIVE

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Helicopters of a single-rotor system with a tail rotor are widely used in various fields of the national economy. Helicopter tail rotor is a propeller designed to compensate the reactive torque and directional control. A rotating rotor tends to spin the helicopter fuselage in the opposite direction - the steering screw mounted vertically on the tail boom is designed to eliminate this phenomenon. The drive of rotation of the tail rotor is carried out by means of cardan shafts from the main rotor gearbox to the tail rotor gearbox, through an intermediate gearbox.

This system has its drawbacks: weight, reliability, price. In terms of survivability, failure of the tail rotor or damage of its transmission often leads to an uncontrolled helicopter crash.

The aim of this work is to design an alternative helicopter tail rotor drive. The object of this study is a synchronous electric motor with magnetic reduction of the end design.

During the search and analysis of patents on this topic, we identified several drive options: mechanical, with a modified gearbox design, hydrostatic and electric. We have chosen an electric drive for the tail rotor of a helicopter. The advantages of this option are the environmental friendliness (low noise level) of the electric motor, ease of operation and a significant reduction in the mass of the tail rotor drive due to the replacement of the drive shaft from the main gearbox by a harness from alternators.

For the initial data, the operating characteristics of the tail reducer of the «Ansat» light twin-engine gas turbine multi-purpose helicopter were taken.

We conducted an analysis of the design of synchronous electric motors with magnetic reduction, highlighted the advantages and disadvantages of synchronous electric motors with magnetic reduction of cylindrical and end designs, and chose the optimal motor design for the designed electric drive of the helicopter tail rotor.

In addition, during the study of the design of the selected electric motor, we noticed, thanks to the introduction of the hubs of the rotor-inductor and the rotor and due to the increase in the inner diameter of the active part of the electric motor from the condition of minimum volume of solid parts at a fixed moment, it is possible to significantly improve the overall dimensions of the electric motor.

Synchronous motor operates as follows. When a three-phase voltage system is applied to the stator winding, a rotating magnetic field with eight poles arises. It carries with it a rotor inductor. Together with it, the areas of large magnetic induction rotate the disks of the stator and rotor. As a result, the rotor is rotated so that the places of coincidence of the positions of the ferromagnetic elements of the stator disks and the ferromagnetic elements of the rotor disks are in the areas of maximum magnetic induction module.

For the half of the period of the supply voltage $T / 2 = \pi / \omega$, the rotor-inductor will rotate by an angle π / p, and the places of the maximum magnetic induction module will be repeated. The rotor speed of the inductor is expressed with the following:

$$\omega_{ri} = \omega / p.$$

In this case, the rotor should turn one sector. Therefore, the magnetic gearbox has a gear ratio $z_p/2_p$. Therefore, the rotor speed will be $\omega_r = 2\omega/z_r$. Here ω is the angular frequency of the supply voltage. Rotor moment (on shaft)

$$M_r = z_r M_{ri} / 2r.$$

The presence of several disks of the stator and rotor with ferromagnetic sectors causes multiple deformation of the magnetic field in the zone of the disks, which increases the developed moment and allows to improve the overall dimensions.

On the end surfaces of the tooth crowns facing the active zone, there are wedge-shaped protrusions in the form of sectors, repeating in shape and quantity the ferromagnetic elements of the stator disks, which increas the developed moment.

Ferromagnetic elements of the disks of the stator and rotor of slow rotation are made of electrical steel lined to reduce losses in the steel due to eddy currents, since during the operation the magnetic induction in the sectors changes.

Transfer moment from the rotor of fast rotation to the rotor of slow rotation is elastic - through a magnetic field. With an increase in the load moment on the shaft of slow rotation, it lags by a certain angle from the position corresponding to idling.

The electric motor does not have mechanical contacts between the moving active parts, is silent in operation, has a long service ability, due by bearings, allows shock loads, since the connection between the rotors is carried out through a magnetic field.

The installation of the rotor-inductor bearing on the shaft increases the base for the shaft and simplifies the design. The rotor inductor amplifies the field created by the motor winding. Thanks to its placement in the middle and the placement of teeth with coils on both magnetic circuits, a symmetrical magnetic system is obtained and the axial force acting on the shaft is reduced. The bearings are loaded only with radial forces, which reduces the starting voltage of the electric motor and increases its reliability.

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УДК 778.28

THE USAGE OF OPERABLE VOLUMETRIC DISPLAYS IN EDUCATION.

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The ability of using the operable volumetric displays has increasing interest due to possibility of having many uses in the field of education in schools or universities. The fundamental possibilities of these volumetric displays are:

1) study from every angle of view;

2) manipulate the displayed object for better understanding of it;

3) fast changing the displayed object or its parameters;

Last century volumetric displays and volumetric images were considered to be some kind of science fiction as the hologram of Princess Leia. They have received much attention in the last decade because the technologies now can allow to create this device. Recent developments regarding this technology have led to creation of fan and prism inoperable volumetric displays that can show 3 dimensional images on fan blades and glass prism that can't be touched.

Within the next few years, this technology is destined to become an important component in modern education because of its features listed upper that can make this process less boring and more effective. And with technologies advancing in every year this can be brought into life in nearest future.

The central problem of this technology is the projection object because light can be visible only if it's reflected from something, so you need this something to see the 3d image in air. The attempts to solve this problem are time consuming and overwhelmingly difficult, but once we find such an object in air then we can project the image on it. The community has raised some questions such as whether we can find such an object in our breathing air or not.

This paper is an overview of the most important things in the field of my topic. The aim of my work was to broaden current knowledge of this technology and such devices of ordinary people.

My article is divided into four parts: the first section gives information about the principles of this technology, second one represents the modern technologies in this field. In the third section future solutions are explained, while in the last one I'll try to give the usage methods of this in education.

In general, the technology of volumetric display uses the reflection of light from some object in air to our eyes. This object can be whatever: air, water, dust or some micro objects flying in air, the only requirement is to be able to control this object not to get just light of several colors, but the controllable image.

In order to achieve this goal, some researchers have been studying this problem for a while and has discovered that there are three main applicants on position of displaying objects:

1) fan blades;

2) prism or other figures made of glass or other transparent materials;

3) micro object that is controlled by laser or other rays;

There are materials that are needed for this technology:

In the first case, the fan blades are covered with a displaying screen, so when they rotate fast an image is shown. This effect is similar to the cinema: your eyes has a time of memory when picture on it can't change, so if images change very quickly you see it like a video. In the second one, the projector displays the image in the volume of glass prism, so the glass reflects the light from the projector into your eyes.

And in the third one, some object that you can't see is controlled by controlling laser while the displaying laser is lighting this object that reflects light into your eyes. If you can move the object very fast you can get the image of displayed object. This effect is similar to cinema, but there is only one ray of light so you have to change its position in thousands of times in order to receive designated image. For now, this is the only one method that is near to the air volumetric display.

As for the software it's only needed the 3d modelling, displaying and controlling program that can be composed in only one program.

The benefits of the third method are:

1) Harmlessness: you can't hurt your fingers when touch it like you could if you would touch the fan blades;

2) Ability to be manipulated: in near future, when we can develop this technology you can operate the projection: when your finger doesn't let the light go, some equipment will get this data and will do operations with the projected object that you wanted.

3) Ability to avoid adding any projection objects other of air (in future): the air in the projection isn't needed to be polluted with any chemicals to be the displaying object;

Of course, prism projectors have first and third benefits too, but they are limited by their shape and the displayed object can't be operated by itself: you can only the device's shape but not the object.

Now in the field of micro object volumetric display (later MOVD) the nearest approach to the ideal MOVD has done Daniel Smalley, who with his assistants has created the device that can project black-white 3d images with a size of nail or 2d colored images with the same size.

Of course, it's not a very big deal, but it's a huge step into future, when we can get a bigger 3d colored images like in sci-fi movies.

But now there is one big trouble: now you can't touch the MOVD because you will just capture object and it wouldn't work. But later maybe if we can use more than one projector we could touch it, because if we block one projector others would work while the system would know what we're doing. With this upgrade we can even operate the displayed object because the system would know that we're doing some action within the 3d image and would recognize our actions.

Now let's think about how to use this great technology in our real life especially in the field of education.

First of all, we claim that we use the future version of this device, that can display 3d operable colored full-sized images.

Let's imagine that we're sitting in the lesson for example of any natural science. And then the teacher turn on this device and you can see and even manipulate the object of your lesson; you don't need to look at boring students books, just watch in front of you and examine the subject by yourself, you can take it apart to better understand it or vice versa make it monolithic. After all of this let's conclude the benefits of MOVD in education:

1) Clarity
2) Informativeness
3) Harmlessness

To sum up this device can develop any sphere of our life including medical service, education, scientific researching, managing and so on, so I think that if we succeed in developing this thing we can greatly win from it.

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УДК 167.7+679

METHODOLOGICAL ISSUES IN THE AVIATION INDUSTRY

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The philosophy and methodology of technology is a field of knowledge created by engineers themselves: in Germany, the first was Ernst Kapp (late XIX century.), in Russia – Peter Engelmeyer (early XX century.). In this area the questions of essence of technology, history of origin and development of technology and technical activity, a place of technology in system of culture, methodological concepts and principles of creative engineering activity are considered, and also

optimistic and pessimistic estimations of application of technologies in society, etc. are analyzed [1]. It is known that the concept of technology has two aspects of its meaning. First, it is artificially created by man means that are absent in nature, the so-called artifacts. These are various tools of labor and scientific activity, mechanisms, tools, devices, equipment, complex devices, etc. secondly, technology is a skillful activity, skills, technology and methodology of various processes, etc.

The philosophy of technology studies technology and technical activity as a holistic phenomenon in the socio-cultural context, at the same time it pays attention to the historical and methodological issues of certain technical areas, for example, the field of mechanical engineering, aviation and space technology and technology. If the philosophical view of things involves the consideration of the object in its General and holistic aspects with an understanding of the deep, essential foundations of everything related to technology, the methodology is aimed at developing approaches, ways and means of studying and developing technical problems and technical creativity [1].

The very concept of methodology comes from the ancient Greek word "method", meaning the way of research, knowledge, direction of any activity. In science and technology, the method is defined as a set of methods, methods of research of the studied object, and the methodology is the doctrine of the method of knowledge and transformation in various areas of reality. Also, the methodology is understood as a set of provisions, principles that determine the direction of research in order to effectively solve the tasks.

Let us consider a specific direction in the field of engineering methodology associated with the solution of complex problems of domestic aircraft industry on the example of one domestic engineer. XX century is the Golden age of aircraft. At this time, new types of aircraft were created, the old ones were improved, new principles of aircraft operation were discovered. Scientific discoveries in the field of aircraft industry were actively introduced into production. After the brilliant development of aviation in the last century, it was assumed no less intensive development of aircraft today. At the moment, not all the ideas of the last century have been implemented. One such idea is the so-called "Boldyrev plane" [2].

Alexander Boldyrev is a Soviet scientist, senior engineer of the Department of aircraft aerodynamics of the Moscow aviation Institute (MAI). In the late 30 - ies of the last century, he hatched the idea of increasing the lift of the aircraft wing. In experiments that the scientist conducted at home, the increase in lift was due to blowing the upper surface of the wing. For this purpose the usual fan was applied. This experiment did not bring visible results. Then Alexander Ivanovich attached parallel to the leading edge of the wing, a long narrow plate. Giving it oscillatory movements, Boldyrev recorded an increase in the lift of the wing. This effect was later called the "Boldyrev effect".

Having received the approval of the management, by the end of 1947, the first working model of the aircraft was constructed, on the basis of the"Boldyrev effect". A crank mechanism was used to cause the slat to oscillate. On tests in a wind tunnel the design of the plane perfectly showed itself. The plane Boldyreva developed a good speed on the runway, but to climb into the sky it wasn’t able.

At high frequencies (30-40 Hz) in the crank mechanism of the aircraft there are exorbitant voltages, and the mechanism is destroyed. To lift the aircraft into the air, the frequency of oscillations of the slat is not less than 100 Hz.

There were "plane Boldyrev" and other problems. One of them is the large power consumption of the electric motor, which creates oscillations of the slat. To solve this problem, the designer proposed to use the energy of the sun by installing a solar battery on the upper part of the wing. Having suffered a number of failures in the tests of the aircraft, Boldyrev decided to leave this project. But the idea of "Boldyrev's plane" keeps on the run contemporary designers [3].

Using this effect has a number of advantages. "Boldyrev's plane" is capable to take off and land practically from a place, to gather speed and to fly like the plane that unites helicopter

advantages on take-off and landing, and high-speed, and also economic advantages of the plane in flight.

What is beyond science in the middle of the last century is quite possible to realize today. To implement the "Boldyrev effect" it is necessary to replace the crank mechanism that cannot withstand heavy loads. The idea is to create a slat oscillation due to alternating current forces. To do this, one conductor is attached to the edge of the wing, the other to the front edge of the slat. By changing the direction of the current, due to the strength of the ampere, the conductors will create oscillatory movements of the required frequency. In this case, the load on the wing will be distributed along the entire surface of the wing, excluding the destruction of the aircraft. Thanks to modern technologies, it is possible to build an oscillating circuit with the required frequency of several thousand amperes.

To implement this idea, it is necessary to thoroughly investigate this effect, using methodological research:

- design and manufacture a working model of the wing, use it as a test bed to remove the characteristics of lift and thrust;
- to investigate the dependence of the lift and thrust of the wing on the frequency and amplitude of oscillations of the slat;
- investigate the ratio of thrust and lift to power requirements;
- to synthesize the control law oscillations slat;
- implement the control algorithm.

After successful testing, it will be possible to design the aircraft using the "Boldyrev effect". This model can have a wide range of applications. Due to its unique characteristics, it can be successfully used in emergency situations, for deck and Arctic aviation, for expeditionary purposes, for local airlines and airmail.

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УДК 608

THE DIMPLING OF THE AIR CHANNELS OF THE CYLINDER HEAD

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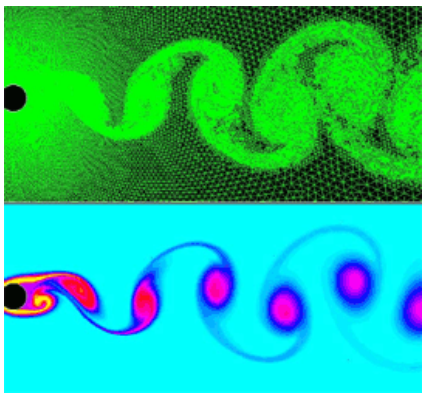
The main purpose of our research is to determine the efficiency of dimpling method for mass production of intake channels of engines and to define the advantages and disadvantages of this improvement. The experiments on a special purge stand show that the improvement in channel throughput is only 1% which is not significant for mass production.

Nowadays, the automotive industry is developing very quickly. Every year, designers and technologists create all new inventions that modernize the design of machines and units, in particular internal combustion engines. Over the past few years, many new ideas have been put forward, one of which is the dimpling of the air channel of the cylinder head. So let us consider what it is.

It is known that the main component of the game golf is the golf-ball. Its entire surface is covered with small recesses, and this is done for a definite reason. During the flight, the ball experiences strong aerodynamic resistance, which is formed from the friction of the ball's surface against the air and from the difference in pressure between the front and the back of the ball relative to its path of movement. Due to the fact that the boundary layer of air is detached from the ball, a zone of low pressure, called the Von Karman path, is formed behind it (Fig.1). As a result the ball slows down. Due to their relief these recesses create small turbulence, which contribute to the attraction of air flow to the surface of the ball, thereby reducing the area of low pressure [1]. This discovery pushed people to refine, which is discussed today.

Fig. 1The Von Karman`s path



As it is known, the engine intake duct has a curved shape. Having a sufficiently high speed, the flow of the fuel-air mixture cannot instantly change the trajectory of its movement, as a result the flow is disrupted, i.e. the formation of turbulence in the zone of rotation, which impairs the filling of the cylinder with the fuel-air mixture. Compared to the surface of the golf ball, which is capable of attracting air flow to itself, American engineers decided to make recesses in the zone of formation of turbulence, thereby minimizing the phenomenon of flow stall [2]. There were a lot of attempts before they managed to achieve an improvement in channel permeability by 5-6%. Naturally, this refinement is very expensive, whence the question arose whether it was worth making these recesses for the sake of a slight improvement in throughput.

On the bases of this date, we carried out the experiments in our laboratory and created a similar surface in the intake channel in order to find out its efficiency. A number of experiments were conducted both with the balls and with the channels (Fig.2, 3).

Fig. 2. Ball with golf surface on the purge stand

Fig. 3. Golf surface at the intake chanel

On a special purge stand, we checked how recesses in various places affect the throughput of the air. Using different arrangements of these recesses in the channel, we got two most important values of air flow - with recessed channel (201,76cfm) and with regular channel (200,17cfm).As a result, we obtained an increase in the air flow rate of the order of 1%, which is not significant. Thus, it can be concluded that without special equipment and qualified engineers it is not possible to achieve the desired result of throughput (5-6%).

Summarizing, we can say that this revision does not have any economic benefits for the mass production. The only area where this technology is applicable is motor racing. There are practically no restrictions on the budget, so engineers in all possible ways are trying to increase engine performance.

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УДК 004.4

ELECTRICAL ROUTING OF WIRING AND HARNESSES WITH THE NX AND E3 SERIES PROGRAMS

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Currently, industrial enterprises and large organizations in our country have been given the task of automating production and introducing modern technologies. The Government of the Russian Federation is insisting on an early transition to "Economy 4.0", and decisive steps are needed for this.

The process of automotive production is based on the introduction of programs that help people to jointly improve the pace of production and product quality in various fields. In the field of energy and electrical engineering, the arrangement of wires and harnesses always remains one of the fundamental and pressing issues, since the speed and quality of the transmitted energy from sources to consumers directly depends on this. First, you need to give definitions of concepts such as wire and harness.

A wire is an electrical product used to connect an electric current source to a consumer, components of an electrical circuit.

Wiring harness is a finished product, consisting of individual wires fastened together in a bundle, the ends of which are reinforced with contacts that are assembled into pads or protective elements are put on them (tubes, rubber caps, covers).

A complex of programs is involved in the routing process of laying electrical harnesses. The main ones are the E3 Series and NX. Let’s consider the E3 Series program, since the entire routing process begins with it. E3 Series is a software package that allows you to solve the full cycle of design tasks in the field of designing electrical systems, process control systems, instrumentation and automation systems - from the creation of functional and conceptual schemes, to the drawings of the layout of cabinets and panels, as well as the release of ready-made design documentation.

NX is an interactive multifunctional system designed for computer-aided design, manufacture and calculation of various products. NX is a three-dimensional modeling system in which an engineer can create products of any degree of complexity.

To get started, take a look at a generalized diagram of the entire process of designing an electrical network from start to finish. As can be seen from the flowchart (Fig. 1), the entire design process can be conditionally divided into 3 stages. Stage 1 - analysis of the technical specifications and the creation of restrictive lists. Stage 2 (main) - the development and design process itself. At this stage, routing of wiring and harnesses occurs. Stage 3 - release of finished documentation [1].

Let's take a closer look at the routing process itself. First of all, a full range of circuit diagrams and wiring diagrams is developed with automatic generation of connection tables, a list of elements and specifications in the E3 Series program.

After the development of the electrical circuits, the files with data on electrical connections via an XML file generated through the special E3 Series module - 3dRoutingBridge are transferred to the NX electrical wiring module, where 3D modeling and wiring of the harnesses takes place. As a result, wire lengths are automatically calculated.

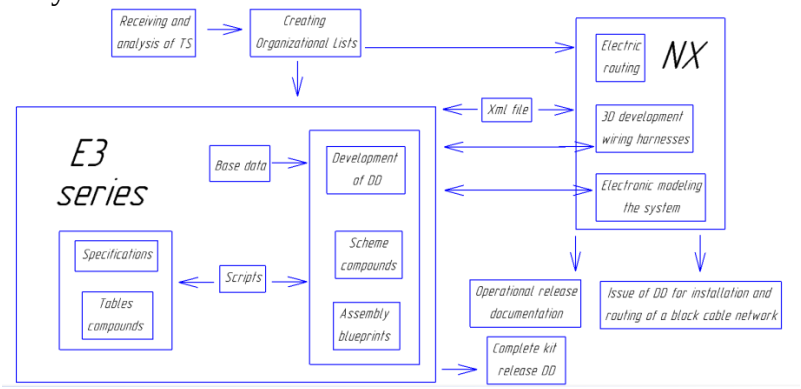

Fig. 1. The process of designing an electrical network

A serious advantage of the electronic model of the product with engineered harnesses is that it allows you to constructively evaluate the product as a whole for the necessary space for both the harness itself and its fasteners, intersection with other harnesses, etc.

Routing in NX is done using the “Electrical System Development Unit”. Built in the routing process, the model consists of the following elements:

- Pipeline control points — used to control the path and to insert standard parts;
- Path segments - a path connecting two control points;
- Port — is necessary for connecting the route, positioning and orientation of the pipeline elements relative to each other when they are connected parts [2].

The results of electrical routing are imported into E3, which allows you to automatically generate specifications and statements of purchased products. Also, either in the NX or in the E3 Series, subsequent design of assembly drawings of harnesses is carried out. As a result, you can get a complete set of design documentation for the product.

Benefits of using the NX and E3 Series software:

- Reducing the timing of work on average by 50%;
- Ability to connect to work at any time;
- The required reliability and quality levels are already at the design stage;
- Control of the mass and cost of the developed system at any stage of production;
- Release of a ready-made set of design documentation for transfer to production ..

Thus, it is worth noting the indisputable advantage of using programs for computer aided design, in particular the NX and E3 Series. Moreover, in recent years, the aviation companies of our country have been actively introducing and successfully using the NX program complete with a unified Teamcenter database system.

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УДК 004.4

CONSTRUCTION OF A STEP-BY-STEP ENGINE CONTROL SYSTEM ON MICROPROCESSOR LOGIC

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The control system is designed to control a 6 phase end stepper motor. Basic requirements for microprocessor control system:

1. The ability to set various engine operating modes;
2. Flexibility;
3. Compatibility of the controller with the computer;
4. Autonomous operation of the controller according to control algorithms previously recorded from the computer;
5. Versatility;
6. Cheapness [1].

Figure 1 shows a structural diagram of a microprocessor control system. The control device performs the following functions:

• engine control through a power amplifier;
• data input and processing;
• data output on the liquid crystal indicator.

The clock generator is necessary for synchronization of the microcontroller, the reset circuit generates a reset signal until the supply voltage stabilizes, volatile memory is designed to store the necessary data.

The microprocessor control system functioning algorithm:

1. Configuring the peripheral modules of the microcontroller;
2. Setting the LCD indicator through the initialization routine;
3. Reading data from an external memory chip.
4. Keyboard polling algorithm.
5. Reception of data and control commands from a computer;
6. Data output to display [2].

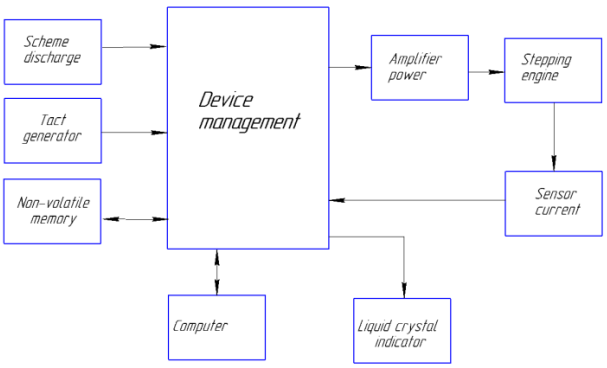

Fig. 1 Block diagram of a microprocessor control system

Figure 2 shows a stepper motor control routine. It allows acceleration and deceleration of the engine with constant acceleration, and rotation at constant speed in modes with one switched phase, with two switched phases and electronic crushing of the motor step. In addition, a mode of working out a given angle and a step-by-step mode are provided.

In the beginning, the engine control ports are cleaned. Then the keyboard polling routine. The next step is to analyze the selected mode. We will consider the continuous rotation mode, acceleration and braking are carried out with constant acceleration, so the speed varies linearly.

The phase sequence is tabulated; for forward rotation, it is necessary to increment the pointer, and for rotation backward, decrement.

The program makes updating the values of speed and the period of following the steps based on a comparison of the values of two variables: the instantaneous speed VC and the required speed VR.

Depending on these signals, the main program loads the variable VR with the value of the required speed. In this program, this is V for moving forward. V for backward movement and 0 for stop.

Depending on these signals, the main program loads the variable VR with the value of the required speed. In this program, this is V for moving forward. V for backward movement and 0 for stop.

If the speeds of VC and VR are equal, then the stepper motor is in stationary mode and no updates are required. If the stop flag was set before (VC = VR = 0), the engine is stopped, and the TVSP control subroutine is exited.

If the speeds are not equal, then the value of VC with a given acceleration approaches VR, i.e. the engine accelerates (or decelerates) until it reaches rated speed.

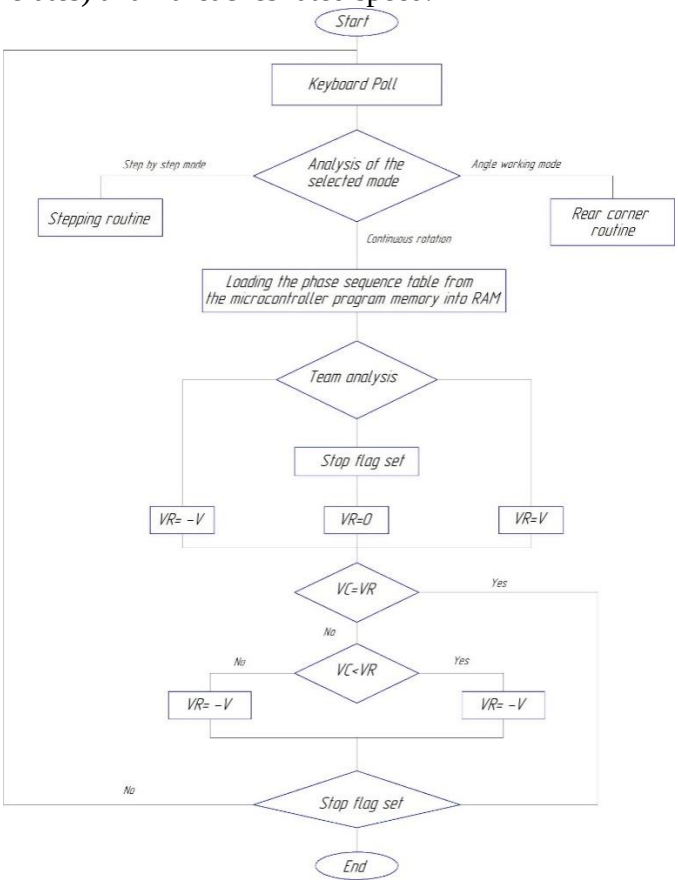

Fig. 2. The engine rotation control algorithm

Then the calculation of the period T - the duration of the PWM pulse. First, the module of the current speed is calculated. Then the minimum speed is limited.

The PWM pulse generation routine generates pulse sequences for the motor control winding; shaping is performed in the PIC hardware timer interrupt processing.

Thus, this control system allows you to control any stepper motors. The use of a microcontroller allows you to build a control system with the best price / quality indicators, which indicates the prospects of using microprocessor control systems.

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УДК: 621.452.3

LASER FLAME STABILIZER IN THE AFTERBURNER OF TURBOJET ENGINES

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We live in the 21st century - the century of innovative technologies and flourishing science. In the aircraft industry, for example, scientists and engineers are constantly working on creation and improvement of aircraft, but cannot get rid of a single problem - radar visibility of airplanes. The reason is the irreplaceable part of a turbojet engine – flame stabilizer. The flame stabilizer allows changing the direction of air masses to provide less friction of gas against the chamber wall. Stabilizer's design has not changed significantly since its invention, but now it is possible to use low-temperature plasma instead of the main material used for the flame stabilizer manufacturing. It is a well-known fact that plasma does not reflect radio waves, moreover it does not allow to pass them through, due to the absorption of radio signals [1]. Thus, plasma has a number of advantages over the metal counterparts. However, the question now arises of whether plasma is a solid for air. It is possible to prove that plasma is a solid for air by creating an experimental facility. It consists of an air compressor, a steam generator on the glycerin, a laser, a collecting lens, a tube, and a U-shaped pressure gauge. Schematic diagram of an experimental facility is shown in Figure 1.

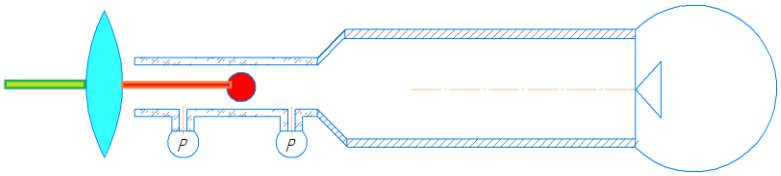

Fig. 1. The experimental facility

Description of the experiment

Air under pressure enters the tube, while a laser beam simultaneously passes through a collecting optical lens, thus, an optical-induced breakdown occurs, which results in low-temperature plasma forming [2,3]. The air that enters the tube goes round the plasma. this can be seen through the use of a glycerin steam generator. In addition, differences of pressure are observed with help of the U-shaped pressure gauge. According to Bernoulli's equation for gases: $\frac{\rho * V^2}{2} + P = const$, where □ is air density, V is speed of air, P is air pressure, we can state that air speed has changed while air was going around the plasma. It means that plasmais a solid for air.

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УДК 621.311

THE PROBLEM OF ELECTRICAL INSTALLATIONS SAFETY AT ENTERPRISES AND ORGANIZATIONS

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The highest priorities of all activities are human life and health. Therefore, at present the improving of electrical safety is considered as one of the main tasks at any enterprise, since electric shock immediately leads to injuries, growth of accidents and fires.According to statistics, more than 4,500 people die from electrical injuries in Russia each year. Moreover, the state of electrical safety in Russia remains currently less favorable in comparison with other highly developed countries. Over the last decade the rate of electrical injuries in Russia has increased by 2.3 times, while in other countries it has decreased: the U.S. – 1.25 times, in Japan and Austria – 2.35 times, in Germany – 2 times, in Spain – 2.28 times. The analysis of different areas of industry shows that the most disadvantaged sectors are: construction and agriculture – 40% of accidents in each; household - about 40%; while the number of fatal accidents in light industry is – 17%; in electrical industry – 14%; in chemical – 13% [1]. The main reasons for this are the significant worn of networks, the lack of modern electrical protective equipment, safety violations, poorly trained personnel. One of the most dangerous cases is electric shock, whena person unintentionally touches open conductive parts of electrical installations, which may be energized as a result of various emergency conditions.

From these positions, it is important to analyze the state of electrical safety at an enterprise or in an organization, identify the causes of its decline and develop measures aimed at it improving [2].

According to electrical safety conditions, electrical installations are divided into electrical power with a capacity of up to 1000 V and models with a capacity of more than 1000 V. Low-power electrical installations are characterized by maximum safety, so they are actively used in kindergartens and schools, private cottages, as well as in high-rise buildings. They can provide equipment with power supply up to 1 kV. Complexes with a capacity of more than 1000 V are designed for production purposes. In addition, they are used when people need to provide power supply of several buildings and structures.

Low-power systems can operate on an isolated or deaf-grounded neutral. Direct current equipment may include an isolated zero point or a deaf-grounded type. In case of using the electrical installation in dangerous conditions when it is necessary to comply with the requirements for electrical safety, and also careful control of integrity of safety locks it is better to apply the isolated neutral. This allows people to find quickly the faults in the case of an automatic output to the off state, and to prevent emergency situations. In installations with voltage up to 35 kV, an isolated neutral is used. If the system is used to power equipment with a capacity of 35 to 110 kV, the ideal choice is a neutral, which is connected with a reactive resistance. This solution

compensates for capacitive currents and leakage currents. If there is a problem of operation of the complexes working with voltage over 110 V, the deaf-grounded neutral is applied.

To work in a dangerous environment, special explosion-proof electrical installations have been developed. Protection in this case is carried out through the use of structural electrical equipment. The principle of its operation is based on the schematic arrangement of components. Such electrical installations can operate both in normal mode and in a state of earth fault, as well as emergency shutdown. They are made of special refractory material and contain additional protection elements - Ex-components, O-rings, pipe glands, which are mounted partially or entirely inside the shells of electrical equipment. To ensure the protection of cables in explosion-proof complexes, special types of wires are used with quartz, oil filling.

Having compared different industries in respect to electrical safety we can conclude that agriculture and household are the areas with the highest level of electrical injuries. Although these areas mostly use low-power electrical installations they are not often serviced in a proper way and most electrical installations and wires are not in the best technical condition. And what is more important, people working in agriculture often do not have a special electrical education, while compliance with safety regulations and qualification of workers are crucial factors in reducing electrical injuries.

Thus, whatever electrical installation is used, first of all, it is important to observe the safety rules. The main ones include: 1) the prohibition on maintenance or repair of equipment in the switched on state; 2) the use of rubber gloves and special tools with dielectric handles when working with wires and electrical appliances; 3) the presence of special permission for specialists who carry out any work with electrical equipment. It is important to pay a special attention to grounding as well as insulation. Electrical measurements and tests should be carried out regularly to analyze the system [3].

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УДК 629.33

USING 3D TECHNOLOGIES IN MODERN AUTOMOTIVE INDUSTRY

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Objectives of the research are the consideration of the usage of 3D technologies in modern automotive industry; review of the modern automotive industry market; analysis of prospects and development trends of 3D technology usage in automotive industry.

Automotive industry is one of the first industries where 3D technology found commercial application: back in 1988, Ford began using 3D printers to print individual prototype elements.

Today, this sector of the economy uses the most of the achievements of additive technology and 3D scanning. Three-dimensional printing is an ideal way to create prototypes, functional parts and assemblies, as well as tools and molds. It saves time and money at the stage of design of a

product, that ensures the high level of accuracy in production of components with complex geometry. 3D scanners and specialized software solve the problems of geometry control and reverse engineering at a new level, that shortens the time of car production and help improve product quality and reduce possible failures.

Some major automakers have already set up serial production of components for their classic models or custom cars on 3D printers. Market leaders are investing actively in the creation of additive technology centers for experimental production. For example, BMW has such a center - it produces more than 100 thousand components a year, and it is planned to open another large complex in 2019.

Development of 3D printing technologies and the development of new materials with improved physical properties allow the introduction of modern new innovative ideas. So, the technology of "airless" Michelin Visionary Concept tires with opportunity to change the tread pattern according to weather, excludes punctures, low pressure problem and other risks while driving.

Additive technology effectively solve the following problems of automobile production:

1. creation of functional prototypes;
2. creation of burnable and lost wax casting models;
3. production of tools and molds;
4. small-scale production.

Prototyping will make it possible to optimize production for those enterprises that produce cars (but not just assemble final models), as well as for manufacturers of car components.

By means of topological optimization, the designer can set almost any necessary geometry of the part and make design changes at later stages of the production. The 3D model is transferred from CAD to a 3D printer, which quickly prints prototypes, or molds for product casting. This reduces production costs, the timing of product design and its introduction to the market. In particular, the company can start the production of components simultaneously with the production of a car itself.

By using the 3D printing technology the Nissan plant in St. Petersburg saved more than 1 million rubles in 2017 by not ordering components from a component production partner-company.

Equipment and products that meet the strength characteristics requirements can be produced directly at the factory with the help of only one 3D-printer. It will print various parts according to the nomenclature, which is impossible when using machine tools and other traditional tools.

Technologies mainly used for prototyping:

1. FDM (Fused Deposition Modeling);
2. SLA (Laser Stereolithography);
3. SLS (Selective Laser Sintering).

Tools and forms that are printed from plastic and photopolymer resin will be several times cheaper than metal ones.

Functional products can also be made on metal 3D printers (for example, using SLM technology). 3D metal printing is also suitable for small batches, including the creation of individual products. Recent inventions in the field of metal powders have paved the way to the production of lighter, denser and more durable parts. Thanks to topological optimization on a 3D printer, it is possible to grow components of a complex shape and texture (with a honeycomb structure, internal channels, etc.), as well as solid-metal ones, which were previously assembled from several elements.

The peak of sales on the car market of Russia came in 2012 which was followed by a decrease. A strategy for the development of the automotive industry for 2018–2025 developed by the government of the Russian Federation gives a chance to improve situation. This program clearly defines the priority tasks of the industry - increasing the production of own car models and high-quality automotive components, as well as establishing direct contacts between manufacturers of automotive components. The localization should be at least 70%.

According to the government strategy, the percentage of the companies budget that is laid in

innovations and new development projects is now about 15%. The goal is to bring this indicator to a global figure of 25-30%, and this opens good prospects for the introduction of 3D-printing technology to the Russian automotive industry.

For domestic automakers, the additive technology remains almost an undeveloped sphere and therefore, there is little information about the usage of 3D method. The Vedomosti newspaper reports that the GAZ group, according to its representative, uses 3D printing to create prototypes of machine parts. According to the official website of the Altai Territory, the KamAZ company received two unique Russian-made 3D printers this year. This equipment allows toprint high precision sand molds for steel casting.

So, 3D printing enables manufacturers of automobiles and automotive components to receive a number of advantages:

1. reduction of time at the stage of product design and casting;
2. time and cost economy in tool and molds manufacturing;
3. refusal of services provided by contractors-manufacturers of equipment;
4. conduction of technological experiments and functional testing;
5. creation of products with complex geometry and small elements that cannot be manufactured by traditional methods;
6. weight reduction of a component and materials economy due to topological optimization;
7. acceleration of the launch of a new product or an exclusive models on the market.

With an intensive competition of our modern world, the issue of innovations in this sphere is becoming more and more urgent. A growing number of automakers have realized the benefits of 3D technology to optimize the manufacturing process. As we have seen, additive methods have been introduced to the Russian automobile industry relatively recently and are used only by a few large Russian and foreign companies.

In today's Russian realities, the introduction of additive production is facing many obstacles, among which are insufficient automation of many plants and lack of financing. 3D printing technologies such as SLS are not yet available to us due to the high cost of equipment and materials. Today, the optimal solution that will be beneficial to the manufacturer and will be paid off within a reasonable time period is to purchase one 3D printer to produce plastic prototypes and accessories (without having to order it from suppliers).

The government strategy for the development of the automotive industry for 2018-2025 gives hope that the process of implementing 3D printing will go faster and become widespread.

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УДК 621

OVERVIEW OF TECHNICAL CERAMICS AND ITS PROBLEMS MACHINING

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Abstract

The basic methods for producing ceramics, their varieties and properties, the structure of the resulting material were studied, modern methods of machining ceramic products were also

considered. Purpose of ceramics, advantages and disadvantages. An assumption was made about the most acceptable state of ceramic products for their more efficient processing with a blade (multi-blade) tool.

Introduction

Ceramics are polycrystalline materials and articles made of them, consisting of compounds of non-metals of groups III – VI of the periodic system with metals or with each other and obtained by molding and calcining the corresponding feedstock. The raw materials for the production of ceramics can serve as substances of natural origin (silicates, clays, quartz, etc.), and obtained artificially (pure oxides, carbides, nitrides, etc.) [1].

The main disadvantages of ceramic materials include the fragility and complexity of processing. Ceramic materials do not work well under dynamic loading or sudden temperature changes, as well as under cyclic loading conditions. They are characterized by high sensitivity to incisions. At the same time, ceramic materials have high heat resistance, high hardness, excellent corrosion resistance and low thermal conductivity, which makes it possible to use them successfully as thermal protection elements.

At temperatures above 1000 ° C, the strength of ceramics is higher than that of any existing alloys.

The main areas of application of ceramic materials in mechanical engineering include: cutting tools, parts of internal combustion engines and gas turbine engines, etc. In everyday life, the most common use is in plumbing and utensils, it is also worth noting that modern medicine uses ceramicsas a replacement bone tissue.

Types of ceramics

Technical ceramics are artificially synthesized materials with different phase and chemical composition, due to which it has a number of specific properties. The main elements of technical ceramics are oxides and metal compounds (oxygen-free).

Currently, there are two types of technical ceramics:

1. Oxide ceramics. These materials consist of pure oxides Al_2O_3, SiO_2, ZrO_2, MgO, etc.

2. Oxide-free ceramics. This class consists of materials based on carbides, nitrides, borides, silicides, phosphides, arsenides and chalcogenides (except oxides) of transition metals and non-metals of groups III – VI of the periodic system.

A review of oxide ceramics made it possible to single out two of the most promising types: ceramics based on zirconium dioxide and alumina.

Zirconium-based ceramics is the most promising ceramic material for structural and tool purposes, which is used in the technology for producing diesel engine parts, shut-off valve elements, as well as in metallurgy and medicine (for the manufacture of implants). High mechanical strength, wear resistance, corrosion resistance and biocompatibility characterize zirconia-based materials.

Along with this, ceramic based on alumina is also characterized by high biocompatibility, has high wear resistance, corrosion resistance, strength [2].

Promising are materials based on zirconia containing alumina as a second phase. Due to the high modulus of elasticity and limited solubility, the introduction of alumina interferes with the process of recrystallization of zirconium ceramics and contributes to an increase in mechanical properties.

Ceramic manufacturing technology

The analysis of existing ceramics manufacturing technologies revealed 4 main stages of production, for different types of ceramics each of the items has its own characteristics to give the desired material properties.

1. Preparation of raw materials (cleaning, exhaustion, etc.).

2. Forming (plastic, semi-dry, dry, pressing).

3. Drying (up to 0.5-5%).

4. Firing (sintering).

In most cases, to obtain the desired shape of the product at the second stage of production of ceramic products, pressing is used, based on the comprehensive compression of powder ceramic materials. This method does not allow to obtain a complex shape, because in this case the required uniform density of the material is not achieved over the entire volume of the work piece. For this reason, to obtain products of complex shape by pressing, a preform of a simple shape is initially obtained, in connection with this there is a need to introduce another stage in the production technology - machining, with the removal of a large allowance, which is complicated by the strength characteristics of the processed material, and the appearance of defects during processing.

Since the mechanical processing after firing is significantly difficult, since the ceramic mass acquires high strength characteristics, it can be concluded that it will be advisable to carry out the treatment before the sintering stage.

Processing of ceramic parts

Processing ceramics is necessary to obtain the required dimensional accuracy and the necessary roughness, taking into account the geometry, since this does not seem possible by molding and subsequent heat treatment due to shrinkage or expansion of the sintered mass.

When machining ceramic products, a number of problems arise associated with high abrasive properties, such as the formation of cracks and chips, the rapid failure of the cutting edge of the tool and the intensive greasing of grinding wheels. During the molding of a work piece or product, it is worth striving for maximum precision in order to minimize the amount of machining, but this is not always impossible, therefore various methods are used: grinding, turning, milling and drilling.

Output

Based on the analysis, we can conclude that the use of ceramics based on zirconium dioxide and aluminum is promising both in the field of engineering and in other fields. Most of the literature data contains information on the technology of manufacturing ceramic products, which does not meet the requirements for creating modern products of complex shape from technical ceramics. The lack of regulatory documents on cutting conditions and the tool used allows us to conclude that research is needed in this direction. In addition, a review of existing technologies for creating ceramic products suggests that the strength characteristics of ceramic materials are different at all stages of production. This fact allows us to conclude that the study of the dependence of machinability on the state of the ceramic material is promising.

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POWER SUPPLY SYSTEM OF GAS PUMPING UNIT

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The relevance of the topic is that transportation of natural gas is impossible without effective operation of gas pumping units (GPU). There are more than one thousand GPU units of various types, capacities and designs in Western Siberia. Foreign developments of gas turbine drives are distinguished by the following features:

a) The design of aviation gas turbine engines is specially and significantly modified for ground-based applications in order to increase the resource of the unit and to take into account the specific conditions of its operation on the ground;

b) Industrial gas turbine drives widely use the achievements of aviation engine design in order to increase its efficiency;

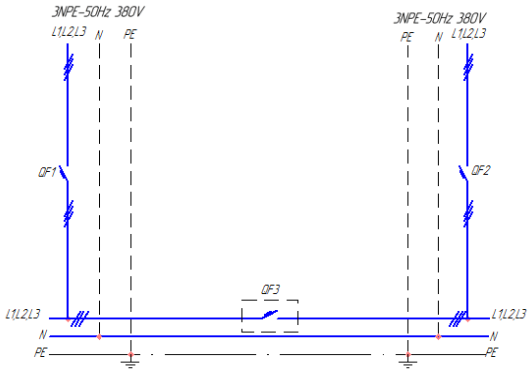
c) Great attention is paid to the refinement of the design of gas turbine drives when they are promoted to the market. For example, General Electric declares its own NPI standard («new product introduction»).

The purpose of designing of the GPU's low-voltage package device (LPD) is intended for:

- receiving and distribution of electricity between consumers of power units with supply and removal of voltage according to commands from the automatic control system or from buttons on the front panels of low-voltage package device;
- protecting of power circuits and electric engines from short circuits and overloads;
- formation and transmission of the electrical receiver's status signals (on / off) to the automatic control system, and signal of readiness of the low-voltage package device to work in automatic control from the automatic control system.

Tasks:

1. Analysis of literature on GPU;
2. Development of technical requirements;
3. Calculation of the main elements of the electrical circuit scheme;
4. Development of the principle diagram,;
5. Development of the wiring diagram;
6. The layout of the control cabinets;
7. Explanation of the business case for the project.



The power supply system of the gas pumping unit is a generation center, which consists of two sections installed on one platform in one module, which are powered by an industrial network

Two sections of electrical receivers are powered by the generation center. In this case, the power cables are mutually redundant.

Scenario A shows the normal operation, when the power of the GPU is made up of 2 sections, with a rated voltage.

Scenario B demonstrates the emergency operation when one of the supply cables, using the automatic load transfer, feeds both sections.

The design of the power supply system for linear consumers is regulated by the PUE (Rules of the structure of electric units:

- GOST 28775-90 - Gas pumping units with gas turbine drive. General specifications;

- GOSTR 51330.9-99 - Explosion-proof electrical equipment. Part 10. (Classification of hazardous areas).

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PERSPECTIVE OF DEVELOPING SUPERSONIC AIRPLANES

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Abstract: *The relevance of the topic chosen due to introduce the history of supersonic airplanes, their heritage and future. Are there any facilities of a mankind to develop supersonic jets again?*

Key words: *supersonic, fuselage, turbofans, twinjet, fuel consumption, engine, runway.*

Supersonic jets are attracting considerable interest due to their unique shapes, engineering solutions which were ahead of it's time, incredible power and their contribution to the aviation on general. There were only two commercial superjets: Concorde or Tu-144, both which provided unprecedented performance. Their appearance was a breakthrough back in the 70s.

During the last century superjets were seen as the most innovative and perspective machines. USSR and France in collaboration with Britain proved to the mankind that flights from one side of the earth to the other can take less than 6 or 9 hours. First commercial flight happened in 1976. Concorde could provide fast and exciting flight for the passengers from Paris to New-York in only 3 hours. Soviet analog, Tu-144, did not succeed in commercial flights. After fatal incident with Tu-144[1], Aeroflot reduced their enthusiasm for soviet passenger supersonic plane. Restrictions on the Tu-144 following the Paris Air Show crash meant that it only saw limited service during 1977 and 1978, and following another crash in May 1978 it was finally withdrawn. Last flight of supersonic commercial jet took place in 2003.

There are some reasons why airlines refrained from the usage of supersonic aircrafts:

1) The Price. List price was about 12.000$ for round trip. Small number of passengers could afford that.

2) Fuel consumption. One hour of flight in Tu-144 required 39.000kg fuel. Concorde spent less: 25.000kg fuel per hour.

3) Noise. Citizens who live close to runway, complained that it was very loud when Tu-144 or Concorde took off. Sometimes, these supersonic jets caused window break. But in reality nothing blows up - The loud “bang” comes from air pressure difference. This difference is only about a few tens of the atmospheric pressure, but is perceived by a human ear as a faraway thunder strike from afar. And there were causes when glass burst due to low flying Tu-144s and military vehicles, and cracks went through the buildings. Moreover, a sonic boom arises not only under a flying airplane - it covers the earth with a carpet tens of kilometers wide, which spreads under an aircraft while the speed remains supersonic

3. The next decade is likely to see a rise in commercial supersonic jet productions. Companies such as Boom Technology, Lockheed Martin and Spike Aerospace have already presented their concepts. Boom Technology Overture designed by a Boom Technology, is going to be shown in 2025. It can carry 55 people on board with the maximum speed 2200 km/h, the project is very ambitious. X-59 QueSST which was designed by Lockheed Martin for NASA will be set on test in 2021. The Spike S-512 is a supersonic business jet, designed by Spike Aerospace. It has been in production for 2 years. There are only 14 passenger seats and no one is expecting more because this was created for businessmen. Another example of supersonic commercial jet is Airbus Zehst (Zero Emission HyperSonic Transport). Unveiled on 18 June 2011 by EADS at Le Bourget air show, it would combine three propulsion systems: two turbofans for take-off and up to Mach 0.8, then the rocket boosters up to Mach 2.5, then two underwing scramjets would accelerate it to Mach 4. The aircraft is envisaged to be propelled by biofuel made from seaweed[2] and by oxygen/hydrogen. Airbus Zehts would be able to fly with 50-100 people on board 32km above the ground. It is going to be able to transport you from New York to London in an hour. However, i think that the first one to become commercially viable is going to be Aerion AS2. It’s a private jet plane, which utilises the laminar flow technology to achieve better range and fuel efficiency. As good as it is, there are still many problems that lie within the technology of a supersonic jet aircrafts, so the private jet market will become a good testing ground for new technologies in this sphere. After all, private jets are a display of luxury, so we think that there will be people, who are ready to overpay for the privilege of flight beyond the speed of sound. In the first place, the original Concorde planes were targeted towards businessmen, who had the necessity for quick transportation to the other part of the globe, and had the finances to do so.

Although this news seem to be exciting and inspiring hope, engineers are faced with some problems which are needed to be solved:

1) Fuel consumption has to be similar to a common twinjets. Not one airline is interested in using airplane which need 25.000kg of fuel per hour. Engine in general has to be very efficient and eco-friendly.

2) Reduction of the sound which is being produced by engines. First, it is impossible to live near to run-way for people because of loud noise; animals might also get influenced, some of fish might change their path during the migration season.

3) Engineers are responsible for designing an aircraft shape which is needed to be resistant for temperatures, also be lightweight. Fuselage and all the parts together should be durable and reliable, they must provide safe landing and take-off.

4) To make process cheaper, companies obliged for invent new materials or improve commonly used materials. One production of Concorde cost 46 million dollars in 1977, when at the same time Boeing 767 cost 18 million dollars.

5) Responsibility for making an airport net with special runway which is suitable for supersonic jets to take-off and land is entrusted to city management. They must comply with conditions which are defined by law.

6) All modern concepts have engines which are going to run on eco-fuel and it is not cheap. By inventing new sorts of fuels, we will be able to solve the air pollution problem

The jet powered aircrafts has gone through a lot. The base of it's working principle, in a nutshell, is as old few thousand years old and goes down back to times of the ancient China and the invention of the fireworks. Through many centuries , the same principle of jet propulsion is what allowed humanity to enter space and even set foot on the moon. Jet engines, and jet-turbine engines in particular has gone a long way and are now much more profound and efficient than they used to be. Many companies have plans to test their aircrafts in the next decade. And we are sure that in the upcoming years the scientific advancements will allow for the Jet-turbine powered supersonic passenger aircrafts to soar in the skies once again.

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УДК 621.3

NFC TECHNOLOGY AND ITS APPLICATION

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Today you do not need to use passes or cards that occupy a place in your bag, you just need to have a smartphone in your hands with a built-in NFC chip that will solve such problems as compactness, reliability and mobility.

The abbreviation NFC stands for Near Field Communication. Near Field Communicationis defined as a short-range wireless technology that works at a distance of no more than 10 centimeters. NFC communication is maintained by magnetic field induction when two loop antennas are in each other's field, forming an air core transformer.

In 1983, the history of NFC begins. On May 17 of that year, Charles Welton, an electrical engineer by training, received a patent for a "portable RF emitter-identifier." In 2004, Nokia, Philips, and Sony formed an organization called the NFC Forum. In 2006, the NFC Forum released the first standard specifications for NFC devices [5].

NFC technology supports three modes of operation. Card emulation: An NFC-enabled device is used to emulate a contactless card. Reader mode: an NFC-enabled device is in active mode and reads data from a passive device, such as a radio tag. Point-to-point mode: two NFC-enabled devices operate in active mode and use the technology to exchange information with each other.

At the moment, NFC devices are used in many areas: mobile payment for public transport, smart posters, some modern forms of car keys with this technology [2].

NFC does not differ from other wireless technologies. Nevertheless, a number of features makes this technology unique, with its own advantages and disadvantages. The advantages of NFC technology are high speed connection, low power consumption. An important advantage for specific NFC applications in the calculations is also a short range of protection.

The disadvantage of NFC in terms of electronic systems is the lack of built-in cryptographic data protection. This disadvantage is compensated by the used encoding methods, which protect against unauthorized modification of the transmitted [4].

Thus, NFCtechnology is easy to use, safe and multi-functional. The wide possibilities of this technology give us many advantages. Many believe that the future of our civilization and technology as a whole is behind this technology. After all, NFC is already used in many devices and not only smartphones.

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CONDUCTIVE ADHESIVE AND ITS USE IN MICROELECTRONICS

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The modern stage of electronics development is characterized by the wide application of integrated circuits (ICS). This is due to the significant complexity of the requirements and tasks solved by electronic equipment, which leads to the increasing growth in the number of elements in it. The complex systems being developed now contain tens of millions elements which dimensions are measured in nanometers. In these conditions, it is extremely important to solve the problem of improving the reliability of equipment and its elements. The purpose of this work is to analyze the existing methods of connection of microchips components and identify the most effective in the conditions of microminiaturization of electronic components and complex miniaturization of equipment.

Soldering is an integral part of repairing microelectronic equipment and its building. However, some parts are so tiny and elegant that the soldering iron tip exceeds the size of the surface, and its application becomes impossible. There are soldering irons that have a cone-shaped small sting, but they are very expensive. Also, due to the small size of the parts, and the high temperature of the soldering iron increases the threat of microchips deformation. One of the ways to solve this problem is the use of conductive adhesive compositions designed to provide a reliable

connection of electronic components, microchips, etc., and the necessary electrical and thermal resistivity.

Conductive materials are the materials, which main electrical property is strong current conductivity. They are widely used due to the property of high electrical conductivity at normal temperature. The electrical conductivity of a medium is related to the ability of charged particles (electrons, ions) contained in a given medium to move freely enough in it. The magnitude of the conductivity of the current and its mechanism depends on the nature of the substance, its chemical composition, the aggregate state, as well as physical conditions, primarily such as temperature. Metals and their alloys are mainly used as conductive materials. The main electrical characteristics of these materials are conductivity (or resistivity) and temperature coefficient.[2]

Conductive glue is a special adhesive consistency designed for reliable connection of electronic components, all kinds of microchips, small components of electrical appliances. But at the same time the properties of specific thermal and electrical resistance should be preserved. It contains a fine powder of nickel, palladium, silver or gold. As a result, it acquires the ability to conduct current maintaining good connecting qualities. Due to its high conductive properties, the adhesive is used for installation and repairing of electronic circuits, for fastening parts in radios.[1]

Glue with conductive properties has a lot of advantages:

1) high adhesion - the ability to be attached to materials with different textures (smooth, porous, metallic);

2) a convenient applicator, which allows you to fasten very small parts;

3) provides mounting elements where the heating above 1800C is not allowed;

4) seals perfectly, dries quickly, withstands temperature changes.[1]

Depending on the components with conductivity, there are the following types of adhesive compositions:

- silver-based (for high conductivity);
- gold-based (with the highest electrical conductivity, but its cost is much higher than analogues based on silver or nickel);
- graphite-based (low-cost adhesive with low conductivity).[3]

Thus, conductive adhesive is becoming more popular and affordable due to its properties. It acquires more and more analogues and many varieties, thereby expanding the range of its application. Conductive adhesive compositions have sufficient electrical conductivity for use in the connections of piezo-ceramic plates in radio devices, for "cold" soldering, in repairing computers, mobile devices and other high-tech equipment, for attaching crystals and microchips to the board.

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СЕКЦИЯ 3
АКТУАЛЬНЫЕ ПРОБЛЕМЫ ПЕРЕВОДОВЕДЕНИЯ

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WILL THE ONLINE TRANSLATORS REPLACE HUMANS?

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Nowadays Online translators are very popular. They simplify our lives so much that the question is whether they will really replace humans? This problem is urgent, because in the age of information technology, many professions lose their importance and become unnecessary.

The purpose of my work is to answer the question posed, to give arguments confirming my point of view, to express my own opinion to the problem.

The method of my research work is the analysis of matching translations and the component analysis method.

It is worth mentioning the advantages of online translators. The simplest online translators facilitate the performance of many tasks for students and schoolchildren, dictionaries of foreign words have already lost their importance. Nowadays to learn the meaning of a foreign word, you do not need to flip through the pages, just press a few buttons or say the desired word. There is no need to carry a paper version of the dictionary, which will take the whole backpack, because all the words are in your smartphone, which fits in your pocket. This facilitates greatly the lives of students and schoolchildren. In addition, you can translate a text, article, essay for free. The learning process has become easier.

It is also important to note that now you can meet online with residents of other countries. No matter if a person speaks a foreign language, everybody will be able to understand the interlocutor and express his or her own thoughts online.

For travellers electronic translators are the real salvation. If a person does not know foreign languages, this is not a reason to refuse to travel abroad or hire an interpreter, which will cost a round sum. Online translators will help you to familiarize with the menu in the restaurant, to learn about interesting excursions, to communicate with native speakers.

However, online translators don’t make thousands of real translators stay without work. Currently, the online translator is not able to translate correctly the idiom, phraseology, slang. Each language has its own national characteristics, which can be understood only by a native speaker. It is necessary to improve the existing translation algorithms, to make the program development, to accumulate the existing vocabulary. Every language has little-used words, phrases and turns of speech which are difficult to translate, new generations create new forms of words, speech constructions, abbreviations; so the online translators must constantly change.

Existing translators need to be improved. No online translator will translate correctly the Russian "Storm in a glass of water" bringing to speakers of another language the true meaning of this expression.

Summing up, I would like to conclude that in future translators will be replaced by online translators, but they need a lot of improvement, which may take years.

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THE WAYS TO IMPROVE THE WORK OF ONLINE TRANSLATORS

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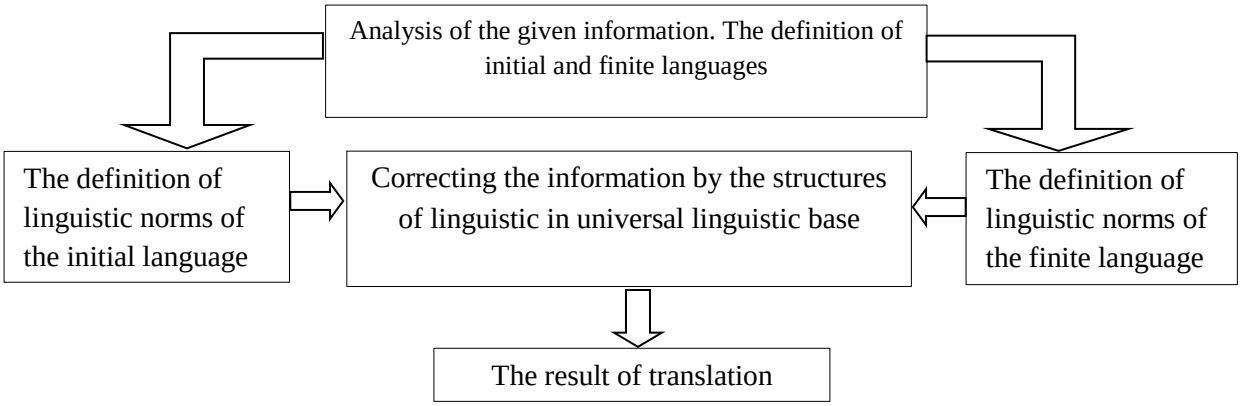
It's not a secret that online translators had replaced lots of bilingual dictionaries in our modern life. You don't need to lose your time searching the translation of some word or to keep hundreds of books at your workplace. It's very practical. Of course, the process of translation is simplified but we need to be sure that the result of process will be of high quality. Unfortunately, online translators have lots of disadvantages and they need some changes. It’s the reason why we would like to present little idea to improve the online translators’ functions.

As we know online translators are weak in language sections and linguistic norms. For example, the syntax causes lots of problems. The translation of words seems to be going on in terms of single words translation. It happens because online translators represent a base of many dictionaries what used by translator. But what will happen if the team of linguists and program developers create the universal linguistic base (ULB) for the online translators? At first linguists need to find out the similarities between lots of well-known languages in all fields of the linguistic science and present some common patterns and rules for the ULB. They should explain well these rules to program developers because they need to structure the patterns and communicate them with patterns of the languages which are reviewed by linguists. Then program developers can codify the sides of linguistics and make the special sections which will be used in translators to make the correct translation and the connections between words. The simple plan of this system can be shown in next scheme:



The main feature of the ULB should be the automatic export of the information from initial language to the finite one according to the linguistic rules and norms of each language. The function of this base can be improved by many ways but the first step to be done is to improve the work of the online translators. I hope there will be more ideas that can start global changes in these programs. But if we want to achieve excellent results of work we always need to remember the aim of this work. It's the simplification of the translating process and giving more opportunities to the translators for getting the correct translation.

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NEOLOGISMS IN SCIENTIFIC PUBLICATIONS

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Our research is devoted to neologisms in scientific publications, we consider different ways of formation of neologisms that penetrate to the Russian language from the English language. Science, in particular information technologies have become an enormous source of new words. Neologisms are the words with new meanings for new objects, phenomena and ideas. In our research we collected data from publications at www.sciencedaily.com, Oxford English Dictionary and Merriam-Webster Dictionary.

New words appear in a language by means of different ways.

1) word-formation (affixation, word compounding):

'Technoference' means any negative effect imposed on an interpersonal relationship by the intrusive use of technology (from techno(logy) + (inter)ference).

'Technojunkie' is a person addicted to or obsessed by new technology.

'Technography' is the study and description of the historical development of the arts and sciences in the context of their ethnic and geographical background.

2) reinterpretation of old words:

Big Data denotes an accumulation of data that is too large and complex for processing by traditional database management tools.

Applet is a short computer application especially for performing a simple specific task.

3) abbreviations, acronyms:

HTML is a markup language that is used to create documents on the World Wide Web incorporating text, graphics, sound, video, and hyperlinks.

4) functional shift of a word.

'Browser' is a computer program used for accessing sites or information on a network (such as the World Wide Web). It is a derivation from 'to browse/ (to look over or through an aggregate of things casually especially in search of something of interest).

In computer sphere words like 'browser', 'server', 'site', 'blog' are not perceived as technical terms at present. The process of language evolution goes along with the development of technologies and IT sphere plays a crucial role in this process.

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DIFFICULTIES IN TRANSLATING SLANG

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Slang became widespread at the beginning of the 19th century. The interpretation of the term “slang” is ambiguous and for the first time it was most fully formulated by M.M. Makovsky. The scientist defined slang as a special historically developed version of lexical and grammatical norms, which includes words and expressions created by the using word-formation models of the English language and used in specific meanings due to the emotional coloring they acquire. [1]

The problem of translating slang is acutely felt nowadays, since colloquial speech is constantly undergoing changes. This creates many difficulties in translation, not to mention the use of new loose words.

Since slang carriers are mainly young people aged 12 to 30 and often its true meaning is clear only to a certain group of people, translators are faced with the difficulty of correct deciphering slangism and transmitting the emotional coloring that it carries in itself. After all, it is important not only to understand the meaning of an unusual expression in the context of its context, but also to know about its origin in order to take into account all features of the original vocabulary. At the same time, it should be noted that changing the style of slang introduces distortions into the semantic appearance of the speaker, and may convey inadequately his image and background knowledge.

Slang has already influenced the usual options for us to affirm and deny. Now people use the words “yea” and “yap” instead of “yes” in their vocabulary. Negation can go from “no” to “nope.” Some words from slang are important for understanding. For example, "an elevator" in the UK is called "a lift".

The 21st century is marked by the activation of the process of transitioning slang vocabulary to literary English, which means that we are beginning to recognize and accept the existence of slang. An example of this is such expressions as, for example, “of course”, “to take part”, “to get up”, which were considered slang five years ago. English slang is daily, if not replenished hourly, and at the same time difficulties increased with the translation, the perception of new units. For example, the English word "price", had the meaning of "value" at first, later it retained the meaning of "money" that was missing in the English language. [2]

There are two ways to translate slang, as well as to use formal vocabulary: literal and indirect.

The first method is not consistent, as with direct translation, the originality of the language is lost and the true meaning of the phrase escapes. In this case the translators resort to the second method.

Slang speech of English-speaking representatives can be understood intuitively, but this language is not native to us, so this way of translation can be risky. When translating from one language to another, it is also necessary to take into account the effect of the same logical and semantic factors to convey the semantic content of the text. It is important to preserve its stylistic, expressive and other features in accordance with the norms of the language.

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FEATURES OF TRANSFER OF ECONOMIC TERMS

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In modern society, linguistics pay great attention to the translation of English terminology into Russian, as economic relations between states, individuals and legal entities are actively developing; at that, it is English that is the language of international communication in the field of economics. More and more people are entering into relationships with foreign companies. Thus, an important aspect is the translation of economic vocabulary from one language to another in order to prevent misunderstanding between the participants in communication.

It is obvious that the economy covers various areas of human life: agriculture, industry, communications, trade and exchange spheres. Moreover, each branch of economic activity has its own specific features, which require finding the most accurate definition of specific expressions, taking into account the legal, economic, cultural and political realities of a particular country.

High-quality translation of economic terms allows you to accelerate the exchange of information between experts around the world. The concept "Economic term" implies a term that is a word or phrase used to designate logically precisely formulated concepts of a given branch of knowledge and form the basis of economic theory.

When translating economic terminology, certain aspects must be considered. Economic vocabulary should:

* accurately convey the information;
* be brief;
* be systematic;
* do not contain emotional coloring [1].

Thus, the translator must correlate the picture of the world of the addressing and receiving parties and possess the cognitive apparatus of economic science.

The main problem of the translation of economic terms can be called the fact that economic vocabulary often has several translation options. This allows us to divide economic terms into single-translation and different-translation.

Single-translation terms are terms that have one translation option in the language, while different-translation terms are terms that have several translation options in the language, respectively.

As an example of a single-translation economic term, we can consider "exchange risks". This phrase is defined unambiguously and translated into Russian as "currency risks" – "валютные риски" [2].

The term "tax" can be called a different-translation term, as it has different meanings:

In general vocabulary:

* tax;
* taxation;

In the construction business:

* collection;
* duty;

In economics:

* tax (a compulsory, individually gratuitous payment levied on legal entities and individuals in the form of alienation of the money owned by them on the basis of ownership, economic

management or operational management in order to financially support the activities of the state and (or) municipalities);

* scot;
* duty;
* fee (a mandatory fee levied on legal entities and individuals, the payment of which is one of the conditions for the performance by the state bodies or other authorized bodies and officials of legally significant actions, including the granting of certain rights or the issuance of permits);

As an Americanism:

* membership fees (in a trade union, a society, etc.);

As colloquial terms:

* payment on the account;
* price;
* account size;

In economics (verb):

* to tax;
* tax (determine or establish the amount of legal costs, fines, etc.) [2].

In order to overcome the divergence in the translation of economic terms from English into Russian, it is necessary to take into account the cognitive models that underlie a specific text. So, in highly specialized economic texts, facts and reports on the state of stock markets are usually given, and reports on profit and loss of companies are analyzed. We can find such articles in publications such as the Wall Street Journal, Weisenberger Investment Companies Annual Handbook, etc.

Popular economic texts most often describe people who have achieved some success in the economic field, or unusual projects or ideas. As a rule, such articles are published in The Economist, Business Central Europe, and Financial Times.

Economic texts include features of the two above types, combining various elements. In this regard, we consider an example from the magazine "Money", which includes in the main highly specialized articles: "Across the country, myriad independent contractors and small service firms have sprung up to supply streamlined corporations with skills ranging graphic design to bill collecting and executive recruiting" [3].

In the above example, the term "corporation" has several translation options:

1) association; 2) corporation; 3) (Amer.) joint-stock company. In our opinion, in this case it is better to use the equivalent of "corporation", since the article in question is highly specialized, which means that readers of this publication have basic knowledge on this topic. Thus, when translating such types of texts, it is best to use equivalent borrowings in the target language, since it is assumed that the readers of this publication are specialists in the field of economics.

For popular economic texts, it is best to use metaphors that will help make economic terminology accessible to a wide range of readers who have only the most general idea o of certain economic terms meaning.

Thus, when translating economic terms, many different aspects should be considered. This is the main difficulty, since a translator working with economic terms must take into account not only the main essence of the word, but also the context, contextual determinants (lexical, syntactic, morphological and lexical-phrasal), as well as the economic and political realities of the country, which readers this publication is oriented to.

And often, the apparent ease in translating economic terms is not a guarantee of their correct translation, understanding and application.

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FEATURES OF YOUTH ENGLISH SLANG AND ITS USE IN THE RUSSIAN LANGUAGE

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The concept of slang in modern philology gains the increased attention. Nowadays there exist a fairly large number of slang definitions, often contradicting each other. The Oxford English dictionary gives us the interpretation of this concept: "slang is a purely colloquial language that is considered a lower level of speech compared to the standard literary language and containing either new or ordinary words used in a certain special sense." Many sources describe slang as a vulgar language or as a special vocabulary belonging to professional or other groups.

"Dictionary of linguistic terms" 1995 simply puts an equal sign between slang, jargon and argot: "Slang is a layer of words and expressions used by persons of certain professions or social strata. Slang of sailors, artists, etc"[3].

Despite the fact that slang does not currently have terminological accuracy, numerous studies in this area allow us to generalize the most significant properties of slang and define it as a bright, expressive layer of non-literary vocabulary, a style of language that occupies a place directly opposite to extremely formalized speech. Slang is a living, moving language that keeps up with the times and responds to any changes in the life of the country and society.

Slang has become especially widespread among young people, who think up words and try to stand out from the crowd and assert themselves. Using slang, young people, want to impress others. Youth slang differs from other types of slang in that it is based on the youth realities and gives the speech emotional expressiveness, and sometimes a crude familiar coloring [2].

Particular attention should be paid to the English youth slang, which has long gone beyond the countries where they speak English and, so to say, conquered the whole world. Youth slang in the English language plays a rather important role, which determines the development of the language as a whole, its originality and difference from other languages of the world. In addition, youth slang in English allows us to communicate on a completely new level, without using classical sentence constructions and grammatical foundations, which in its turn suggests that young people can communicate more relaxed and understand each other perfectly.

In youth circles, where slang-making is especially widespread, the desire to separate from the adult world, to “encrypt” their own language, as well as to simply stir up the mirror surface of respectable English, the so-called Queen’s English is clearly expressed. Thus, often many youth slangisms in the English language are derogatory and even offensive.

Usually slang expresses a negative value when describing a person’s quality: "chicken" – "coward", "bigmouth" – "chatterbox", "deadhead" – "bore", or actions of a person: "to goof off" – "to fool around", "to wasting time", "show off" – "to boast", "to beat one's brains" – "to puzzle", " to bite the bullet" – "to reconcile", "to be nuts about" – "to be crazy about something", "to blow the whistle on" – "to fiscal", "to pin somebody’s ears" – "to give somebody an earful", "to take a powder" – "to rinse off", "to sell a pup" – "to impose junk", "piece of cake" – "a couple of trifles".

On the other hand, slang expressions in English are also used in a positive, laudatory context. So, the positive qualities of a person can be expressed in the words of slang: "awesome, bomb,

biggity / diggity, bommy" – "amazing, delightful".

The English slang is short, so it is often used in the form of abbreviations, especially: "gonna" – "going to", "wanna – want to", "ama" – "I am", "yep, ye" – "yes", "U" – "you" "dunno" – "don't know". Often these abbreviations are found in SMS correspondence, and this slang is called mobile slang: "AFAIR" – "As Far As I Remember", "AGF" – "Assume good faith", "BBIAB" – Be Back In A Bit", "BFF" – "Best Friends Forever", "FYEO" – "For Your Eyes Only", "OMG" – "Oh My God".

At present, in the speech of Russian youth, borrowed words are found, which mainly come into Russian from English. This also applies to slang expressions. It is interesting that even people who do not know English can understand this slang. For example: "фифти- фифти"– "50/50%", "дринк" –"drink", "пипл" – "people", "крейзи" – "crazy", "бест" – "best", – "лав стори" – "love story" and many others.

The lack of a standardized translation from English was the reason for the appearance of such a number of youth slang. As цу can easily see, borrowed youth slangism from the English language comes into modern Russian with the help of transliteration – a borrowing method in which the spelling of a foreign word is borrowed: the letters of the borrowed word are replaced by the letters of the native language.

Next, we consider in more detail some examples of English youth slang that has been firmly included in the speech of Russian youth in recent years. Linguists identify several factors that influence the development and replenishment of slang, and, consequently, several slang groups.

The development of computer technologies and social networks, which are popular among young people, certainly affects the slang. IT terms are firmly rooted in our lives: "юзер" – "user", "геймер" – "gamer", "логин" – "login". Some slangisms have entered the vocabulary of Russian people relatively recently. An example is the word "контра" – the abbreviated name of the computer game Counter Strike: "He is a complete rookie in contra" – that is, he plays a computer game poorly. Slang expressions are not always borrowed in the original version. Some slangisms are formed by the merger of two or more words, for example, we got the word "копипастить", which means copying information, mainly computer information, without change, often passing it off as our own. It was formed by combining the words "copy" and "paste". "The student copypasted the report from the Internet" – that is, the text of the report completely coincides with the text posted on any site.

Modern music and club culture, as well as the film industry, have a direct impact on the lives of young people. This group of slangisms includes such words as "релиз" – "release", "плейлист" – "playlist", "ремейк" – "remake", "фейсконтроль" – "face control".

Media and television are an integral part of youth life and, therefore, affect the state of slang. Thanks to the media, the vocabulary was replenished with such words as "праймтайм" – "prime time", "трейлер" – "trailer».

The names of popular sports are also borrowed by the Russian language. This group includes the following borrowings: "фитнесс" – "fitness", "бодибилдинг" – "bodybuilding", "шейпинг" – "shaping". The massive use of the above-mentioned slang units in the speech of Russian youth is due to the fact that the so-called "cult of a beautiful body", widely promoted in the West, is gaining popularity [1].

The development of fast food chains has led to the emergence of some slangisms, such as "фастфуд" – "fast food", "чизбургер" – "cheeseburger", –"хот-дог" "hot dog". The trend of widespread use of such words in Russian dates back to the 90s. in connection with the opening of the first fast-food stores. The slangisms of this group can also be reduced, for example "mackduck" from English "McDonald`s".

The imitation of the lifestyle of American and English youth served as an incentive for the emergence of the largest slang group. It includes the following words used by Russian youth in everyday communication and in standard everyday situations: "бойфренд" – "boyfriend", "уикэнд" – "weekend", "пати" – "party", "лузер" – "loser", "бэйби" – "baby", "гоу" – "go". Some of these slang units are no longer regarded as slang at all, since they have firmly entered our lives and, as a

result, into our vocabulary [1].

The analysis allows us to make the following conclusion:

In the modern world it is impossible to imagine young people without slang. Both Russian and English slang is widely known and common among young people, as it enables young people to find a common language, facilitates the process of learning and expanding new foreign vocabulary.

There are both positive and negative aspects to using slang.

The slang reflects the actions, processes taking place in people's lives, their cultural level, moral and moral qualities.

Slang gives the speech emotional coloring, expressiveness and brevity. Youth slang enriches a person's vocabulary.

On the other hand we should not abuse slang. It goes without saying that it's not good if slang replaces completely correct speech. Literary language cannot be neglected. Of course, it is impossible to force young people not to use slang. But the older generation needs to exert a positive influence, to convince young people to use literary words in their speech more. Nevertheless, knowing and understanding the difference between rude, vulgar and correct speech, one can appreciate the beauty of literary speech.

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FUNCTIONING AND USAGE OF NEOLOGISMS IN THE ENGLISH LANGUAGE

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In our research we focus on the functioning and usage of neologisms in the English language. Neologisms are the words or word collocations which recently appeared in the language. Neologisms are new coinages which are used to denote new ideas and senses. As in any language, new words appear in English. Many new words come from slang, from various narrow disciplines, as well as under the influence of fashion.

English is today one of the most popular languages in the world, it is an international language of communication in such areas as politics, business, science, technology, trade. English is the language of navigation, aviation, literature, education, modern music, international sports, tourism, programming. 75% of world correspondence is in English, 60% of radio stations broadcast in English, more than half of world periodicals in English, 80% of information on electronics is stored in English.

Over 650 new word and phrases were added to the Oxford Dictionary in October 2019, 1,400 words – in June, more than 4,800 words and phrases in 2018. In this paper we look at some new words which were added into Oxford English Dictionary, Merriam-Webster Dictionary in

September, October 2019. Some of these words derive from different spheres such as pop culture, psychology, business and finance, tech and IT, others develop new senses.

New Words from Pop Culture:

Bechdel test	refers to a set of criteria used to evaluate a movie or other work of fiction on the basis of its inclusion and representation of female characters
Stinger	the name for short scene that appears during or after the closing credits of a movie
Coulrophobia	meaning "abnormal fear of clowns"

New Words from Psychology:

Term	Meaning
Aphantasia	the inability to form mental images.
Autogenic training	a self-relaxation technique that involves repeating calming statements to yourself.

New Words from Business and Finance:

Term	Meaning
Pain point	a persistent or recurring problem (as with a product or service) that frequently inconveniences or annoys customers.
Haircut	a new sense was added meaning "a reduction in the value of an asset."

New words from Tech & IT

Term	Meaning
Hyperautomation	an innovation that results in the creation of a 'digital twin': a self-sufficient bot that can conduct a range of sophisticated human tasks, often under pressured environments
Autonomous Architecture	robots that print entire buildings
Platooning	semi-autonomous trucks with sensors which enable tight-knit convoys, led by a human driver
Machine Bias	machine learning algorithms calculate our credit, assess insurance claims and policy applications, make music recommendations, etc.
Computer Hallucinations	use cameras and object recognition software to control self-parking technology

The words that developed new meanings include colour, the direction of wind during flight and others. The word "flake" is now used to mean both "someone regarded or treated as unique or special" and "someone who is overly sensitive". In the word "purple" political affiliation during general elections is conveyed metaphorically and is now referred to geographical areas where voters are split between Democrats and Republicans (blue and red). The words "tailwind" and "headwind" are often used figuratively to refer to a force or influence that either helps or hinders progress. Even a fairy tale can become a metaphor, and this new colorful definition "Goldilocks", referring to the character whose preferred porridge is neither too hot nor too cold, has inspired astronomers to use it to describe "an area of planetary orbit in which temperatures are neither too hot, nor too cold to support life".

In conclusion, it should be noted that evolution of a language enriches our life and culture. The words that come into languages can disappear in a year, but this process is constant and continuous.

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WAYS OF TRANSLATION OF NEOLOGISMS FROM ENGLISH INTO RUSSIAN

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In our research we deal with translation of neologisms from English into Russian. Since English has become a language of global communication, new words that come into English are currently penetrating into different languages. Our aim is to consider the ways of translation of recently appeared words. Neologisms are words used to denote new meanings to describe new objects, phenomena and ideas. The most commonly used ways of translation are interpretations or descriptive translations, loan translations, phonetic transcriptions.

In this paper we consider new words which were included into Oxford English Dictionary, Merriam-Webster Dictionary this year. These words originate from different areas such as pop culture, psychology, business and finance.

The first commonly used way of translation is interpretations or descriptive translations. The word “stinger” used as the name for short scene that appears during or after the closing credits of a movie can be translated as “сцена после титров”. Another example of this method of translation is “coulrophobia” which means “abnormal fear of clowns” is translated as “патологическая боязнь клоунов” or “клоунофобия (коулфобия)”. The next word “haircut” gets an extra meaning “a reduction in the value of an asset” and is interpreted as “дисконт от рыночной цены”.

Loan translations are “autogenic training” that is a self-relaxation technique that involves repeating calming statements to yourself”, the Russian translation of it is “аутогенная тренировка”; ‘pain point’ that is used to describe a persistent or recurring problem (as with a product or service) can be translated as “проблема, проблемный вопрос”.

The examples of phonetic transcriptions are represented by words “aphantasia” (the inability to form mental images), in Russian “афантазия” and “coulrophobia” meaning “abnormal fear of clowns”, in Russian can be rendered as “клоунофобия (коулфобия)”. “Bechdel test” which refers to a set of criteria used to evaluate a movie or other work of fiction on the basis of its inclusion and representation of female characters is rendered as “тест Бекдэл”.

We can conclude that in some cases different translation methods depending on the context are used as with coulrophobia. At the first stage borrowed words can be translated descriptively, and then as in any language the most laconic way of translation is preferred.

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REPETITION AS A STYLISTIC DEVICE ON THE EXAMPLE OF THE STORIES OF E. HEMINGWAY

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The special organization of the utterance and the individual attitude of the author to the objects and phenomena are expressed using various stylistic means and devices. In modern science, linguists distinguish syntactic and stylistic expressive means of the language. In this article, we will consider the use of stylistic repetition and its function in the stories of E. Hemingway, namely: “The Killers”, “A Day’s Wait” and “The Short Happy Life of Francis Macomber”.

Repetition as a stylistic device is a typical generalization of the means available in the language for expressing an excited statement, which, as you know, is expressed in speech by various means, depending on the degree and nature of the excitement.[2]

Many scientists and linguists made a huge contribution to the study of repetitions and their use in the text as a stylistic device, they are: I.R. Galperin, I.B. Golub, V.A. Kukharenko, I.M. Skrebnev and many others.

The most common function of the stylistic syntactic repetition is emphasis. In this function, the repetition demonstrates the norm of the live excited speech.

The repetitions used in the stylistic function of the emphasis are usually classified according to the distributional principle, that is, the place of the repeating unit in the sentence or paragraph.[2]

Let us see the examples taken from the stories.

So, in the Hemingway’s short story “The short happy life of Francis Macomber”: “She's damn **cruel** but they're all **cruel**” the author uses epiphora which serves to emphasize the fact that in reality the society of that time was cruel and the wife was more likely to treat her husband as a "wallet", rather than as a beloved person.

Looking at the passage: – “You know you have a very **red** face, Mr. Wilson ” – “Drink” – “I don’t think so,” she said. “Francis drinks a great deal, but his face is never **red**.” – “It’s **red** today,” Macomber tried a joke. – “No,” said Margaret. “It’s mine that’s **red** today. – But Mr. Wilson’s is always **red** ”, we see the case of the ordinary repetition and can assume that wife reproaches her husband for cowardice and even tries to offend him. Here the word "shame" which the author disguises with the word "red".

An example of asyndeton “... and she looked away from his face at the way his shoulders sloped in the loose tunic he wore with the four big cartridges held in loops where the left breast pocket should have been, at his big brown hands, his old slacks, his very dirty boots and back to his

red face again", helps to focus on each word after the conjunction and shows us how rude and dirty the hunter was. There was something animal in him that attracted Mrs. Macomber. This type of repetition, attracts the reader's attention to all the elements that are listed in this sentence.

The inverse of asyndeton, **polysyndeton**, given in the story "A Day's Wait": "I took the young Irish setter for a little walk up the road **and** along a frozen creek, but it was difficult to stand or walk on the glassy surface **and** the red dog slipped **and** slithered **and** I fell twice, hard, once dropping my gun **and** having it slide away over the ice. " separates each element, and we can easily imagine very slippery terrain, and a person who has difficulty moving around. The picture is clearly presented before our eyes also because the text contains a description of a young setter sliding on ice, as well as his master.

The repeating unit at the beginning and the end of the passage, forming a kind of frame, is called a ring repetition or frame. The function of this repetition and the additional information that it carries can be varied. Repetition can, for example, highlight the main idea or topic of the text. For example, the frame in E. Hemingway's short story "The Killers": – "The town's full of **bright boys**," Max said. – George put the two platters, one of ham and **eggs**, the other of bacon and **eggs**, on the counter. He set down two side-dishes of fried potatoes and closet the wicket into the kitchen. – "**Just a bright boy**," Max said.

The repetition of this passage clearly shows the reader that, despite the gangster's irritability and sharp remarks, the waiter does not pay any attention to him. We can understand that at that time the appearance of gangsters was not the news and was taken for granted.

So, examining some of the main types of stylistic syntactic repetition in the E. Hemingway's stories and their main functions we may conclude that the author skillfully uses this syntactic device in his stories to give some complement connotations to the thoughts. What is more we found out that some types of repetitions appear in combination with the other types of repetitions and with the other stylistic devices. This adds even more expressiveness to the utterance.

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TRANSLATION ISSUES IN INTERNATIONAL COMMUNICATION

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The tendency towards global cooperation and the accompanying development of international relations sharply pose for linguists the question of understanding the role of intercultural communication. More than ever, it is important to consider modern social systems in a multinational, multicultural and multilingual context. The success of communication is largely determined by the presence of a common knowledge base among communicants, reflected in the content-structural community of certain fragments of the interlocutor's worldview.

Differences in the cultures of communicative partners affect the differences in the interpretation of individual words, phrases, sentences and communicative behavior in general.

Problems arise in both oral and written communication, in the presence of the human factor, and in machine translation. It is fair to say that only proper names, geographical names, terms, days of the week, months and numbers can have full lexical correspondence in different languages, while other non-precision information in the translated text can be subject to ambiguous interpretation. This leads to the fact that during the translation process some semantic nuances of the source language may be lost. In addition, some phrases can often sound ambiguous.

An example of a translation whose contents can influence the effectiveness of communications is the machine translation of the English Gospel dictum: "The spirit is willing, but the flesh is weak" – "The wine is good but the meat is spoiled". In this example, the meaning of the source text is not conveyed, despite the apparent permissibility of the translation of individual elements of the statement (spirit - wine; flesh - meat) [2].

One of the factors of the interaction between multilingual communicants is the phenomenon of “false friends of a translator”. Traditionally, these are words in various languages, similar in spelling or pronunciation, having a common origin, but differing in meaning. Due to the subconscious tracing of the semantics of linguistic structures similar in appearance and sounding, even when translating into the native language, a philologist may be mistaken when it comes to lexical or stylistic compatibility and some other features of using words of this class. Most often, it is in connection with such an imaginary identity that the problem of misunderstanding and translation of the text arises. For example, the English word "corpus" has several meanings and can be translated into Russian as "body", "housing", "frame", "cabinet", "corps", "hull", "code of laws", and "collection of poems". It is a mistake to translate this noun into Russian with the word corpus, if it is not a linguistic term.

According to experts in the field of psycholinguistics, about 30-40% of information in oral conversation is transmitted in words (verbally); while more than half of the information is transmitted by means of non-verbal communication (from Latin verb "erbalis" – "verbal" and Latin "communication") - facial expressions, gestures, symbols or intonation, etc. A number of extralinguistic factors may be misinterpreted by representatives of different cultures, which leads not only to communicative hindrance or cultural barrier, but also to communicative failure and failure in general. This is probably why the most responsible international contacts (diplomatic, business, etc.) are established not by e-mail or telephone, but by personal acquaintance [1].

It is not enough to study phonetics and grammar, to have an extensive vocabulary or to know the style of a foreign language. When communicating, it is necessary to take into account both psychological and cultural-linguistic features of the communicant, since in the process of communication the semantic load is carried not only by words, but also by body movements and gestures, which are not the same in most cultures, and therefore sometimes lead people to misunderstanding. For example, a gesture meaning "fed up" - an edge of the palm of your hand across the throat - is perceived by the American as a threat to cut the throat. Currently, due to the increase in migration processes, sign language as an integral part of the process of communication between people from different cultures can lead to a conflict, which we understand within this topic not as a collision or competition of cultures, but as a communication failure.

Each national culture is a form of self-expression of the people in which features of a national character, world outlook and mentality are manifested. Any culture is unique and goes its own way of development.

Cultural and historical realities are reflected in the linguistic and cultural specifics of different languages. As an example, we consider the features of the construction of Russian and English negative sentences. First of all, it should be noted that the grammar rules of the English language do not allow the use of more than one negation in a sentence, while in the Russian sentence there are often several negatives indicating their particular categorical coloring: "Nobody could understand anything" – "Никто ничего не мог понять".

In addition, native speakers of English, "thinking positively", in principle, prefer positive constructions which are translated into Russian with the help of a negative prefix. Examples of such expressions include the following: "Stay in touch!" – "Не исчезай! Не пропадай! ", " This is a

difficulty / problem" – " Это неприятный момент", "Stay well" – "Больше не болейте", " (Please) keep off the grass"– " По газонам не ходить!" . From the above examples it follows that formally negative Russian expressions are often translated into English as positive or neutral, which is dictated by the national-cultural characteristics of English-speaking linguistic culture.

Another urgent problem of intercultural communication in the context of the globalization process is the problem of translation and transliteration of the city's navigation system. Correct transliteration of the navigation system can facilitate the movement of visitors to the city and give it a friendly look for foreigners, which, in its turn, raises the status of any city as a center of culture and tourism.

The translation of pointers should also adequately convey the original message, as the translation errors made can cause misunderstanding at the intercultural level and lead to a distortion of information. An example is the translation of a warning sign "Осторожно! Крутая лестница!" – "Attention! Abrupt ladder! " or "Caution! Steep stairs". In this context, the word "abrupt" (meaning "sudden, abrupt") refers to an action rather than an object, therefore it cannot be applied to a staircase. In addition, the lexeme "ladder" means a ladder with rungs, such as a rope or stepladder, while a staircase with stone steps is usually indicated by the word "stairs". The noun "Attention!" proposed by the translator is also not appropriate to this context. It is usually used to attract attention in order to convey any important information. In this case, there is a simple call for caution. In English, the words "caution" or "mind" are used for this purpose [1].

As for the transliteration of the proper names of intracity topographic objects (cultural monuments, squares, individual buildings and streets, called urbanonyms), today in Russia there are about 20 different GOSTs for the purpose of transferring them, for example GOST 7.79-2000 and GOST R52290-2004. Comparing the transliteration tables of Russian letters with Latin ones, one can notice obvious differences in the translation of letters (and their corresponding sounds), such as " ё", "х", "щ", "й", etc. These inconsistencies often lead to difficulties in transliterating street names. Examples of differences caused by the inconsistency of GOSTs and the lack of clear procedures for their use are widely represented on city maps, road signs, navigation tables and in the names of urban and cultural objects, as is the case with various options for transferring the letter"щ" in the name "Площадь Революции" on metro maps and in the text of a running line: "Ploschad Revolyutsii", "Ploshchad Revolyutsii", "Ploshad Revolutsii".

Thus, consideration of communicative behavior features requires a comprehensive consideration of the cultural realities of communicants. Focus on the transfer of meaning, ensuring the adequacy of translation and compensation of nonequivalent cultural phenomena in the resulting message are key conditions for synergistic interaction within the boundaries of the modern cultural environment. Overcoming the cultural barrier is carried out on many levels simultaneously, and to achieve success, it is necessary to take into account not only the meaning of the source text, but also a number of related extra-linguistic factors, such as: body language and gestures, visual images (as can be seen in urban signs, information tables and warning drawings), graphic conveying of letters in writing for the purpose of their subsequent unambiguous interpretation.

In the modern world, with the expansion of international contacts, there is a need to supplement the language and speech skills of a communicative person with intercultural competence, since the lack of basic knowledge about the general world picture and the culture of communicants can become the main reason for misunderstanding in intercultural dialogue. The significance of the intercultural approach is manifested in the possibility of expressing various cultural connotations by means of language, and the continuous dialogue of cultures allows us to perceive and evaluate the "native" reality in a new way. A scientifically based culture-oriented approach to communication implies the specifics of both verbal and non-verbal communication and provides a solid foundation for everyday social interaction between speakers of different languages.

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CULTURAL DIFFERENCES IN ADVERTISEMENTS IN RUSSIA AND IN AMERICA

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Introduction.

Today, in our modern world, advertisement has become more popular than ever: we see it on billboards, on TV, in the internet, in newspapers and even on cars, pens etc.This is because many companies compete with each other and the success of any separate business directly depends on the success of its advertising campaign. Maybe in the previous century it was enough for people to hear the positive reviews about the product to buy it, but now there are too many similar companies, and buyers hear too much about the same products, that it is not so easy to decide which one to buy. Ordinary commercial suggestions will not attract many consumers, thus, companies need to interest or even surprise their clients.

The relevance of our research is evident. Every day the number of international companies is growing up. Therefore, if they want to be successful all over the world, they must know how to run advertisement campaigns abroad. But if they use the ad, without taking into account the differences between the countries they wouldn't be successful. Culture and habits differ in different countries, so if the advertisement was not adapted, people might not understand it, might not like it or even might be offended.

Adaptation means, that something in promotional campaign needs to be modified or tailored to the people and their mentality. If to do the necessary changes the commercial from one country may become efficient in another. Modifications may include changes in the text or actors. Also some companies may create new advertisement, because sometimes it is easier, than to adapt the original one.

It should be noticed that some abroad companies have the most high budget and wide advertisement campaigns in Russia so it is very important for them to know how they should show and advertise their product.

The aim of our research is to distinguish the differences between Russian culture and cultures of other countries.

To achieve the aim we need to realize the following **objectives**:

1) To pick up the necessary material about cultural differences between Russian and foreign people.
2) View promotional posters and videos from Russia and other countries and highlight the differences in them.
3) To decide if all advertisements in our country are suitable to Russian consumers.

Research hypothesis:

Our research hypothesis is that the advertisements in Russia differ tremendously from those of American ones, and foreigners do a great job to tailor their commercials for Russian consumers.

To prove this hypothesis, many commercial posters and videos were analyzed. And now we can classify the following differences, which were divided into two groups:

1. Cultural differences
2. Language peculiarities
3. Differences in law

1. Cultural differences.

Here we imply the differences in behavior, practices and expressions considered unique to the members of a specific ethnicity, race or national origin.

- *In everyday life.*

Every people have some habits, expectations about behavior or appearance, and many of them may be the same within one nation. For example:

- In our country people have got used to the Russians or Tatars, because we see them everywhere. Types of clothes, hairstyles or demeanor are also very important because it will be easier for us to trust to the advertisements where people are like us.
- It is well known that Russian people do not smile without the reason and many of our citizens think that serious problems should be solved with serious faces, so in commercials regarding some serious questions it's better to avoid many constantly smiling people.
- *Socially – historical differences.*

Some things that are usual in one country may be unknown, unusual or even offensive in other. That is why successful advertising campaign needs to adapt to the target country. Examples:

- One product or service that is popular in one country may be unknown in other, so not many people will buy it, if the company will not explain in advertisement how to use it and why you need it.
- Peoples in different countries have different problems that need to be solved. In USA, one product may be more popular than other, if it has more vitamins. However, in Russia people rather buy product without cholesterol, than with vitamins.
- Researchers say that Russian peoples have more general knowledge, than American peoples do, for example. Therefore, for Americans advertisement should be more straightforward and understandable, than for us.
- The corporate social responsibility is a common thing abroad. It is expressed in the efforts of companies to help the environment or to do charity and, of course, they mention about that in advertisements. In our country, this is not so popular yet, but if Russian company wants to enter the global market, it should be taken into account.
- American culture have their own holidays or traditions that are differ from Russian.

2. Language peculiarities

As for the language peculiarities, one can say that in all languages they can be divided into 4 main levels, those are: semantic, morphological, phonetic and quasimorphological ones.

1) If USA commercial adapt for our country, it is often hard to translate it's text in Russian without losing the sense and some pun, because means of words, rhyme, grammar or persistent expression usually different in these languages. Sometimes advertisers save meaning of English text, but if it is impossible, they may write new text or even keep English words in commercial. However, in the last case they should take into account social groups in target audience and their age, because not all of our citizens can understand it. Also English language is shorter than Russian, and when advertisers need to choose between meaning and sounding they usually choose second, because slogan should sound like Russian, be memorable and interesting for consumers. For example, English «coke side of life» translated into Russian as «все будет кока-кола» and «I'm lovin it» in Macdonald's slogan translated as «вот что я люблю». These Russian analogues are better in our country than if they were translated directly.

2) It is known that sounds evoke certain associations in our minds. No matter how subjective the desire to interpret the effect of certain sounds from a connotative point of view is, one must admit that the Russian sound [a] has an absolutely different effect on than the sound [s]. Despite serious criticism, many researchers continue to argue that the saturation of the text with certain sounds and sound combinations gives it a certain mood. So, the sound [a] received ... such signs as good, courageous, simple, kind, powerful. This means that the sound [a] subconsciously makes an impression similar to the impression of objects and phenomena with the listed qualities. From this point of view, the successful examples of company names are: Магнит, Августина, Карусель, etc. In English, the names of companies and products, which include vowels, also make a favorable impression - Apple, iPhone, Samsung. At the same time, unsuccessful examples are those where there is a pile of consonants (especially deaf) within small lexical units:РосГосСтрах, Улыбка Радуги, etc. The same thing is in English - Varnish Oxy Action Max, where in the product name hisses, whistles and has loads of deaf consonants.

3) As for the morphological level, the word in the advertising message is easily sliced into morphemes, the morpheme begins to be written separately, highlighted graphically. As a rule, words in the advertising text begin to attract each other due to the presence in them of the same initial, rather than root morphemes. Of course, this is done in order to attract attention, highlighting significant, according to the advertiser, parts of the word and for saturating the ad with some additional connotations. Both in Russian and in English advertisements can be seen such techniques: «ПятеРочка выРучает», «Эдельвейс - если знаешь цену Деньгам». And in English: «Her Family, Her Store, Her Self…”»

4) Regarding the quasimorphological level we may distinguish dividing words into quasimorphems, like: «Какая Дэушка» - about the automobile, «ЖИлой комплекс ЭтаЖИ» or in English: «Maybe she’s born with it. Maybe it’s Maybelline». But English advertising is full of other techniques for attracting your attention, such as: «Color me naughty. Color me nice. The MAXalicious naughty & nice gloss collection» the body cream advertisement the creator of which skillfully uses several techniques to catch the recipient’s attention. Firstly, it is literally oversaturated with regularly recurring graphemes and phonemes: out of 71 letters making up this text, the letter «m» is repeated 4 times, the letter «t» 4 times, the letter «n» 5 times, the letter «c» 8 times, the letter «L» - 6 times, and this is only at the graphic level. The incredible density of the repeated letters makes the recipient subconsciously be focused on the object. Plus the usage of MAX which deliberately hints for «maximum» also has a great impact on the consumer.

3. Differences in law

Our country have one of the most strict law in advertising, more strict than USA, we have many limitations about what advertisers may show in commercial. For example, in Russian commercials must not be used:

- alcohol production, cigarettes;
- products that differ from real ones without mark;
- unlawful actions;
- texts that blame peoples who does not use the production from commercial, etc.

These laws are very important for healthcare, for our citizen’s level of culture and for fair competition, so every company should follow these rules.

Conclusion:

Thus, to summaries all the above mentioned material we can say, that the advertisement in Russia differs quiet strongly from those of American ones. But the differences mainly concern the living habits and daily routines. Though Americans like combining different language techniques or tricks to attract the consumers attention.

Companies that interested in entering the world market should take into account differences in culture and language to be successful in other countries, but now some all of them does not follow these regulations and have mistakes in their commercials.

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СЕКЦИЯ 4
ПРОБЛЕМЫ ПЕРЕВОДА
СПЕЦИАЛЬНОЙ НАУЧНОЙ ЛИТЕРАТУРЫ

Председатель: канд. филол. наук, доцент А.П. Султанова

Сопредседатель: ст. преподаватель Э.И. Зарипова

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УДК 81’25: 811.111

DIFFICULTIES OF TRANSLATING TECHNICAL ENGLISH

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Purpose of work: The aim is to learn about the translation problems of technical English and to simplify the understanding of technical words.

Methods of research: The component analysis method, the translation matching method.

Nowadays communication plays an important role. A technical specialist should be able to work with the information from English sources, and foreign texts and be able to translate them correctly. We learn about the achievements of foreign scientists through their publications. However, to understand foreign information is possible only with the help of a translator. In practice, translation often causes difficulties.

The main difficulty in translating technical literature is the translation of special terms. It is necessary to determine the function of a particular word in a sentence.

In English, there are many pair words, which are “verb-noun”. For example, the verb “to supply” means “снабжать, поставлять, давать питание”, the noun “supply” means “снабжение, поставка, запас, питание”;

average (adjective) - “средний”;

average (verb) - “в среднем равняться”;

mean (verb) - “значить, означать, иметь в виду, подразумевать”;

mean (*adjective*) - “средний”;

The second problem is that many words have different meanings. For example, the verb “offer” is more often used in the meaning of “render (resistance)”, “manifest (properties)”, and not “offer”;

point - “problem”, not “point”;

development - “creation, design work” rather than “development”.

Moreover, words are used in different meanings. This applies to verbs in conjunction with an adverb or a noun. Compare: to bring – bring, to bring about – call;

to give – give, then give rise (to) - create, condition, call.

Also, the meaning of the verb depends on the preposition after it; to result in – приводить к чему-то, кончаться чем-либо; to result from – проистекать из, следовать из, получаться из, в результате.

Translation of technical terms also causes difficulties. Sometimes such words cannot be found in dictionaries. Moreover, every day many new words appear. Examples: breakthrough - an important discovery, achievement;

backup - backup unit, part, duplication, backlog;

coupling - implementation, bringing;

valve - an electronic lamp (in radio engineering), a crane (in heat engineering), a heart valve (in medicine).

To sum up, proper translation requires the determination of the grammatical basis in a sentence, the functions of the words as well as the morphological composition and the use of the dictionary.

The translation of technical literature although is difficult but very important for understanding English and developing skills.

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FEATURES OF THE TRANSLATION OF TECHNICAL TEXTS

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Science is a field of knowledge based on various experiments and observations. As a result of scientific achievements, various technical means and equipment are being invented that simplify human’s life. Since there are many different peoples speaking different languages the disseminating of the information about these achievements and discoveries requires the translation of scientific and technical texts into many languages.

The concept of technical translation means the translation of technical and scientific texts with the special terminology without distortion and loss of important information. A term is an emotionally neutral word or phrase that conveys the name of a precisely defined concept related to a particular area of science or technology. Examples of such texts are scientific articles on technical issues, technical documentation for power equipment, guidance on the use of this equipment, etc. [2]

A technical translation of the text should convey the most complete meaning of the original. Any deviations from the original can only be justified by the peculiarities of the language into which the translation is carried out or by the requirements of the translation style.

The style in which the technical text is translated is called scientific. This style is characterized by accuracy, impersonality and non-emotionality, that is, the author of the translation should avoid using phraseological units and idioms, although this leads to the fact that these texts seem uninteresting and “dry”. However, these characteristics cannot reflect all the requirements for the scientific style fully that must be observed when translating technical texts.

The style of scientific literature is based on the norms of the written language, which can be divided into:

1) vocabulary. This is the use of various specific words and phrases (terms) for a more accurate and correct translation, although even the correct term will not guarantee a translation into another language while preserving the meaning that it carries in the original text, because the same words can be translated in different ways;

2) grammar. Only the correct grammatical structures should be used. Passive and impersonal constructions are often used;

3) the method of presentation of the material. Technical translation is a translation of the original part without losing important information and distortion. It is achieved by the logical justification of the stated fact, without the use of emotionally colored words. [1]

One of the main requirements for the translation of a technical text is that the translator must be perfectly aware of the meanings of the terms used in this field of science both in the language of the original text and in the language into which the translation is carried out. The correct translation of the term, in fact, is very difficult but necessary because these terms are more specific than words of common use.

Another important aspect that should be taken into account by the translator is the fact that

science is constantly developing, generating new words and meanings to denote new phenomena. And for this reason, the translating authors should be aware of the latest developments in the field in which they work, and should gradually replenish his terminological reserve.

To sum up, we can conclude the main features of technical texts translation:

1) use the scientific and technical style of expression, avoiding the use of colloquial speech, metaphor, etc.;

2) the translator must have an extensive vocabulary in two languages to be able to communicate specific ideas, including professional and special-purpose vocabulary (and it is desirable to be trained in this field of science).

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УДК 81

PHRASEOLOGICAL UNITS IN THE TECHNICAL LANGUAGE

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There are a lot of phraseological units or idioms in every language. It enriches our speech and makes our language more expressive. Popular idioms can hardly ever be found in scientific texts because expressiveness is not a characteristic of scientific and technical literature. However, a number of phraseological units belong to the technical language and people who use special – purpose words and idioms or professional slang in their speech may not be understood by everyday speakers.

The paper highlights the outcomes of research into several phraseological units used in scientific and technical texts, based on corpus data. The aim is to find out the peculiarities of using phraseological units in scientific and technical-oriented texts and to carry out the correct Russian-English translation. To do this research I used the method of corpus linguistics that is significant to analyze the usage of phraseological units in natural contexts offered by the British National Corpus which contains one hundred million words.

The second method to study the phraseological units was the method of definitions which helped to find out similarities and differences in explaining the meanings of phraseologisms in the following three dictionaries: Cambridge, Webster and Oxford online dictionaries. The method of component analysis and the comparative method contributed to understanding the structure of the phraseological units under consideration. The novelty is that the British National Corpus data are used to study the phraseologisms to expand our knowledge on the use of idioms in a professional context. [5]

The subject of the research is the use of phraseologisms, and idioms are the object of the research. Table 1 shows the meanings of the idioms given in the three largest dictionaries. We can see that Cambridge online dictionary gives the most accurate definitions.

Idiom	LEXICO by Oxford university	Cambridge online dictionary	Webster online dictionary
1.go back to the drawing board	Used to indicate that an idea, scheme, or proposal has been unsuccessful and that a new one must be devised.	to start planning something again because the first plan failed	to start over
2. It's not rocket science	Something very difficult to understand.	Used to say that you do not think that something is very difficult to do or to understand	Something that is very difficult to learn or understand
3. To hold water	Statement, theory, or line of reasoning appears to be valid, sound, or reasonable.	If a reason, argument, or explanation holds water, it is true	To stand up under criticism or analysis

As we know, phraseological units have their linguistic form, which was the basis to develop the current meaning. [2]

"To go back to the drawing board" has been used since WWII in a joke telling about the failure of a design and the need of a new one. It gained common currency quite quickly and began appearing in US newspapers by 1947.

This idiom is made up of the words "go back" and "the drawing board". A drawing board is, of course, an architect's or engineer's table, used for the preparation of designs or blueprints. The phrase originated as the caption to a cartoon produced by Peter Arno, for the New Yorker magazine, in 1941. The cartoon shows various military men and ground crew racing toward a crashed plane, and a designer, with a roll of plans under his arm, walking away saying: "Well, back to the old drawing board".

The following examples demonstrate that the idiom has nothing in common with preparation of designs:

Two situations are about politics.

1) If that referendum produces a "no" vote, realistically the treaty will be dead and it will be back to the drawing board with a vengeance. [4]

2) That was deeply unpopular with pensioners and within weeks he scuttled back to the drawing board, ending up with a complete policy things. [3]

Our analysis based on the British National corpus has shown that the idiom is mostly used in newspapers. [1]

The next important thing to speak in detail is the pattern the idiom is used in. The pattern is a particular way the idiom is used in a context - the words the idiom is "friends with" i.e. what words go with the idiom before or after it.

If we look at the contexts given by the BNC, we can reveal the following pattern.

The idiom is preceded by the verb "must" and "should" next going the idiom and following by "and" with action.This idiom is used as advice or recommendation. [1]

The second phraseologism I would like to tell about is a phrase which started to be used in the 20th century. "It's not rocket science" is used to say that you do not think something is very difficult to do or understand.

This is generally an American phrase. America was one of the first English-speaking countries to start a program for the development of rocket science. The first people who were widely known as rocket scientists were a group of German military technologists, who were transported to the USA in 1945. Their success during the 1940s and 50s in developing the sophisticated technology required for military and space rockets, was the reason for rocket science

being equated in the US public's mind with outstanding expertise. The perceived equation of 'rocket science = something difficult and clever'. The contexts of the following sentences have nothing to do with rocket science:

1) Coaching football is not rocket science and it's not brain surgery. It's a game, nothing more.

2) Driving a car is not rocket science. I don't know why people don't know how to drive better.

3) Using the internet isn't rocket science. Anyone can learn how to use it. [2]

British National Corpus can't give information about using this phrase. So, I got information from the Sketch Engine - and found out that this idiom is always used with the construction "it's not" and followed by "but", "and" or "to do".

"To hold water" means to be correct, valid, sound, or reasonable and to stand up to scrutiny. This idiom has many synonyms or near-synonyms such as hold up, stack up. Used since the 1600's, the idiom alludes figuratively to a container that cannot hold water and thus is useless. When an argument "has holes in it" the same allusion is suggested. As well, the related idiom "Swiss-cheese argument" refers to an argument with holes in it and thus one that "does not hold water." This idiom and synonyms are most often used in negative. For example, "his explanation does not hold water" means that his explanation is flawed in some way or simply false.

The contexts of the following sentences have nothing to do with a container that cannot hold water:

1) The police found that the suspect's alibi did not hold water.

2) The excuses used in high school will not hold water in college. [4]

In the British National Corpus we can see than this phrase is mostly used in newspapers, magazines and non-academic speech.

If we look at the contexts given by the BNC, we can reveal the following pattern for the phraseologism "hold water". The idiom is preceded by the verb "doesn't" and preposition "for". It is evident that the most natural environment for this idiom is a modal verb and an and-phrase. [1]

I have found out what words these phraseological units are accompanied by, but the frequency of their use will be in the focus of our further research. My analysis has discovered the patterns in which these idioms are used. The findings will be helpful to translate texts from Russian into English more accurately and correctly and use them in speech in the proper way.

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FINDING SOLUTIONS TO THE DIFFICULTIES OF TECHNICAL TRANSLATION

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The main goal of the work is to figure out the difficulties of translation of special literature in the field of electronics and electric power engineering and consider problem solving approaches. Solution finding will be based on the technology of corpora usage and sets of texts divided into several sections. A linguistic corpus is a tool that gives information about the frequency of the word usage in different text sections and words mostly relating to terms.

The translation of scientific and technical texts is a rather difficult issue for people without a special degree of translator connected with various branches of science and industry. Technical translation has several features that should be taken into account. First of all scientific and technical style refers to the bookish type of language, which draws up both written (mainly) and spoken language. The basis of the language design of scientific and technical texts is standardization, i.e. selection of a clichéd language variant prescribed for the given communication conditions. The syntactic features of the design include the syntactic completeness of the statement, the presence of analytical constructions, the frequent use of clichéd structures etc. Moreover, the texts of this category are exclusively loaded with special terminology. The frequency of terms here is unusually high, that makes translation process more labour and resource intensive.

The process of translation of scientific and technical texts requires the usage of monolingual and bilingual dictionaries, special directories and catalogues. People search for ways of simplifying the process and use translation applications and online translators. Such programs usually can not cope with the task, because they don't work with scientific literature correctly and don't give the authentic translation of the various terms. Linguistic corpora may be the solution of that problem.

There are two main types of corpora: a single language or monolingual corpus (the most frequent type of corpus) or multiple languages or multilingual corpus. They include several main groups of texts (spoken, fiction, magazine, academic, etc.). The corpus is usually tagged for parts of speech and is used for scientific purposes. Using monolingual corpora we can estimate and predict new trends of using special vocabulary. [1]

Terms in the fields of electronics and electric power engineering are usually formed on the basis of metaphorization mechanism. It means that those words have primary and special meaning. Modern terms used to have certain meaning, but due to technical progress they have gained new special meanings. This is the most conventional way of term formation in different fields of engineering. [1] The table below shows, how the word with primary meaning started being used as a term in the fields of electronics. [2], [3]

Word	Primary meaning	Secondary (special) meaning
circuit	A line, route or journey around a place	The complete path of wires and equipment along which an electric current flows
conductor	A person who directs the performance of an orchestra or choir	A material or device that conducts or transmits heat or electricity, especially when regarded in terms of its capacity to do this

That mechanism of term formation makes the process of finding a correct meaning much

more difficult, because particularly all the terms have a set of various translations. Using corpora we may also estimate the frequency of the usage of the terms in various text sections and find out the most frequent collocations with the terms. The tables below shows the ratio of usage of the words «circuit» and «conductor» in different parts of the language and the most frequent collocations with those words.[3]

Language section	Spoken	Fiction	Magazine	Newspaper	Academic
Frequency of the word circuit	92	127	333	396	446
Frequency of the word conductor	416	572	432	1004	1612

Collocations with the word «circuit»:

№	Collocations	Frequency	№	Collocations	Frequency
1	Board	106	3	Judges	37
2	Short	50	4	Drive	35

Collocations with the word «conductor»:

№	Collocations	Frequency	№	Collocations	Frequency
1	Orchestra	32	3	Lightning	7
2	Composer	11	4	Principal	7

Using such corpora we can analyze and figure out important information about the way how terms are usually used in different sections of language, especially in scientific and technical literature. Commonly used collocations will show us the most frequent variations of term usage in the text and the most preferred translations. Using the set of texts presented in the corpora and information resulted from the analysis, we may create a special translator for different branches of engineering. Based on the mechanisms of neural networks, it could provide the most accurate translation of terms and their collocations, show the examples of the using of collocations in scientific texts and preferred translation of such examples. According to the fact that such translator application should be used by engineers in different branches of science, those examples should be based on the scientific literature, but not the fiction one, as it comes with the most popular translator applications. Taking into account that technical translation deals with the clichéd structures, translation of the key parts of sentences won't change from text to text. Such a program could simplify translation process of scientific and technical texts.

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FUTURE OUT LOOK AT TRANSLATION

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Nowadays news presenters are constantly telling about various meetings of dignitaries from different countries. However, few people think about those who provide understanding among them. They are translators who help maintain the process.

Nowadays online translators facilitate communication. In general, with the help of smartphones anyone will be able to contact easily with foreign citizens. People are wondering whether translators will be in demand in the future. In the distant future the machine will replace the translator. Many different jobs are going to disappear.

The translation service developed by Google in 2006 has led to a real revolution in the translation service market. In 2016, Google Translator introduced a neural machine translation system that learns independently from millions of examples and significantly improves the accuracy of translations made by the service.

The machine translation process works in the following sequence:

- Speech recognition
- Translation of recognized speech

Now imagine a machine and try to translate the primitive daily phrases: “Вааще, ни о чем” or “Да нет, наверное”

Difficulties arise at all three levels, including the individual characteristics of pronunciation, speech defects, background noises, the use of jargon, fuzzy presentation of thoughts, the inability to convey implications expressed by intonation, and much more.

Translation is the process of transmitting thoughts expressed in one language by means of another language. It is very difficult to teach a machine to translate verbatim. In order to do this, you must at least teach the machine to think like people, to feel like people. But when this happens the machine will cease to be a machine.

Machine translation will never be perfect. Each native speaker is able to add new words and new meanings to existing words and change the spelling and grammar. After all, people do it every day, and these examples can be found on social networks websites, in online chats and popular songs.

Computers simply cannot keep up with the ever-changing shades of meanings and associations from hundreds of fields and fields of application, and this is only within the framework of one language. Despite all its technical drawbacks, machine translation will not go far. The reason is humans are not able to translate large amounts of texts in real time.

Rapid growth in the field of machine translation is also affected by two factors. Firstly, the quality of machine translation is constantly improving. The reason for this is our desire to improve the mechanisms for determining the language area. This has become possible by replenishing the

database of the program with sentences translated by man. In addition, we are constantly amending the algorithms of the system in order to improve the work with the order and forms of words. Secondly, a new generation of technical language users is growing up. They can take the initiative and propose better and more accurate terms and forms to communicate their ideas to help themselves and others.

Machine translation will not disappear and be called a "translation". Such a service will be built into every website, mobile and car application. Translation will become a public good, like electricity, plumbing and the Internet: an essential item and one of the basic human rights.

УДК 001

WAYS TO IMPROVE SELF-CONTROL TECHNIQUES OF THE READING COMPETENCE OF FOREIGN LANGUAGE TEXT BY STUDENTS OF TECHNICAL UNIVERSITY

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Nowadays students of any university have the opportunity to travel, participate in international conferences, work in foreign companies and exchange programs and communicate over the internet. Practical mastery of a foreign language has become a means of getting information and educational activity, and, generally, a means of self-education.

Checking the level of skill to extract the necessary and correct information from the context of a foreign language text comes to the first plan. Thus, the relevance of this topic is due to the need to use different methods of self-control to build foreign text reading skills.

The goal of the research is to study different ways of self-monitoring of reading foreign language texts by students of technical universities.

Research objectives are:

1. to study and analyze the methodological literature on the topic of the research;
2. to consider self-control techniques for developing various reading skills;
3. to develop a set of exercises that are suitable for reading skills self-control of foreign texts by students of technical universities.

The object of the study is the process of self-control of the level of the reading skill competence of a foreign language text by students of technical universities.

The subject of the research are the methods and conditions for self-control of the reading skills competence of foreign texts by students of technical universities.

Research Methods are as follows:

1. Theoretical (study and analysis of methodological literature on the topic of research),
2. Empirical (generalizations, methods of induction and deduction).

Organization of control is of a great importance not only for the teacher, but for students as well as the self-control of their activities in the formation of reading skills can become an important factor in their further motivation to get success.

In the educational process, issues of improving reading skill competence are essential.

Reading skills control undertaken by the teacher is mostly aimed at determination of the level of mastery of phonetic, lexical, grammatical material. According to the requirements of the new educational standards at the end of the English language course students should have an exact level of exact competencies. The level of reading skills competence should imply the ability to extract

information specified by task parameters, the ability to recognize the main and secondary informational units. In other words, the student must be able to navigate in the presented text.

To determine the level of the foreign text reading skill, it is necessary to perform tasks for different types of reading: reading for gist, skim reading, scanning, reading for specific information. Control parameters will depend and therefore set on the type of reading. And for self-control, the student needs to have clear understanding of goals presented before reading foreign texts. Self-monitoring acts as a verification and assessment of the acquired material and is a way to achieve personal goals (for example, filling the questionnaires, carrying out business correspondence, preparing a consistent resume, etc.).

Tasks to control reading skills can be quite different - to restore the text, to search for specific information in the text, to fill in the gaps by selection of suitable words [1]. Retelling or summarizing is viewed as one of the options for training reading skills. But it seems to be a bit ineffective at the initial stage of language learning due to the difficulties of expressing thoughts in a foreign language. The use of tests can be quite reasonable in case of both control and self-control. The same is with the usage of mind-mapping control technique, question-answer work, true-false statements, etc. [2]. These control techniques are suitable for the student's self-training as when working with a text, work is carried out at an appropriate pace and tasks are performed in the most comfortable order for every student personally.

S.K. Folomkina thinks that testing is the simplest form of self-control [2]. Since reading is a complex communicative skill, its testing implies differential number of simple elementary reading skills techniques, as well as their complex combinations. Tests check reading comprehension; perception and understanding of language material; reading technique.

To control the process of reading skill competence, a student may be advised to develop exercises for monitoring and mutual control for developing his reading skills. Each specific text has its own features, and depending on this, tasks for a certain purpose should be developed. There are no general forms and methods of control. There are options that are simply more effective.

A technical university student should also master "technical" English, covering general and specialized vocabulary (according to the major they are studying for) [3]. This includes knowledge of vocabulary used in various fields of engineering. There is a lot of authentic literature containing professionally relevant information, but not translated into the native language of students. In addition, the knowledge contained in these books can be successfully used in the professional area of a future engineer. Therefore, in a technical university a foreign language should be and is taught based on technical vocabulary. Special computer programs do calculations mostly in English. This is another reason for taking into account the specific character of the students' future professional activities when teaching a foreign language at a university.

According to a survey among students, everyone recognizes the need to learn a foreign language at a technical university. Moreover, most of the respondents are inclined to the need to study it at all university levels (Bachelor or Master programs). They advocate its exclusively functional orientation, firstly - the ability to extract the necessary information from authentic sources, and secondly - the formation of the term base of an exact major. [3].

Also, the majority of respondents note the importance of the formation of self-and mutual control skills, which may allow to optimize the process of self-training and self-education.

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THE FUTURE OF ONLINE TRANSLATORS

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The date of birth of MP (as a field of research) is considered to be 1947, and it all began with a letter from Warren weaver, Director of the Department of natural Sciences of the Rockefeller Foundation, to Norbert Wiener in March of the same year, in which the task of translation was compared with the task of decrypting texts. The letter at that time was already performed on Electromechanical devices. This letter was followed by many discussions, a Memorandum of purpose appeared, and finally funds were allocated for research. The advantages of online translators are the speed of translation; the ease of use, due to the intuitive interface and great functionality; availability; free of charge; a large selection of languages;

There are some cons of online translators: firstly, the translation is not always accurate, the translation of large and complex texts can’t be made, the same situation with the technical literature; it is necessary to have access to the Internet; the machine translation programs are not able to take into account extra linguistic factors;

How do online translators work: Most of online translators compare the words you have written with their own database of words in two languages and give the translation corresponding to this word in the desired language. Sometimes there are more complex algorithms, when the program, for example, has a whole phrase in the database. Then they are checked. This approach makes it possible to translate sentences more adequately and realistically.

Features that may appear in the near future are worth mentioning: the translator will analyze the whole sentence rather than the words individually to suggest a more suitable translation. You will be able to analyze previous queries to find the right word for this situation, the meaning. Also, translators will become more human voice words, paying attention to punctuation marks and features of the language. Translators will be able to translate slang, phraseology, aphorisms and dialects as accurately as possible. Translators of the future will use neural networks and machine learning technology to understand better the text.

What kind of online translators will appear: most likely, it will also be in the form of an application on a smartphone or a website. Perhaps there will be a separate device, in the form of wireless headphones, which will transmit the voice recorded through the microphone to the smartphone, and then the translation will be transmitted back to the headphones. Perhaps such devices will be able to work without connecting to a smartphone, connecting directly to the database of languages via wireless networks (WI-FI, LTE) or the most popular languages will be stored in the device's memory so that translation can be carried out offline.

СЕКЦИЯ 5
ФУНДАМЕНТАЛЬНЫЕ И ПРИКЛАДНЫЕ ИССЛЕДОВАНИЯ В НАУКЕ

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ENHANCING THE SECURITY OF TRANSFORMATION BASED BIOMETRIC TEMPLATE PROTECTION SCHEMES

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A reliable identity management system is urgently needed in order to combat the epidemic growth in identity theft and to meet the increased security requirements in a variety of applications ranging from international border crossings to securing information in databases. Establishing the identity of a person is a critical task in any identity management system. Surrogate representations of identity such as passwords and ID cards are not sufficient for reliable identity determination because they can be easily misplaced, shared, or stolen. Biometric recognition is the science of establishing the identity of a person using his/her anatomical and behavioral traits.

Commonly used biometric traits include fingerprint, face, iris, hand geometry, voice, palmprint, handwritten signatures, and gait. Biometric traits have a number of desirable properties with respect to their use as an authentication token, namely, reliability, convenience, universality, and so forth. These characteristics have led to the widespread deployment of biometric authentication systems. But there are still some issues concerning the security of biometric recognition systems that need to be addressed in order to ensure the integrity and public acceptance of these systems.

There are five major components in a generic biometric authentication system, namely, sensor, feature extractor, template database, matcher, and decision module. Accordingly, a biometric authentication system can be vulnerable at all five stages of recognition. Moreover, the general vulnerability of biometric system may include intrinsic failures and adversary attacks.

Intrinsic failure is the security lapse due to an incorrect decision made by the biometric system. A biometric verification system can make two types of errors in decision making, namely, false accept and false reject. A genuine (legitimate) user may be falsely rejected by the biometric system due to the large differences in the user's stored template and query biometric feature sets. These intra-user variations may be due to incorrect interaction by the user with the biometric system, such as changes in pose and expression in a face image, or due to the noise introduced at the sensor, such as residual prints left on a fingerprint sensor. False accepts are usually caused by lack of individuality or uniqueness in the biometric trait, which can lead to large similarity between feature sets of different users, such as similarity in the face images of twins or siblings. Both intra-user variations and inter-user similarity may also be caused by the use of non-salient features and non-robust matchers. Sometimes, a sensor may fail to acquire the biometric trait of a user due to limits of the sensing technology or adverse environmental conditions. For example, a fingerprint sensor may not be able to capture a good quality fingerprint of dry/wet fingers. This leads to failure-to-enroll (FTE) or failure-to-acquire (FTA) errors. Intrinsic failures can occur even when there is no explicit effort by an adversary to circumvent the system. So, this type of failure is also known as zero-effort attack. It poses a serious threat if the false accept and false reject probabilities are high.

Here, an adversary intentionally stages an attack on the biometric system whose success depends on the loopholes in the system design and the availability of adequate computational and other resources to the adversary. We categorize the adversary attacks into three main classes: administration attack, nonsecure infrastructure, and biometric overtness.

Administration attack, also known as the insider attack, refers to all vulnerabilities introduced due to improper administration of the biometric system. These include the integrity of the enrollment process (e.g., validity of credentials presented during enrollment), collusion (or coercion) between the adversary and the system administrator or a legitimate user, and abuse of exception processing

procedures.

The infrastructure of a biometric system consists of hardware, software, and the communication channels between the various modules. There are a number of ways in which an adversary can manipulate the biometric infrastructure that can lead to security breaches.

Finally, it is possible for an adversary to covertly acquire the biometric characteristics of a genuine user (e.g., fingerprint impressions lifted from a surface) and use them to create physical artifacts (gummy fingers) of the biometric trait. Hence, if the biometric system is not capable of distinguishing between a live biometric presentation and an artificial spoof, an adversary can circumvent the system by presenting spoofed traits.

When a biometric system is compromised, it can lead to two main effects: (i) denial-of-service and (ii) intrusion. Denial-of-service refers to the scenario where a legitimate user is prevented from obtaining the service that he is entitled to. An adversary can sabotage the infrastructure (e.g., physically damage a fingerprint sensor) thereby preventing users from accessing the system. Intrinsic failures like false reject, failure-to-capture, and failure-to-acquire also lead to denial-of-service. Administrative abuse such as modification of templates or the operating parameters (e.g., matching threshold) of the biometric system may also result in denial-of-service. Given the dramatic increase in incidents involving identity thefts and various security threats, it is imperative to have reliable identity management systems. Biometric systems are being widely used to achieve reliable user authentication, a critical component in identity management. But, biometric systems themselves are vulnerable to a number of attacks. In this paper, we have summarized various aspects of biometric system security and discussed techniques to counter these threats. Among these vulnerabilities, an attack against stored biometric templates is a major concern due to the strong linkage between a user’s template and his identity and the irrevocable nature of biometric templates. We have described various template protection mechanisms proposed in the literature and highlighted their strengths and limitations. Finally, specific implementations of these approaches on a common fingerprint database were presented to illustrate the issues involved in implementing template security. With the growing interest in multibiometric and multifactor authentication systems, schemes that simultaneously secure multibiometric templates and multiple authentication factors (biometrics, passwords, etc.) need to be developed.

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DEVELOPMENT OF A LAYOUT LABORATORY WORK FOR TEACHING STUDENTS A LOCAL AREA NETWORK BASED ON TWO MULTIPLEXERS

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Aims:

1) To develop a layout of a laboratory installation for teaching students how a local area network performs;

2) Development of guidelines for the phased implementation of laboratory work carried out by the students of engineering faculties.

Justification:

The TOR department is a graduating department, that is, it should train the telecommunications industry personnel for work in the production and maintenance of telecommunication equipment. Telecommunication equipment itself is designed to work with already trained technical personnel. To give students the opportunity for fundamental practice in the operation and maintenance of telecommunication equipment, various laboratory and practical works should be introduced into the educational process. Thus, students can take their first steps in gaining skills in working with telecommunication equipment.

In our case, a layout is being developed to study a local data network based on two multiplexers. The structural diagram of the layout is shown in Figure 1.

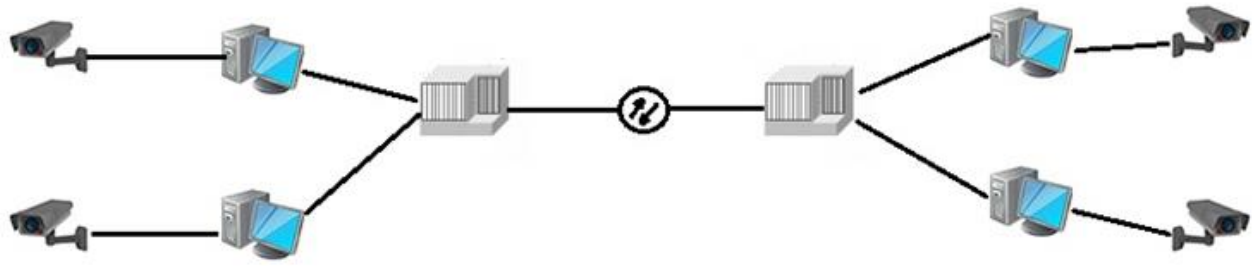

Figure 1 - Structural diagram of the layout of the laboratory setup

The layout will be 4 stations and 2 nodes. Each station consists of a personal computer and a video camera. The node is a NERA AXXMETRO multiplexer. The multiplexer is a gateway converting packet information into STM-1 for transmission to a neighboring node [1]. The station is connected to the node by twisted pair, and the nodes are interconnected by optical fiber.

The list of skills that students should receive when performing this laboratory work [2]:

- ability to solve standard tasks of professional activity;
- ability to work in a team;
- ability to self-organization and self-education;
- ability to organize and conduct experimental tests.

It is assumed that the guidelines will indicate:

- Theoretical foundations of LAN and SDH technologies;
- Brief technical documentation of equipment;
- Description of typical equipment settings;
- Directions for stepwise laboratory work.

When performing laboratory work, the following algorithm of actions is assumed.

Firstly, students study the brief technical documentation of the multiplexer so that they have an idea of the multiplexer, its operation as a whole and its individual boards. This will allow them to lay skills in working with technical documentation and mastering new telecommunication devices.

Secondly, setting the IP addressing of the camcorder, computer and multiplexer. To do this, students need to use different software for each of the devices. This will give a practical understanding of how the local network works and the skills to configure it.

Finally, you need to combine traffic from two stations and transfer it to a neighboring node. One station transmits traffic via fiber optic and the other via radio relay. In case of successful data transmission to each station. Nodes are changed by the transmission medium. Here, students will learn the principle of operation of the multiplexer with various data transmission media.

The acquisition of all this allowed us to achieve the main aim - the possibility of teaching students the general principles of working with telecommunication equipment, which subsequently will improve the quality of training of graduates.

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УДК 629.7.01

OPTIONS TO REDUCE THE MULTI-SIZE PARAMETERS OF THE MULTILEVEL VOLTAGE INVERTER

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Spectral composition plays a significant role in the devices of power electronics in all forms of its use: power rectifiers, thyristor converters and static compensators. Including the updated methods of pulse width modulation (PWM) used to control advanced static converters, such as machine drives, power factor correctors or functional power filters, do not emit flawless sinusoidal signals, which are strongly dependent on the switching frequency of semiconductors. As a rule, with voltage or current converters (because they generate discrete output signals) it is necessary to use machines with special isolation. In some cases, the giant inductances combined in turn with the corresponding load will also be required. In addition, it is well known that distorted voltages and current forms create harmonic pollution, auxiliary power costs and frequency noise, which have every chance to affect not only the power load, but also the associated controllers. All these unnecessary properties associated with PWM converters are likely to be overcome with the support of multi-level converters with the addition of large voltage values. Multilevel inverters can be used not only with the introduction of traditional PWM methods, but also with the support of vector PWM which greatly improves the quality of the output voltage signal. When using amplitude modulation, low voltage harmonics are completely eliminated, generating almost flawless sinusoidal signals (harmonic coefficient below 5%). Another necessary feature is that any converter operates with a low switching frequency, lowering the semiconductor voltage and, therefore, reducing the costs of switching.

Multi-level inverters include an array of power semiconductors and capacitive voltage sources, the output of which generates step-shaped voltages. Switching allows you to add voltage to the capacitor, which achieve the highest output voltage, and power semiconductors must to withstand only reduced voltages. A two-level inverter generates an output force with 2 values (levels) relative to the negative terminal of the capacitor, and a three-level inverter generates 3 voltages, etc. The term multi-level is referred to a three-level inverter. By increasing the number of values in the inverter, the output voltages have more steps, creating the of current in the form of a ladder that contains reduced harmonic refractions. However, the huge number of values increases the complexity of management and creates voltage imbalance. For multi-level inverters 3 various topologies are offered: diode-clamping (with neutral clamps), capacitor (flying capacitors) and cascade multi-element with the separate sources of constant current. In addition, a number of modulation and control strategies have been developed or adopted for multi-level inverters, including multi-level sinusoidal pulse width modulation, multi-level selective harmonic elimination and space-vector modulation.

The most attractive features of multi-level inverters are:

1. They can generate output voltages with extremely low distortion and lower du/dt.
2. They consume input current with very low distortion.
3. They generate less common-mode voltage, thereby reducing the voltage in the motor. In addition, using sophisticated modulation techniques, common-mode voltages can be eliminated.
4. They can operate at a lower switching frequency

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INFLUENCE OF HEAT TREATMENT MODES ON THE DEGREE OF HARDENING BY SURFACE PLASTIC DEFORMATION OF STEEL

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The ideas presented in this paper are related to the field of metallurgy. The novelty of the topic consists in the new method of hardening steels which is used instead of the usual method. The authors have designed an innovative solution for the manufacture of critical structural elements, fasteners for various purposes.

This paper is divided into four sections. Section 1 gives a brief overview of the purpose of the new surface hardening method.

The second section analyses the new invention. The method consists of the fact that the steel casting is forged and quenched from the forging temperature in oil. Then the workpiece is heated to subcritical temperatures (Ac 1 - 5-15 ° C), maintained at these temperatures and subjected to plastic deformation with a compression ratio of 30-60%. This is followed by standard heat treatment,

including hardening and tempering at temperatures of 180-200 ° C. The method allows to obtain steel with a fine-grained structure and a high level of strength characteristics. [3]

In the third section a case study is presented example. 9XC steel casting is processed according to the proposed method. The properties of steel processed according to the known and proposed methods are presented in table. 1, from which it follows that the application of the method can significantly increase the operational properties of steel and reduce the complexity of manufacturing products from it. [3]

Method of processing	Mechanical property		
	σ,N/mm2	KCU,J/s2	HRC
Known method: austenization; deformation of 10-20% during cooling; quenching, intermediate tempering at 500°C; air cooling; rapid heating; quenching and age-hardening	3050	12	62
The proposed method: austenization; heating to temperatures $Ac1$ -(5-15)°C at a speed of 100 deg / min, exposure 2-2,5 hours; plastic deformation 30-60%; secondary quenching with temperatures $Ac1$ +50°C; release 200°C with an exposure of 2 hours.	5100	35	63

Table.1 Properties of steel 9XC after treatment according to the proposed method

The findings of the new methodology are presented in the fourth section. Effect: increased hardness (from 62 to 63 (HRC)), strength (from 3050 N/$mm2$ to 5100 N/$mm2$), fracture toughness (from 12 J/$s2$ to 35 J/$s2$), machining of steel, and steel manufacturing with fine structure.

The application of the method can significantly increase the mechanical properties of steel and reduce the complexity of manufacturing products from it.

As conclusion we can say there is a decrease in grain size in steel after processing to 2-5 microns, an increase in impact strength values compared to similar steels after standard processing, and a decrease in the tendency of steels to manifest a reversible temper brittleness effect. This will expand the scope of steel and reduce the material consumption of products from them. A decrease in the temperature of the viscous-brittle transition to the region of negative temperatures is also observed, which will allow using the products in the north. [3]

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УДК 62.2

LASER IGNITION AND ITS ADVANTAGE

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Nowadays a lot of attention is directed to solving the problem of CO2 emission and to reducing the greenhouse effect. Therefore, we need to reduce the fuel consumption of motor vehicles. In addition to optimizing the vehicle by reducing its running resistance as well designing the drivetrain in such a way as to minimize consumption, it is the engine in particular that offers potential for reducing fuel consumption. The most important contribution towards lowering fuel consumption can be made by the petrol engine, due to the outstanding thermodynamic potential of direct fuel injection [1].

There are some disadvantages of conventional spark ignition. Firstly, location of spark plug is not flexible, as it requires shielding of plug from immense heat and fuel spray. Secondly, flame propagation is slow. Thirdly, erosion and degradation of electrodes at high pressure and temperature. Laser-induced ignition can solve these problems. The combination of technologies (a spray guided combustion process and laser-induced ignition) is of particular interest since ignition in the fuel spray is direct, with the result that the initiation of combustion is secure and unaffected by wear. In addition, potential benefits are no quenching of the combustion flame kernel, the possibility of delivering the beam simultaneously to different positions and the temporal control of ignition.

Research has shown that a bright and hot plasma is produced when a short laser pulse is focused in air. This effect is known as “optical breakdown” and is generally ascribed to multi-quanta ionisation. The power densities required are between 10 and 100 GW/cm2. The plasma that is produced by ionisation absorbs the incident laser beam exceptionally well and heats itself up strongly. Consequently, a rapidly propagating shock wave is produced, causing a clearly audible bang in tests in ambient air [2].

The laser ignition process can be initiated by different mechanisms. In particular, the mechanisms can be divided into laser thermal ignition, laser induced photochemical ignition, laser induced resonant breakdown ignition and laser induced non-resonant breakdown ignition. The most common mechanism used for ignition of a fuel/air-mixture is non-resonant breakdown.

The laser system has a laser transmitter with a fiber-optic cable powered by the car's battery. It shoots the laser beam to a focus lens that would consume a much smaller place than current spark plugs. The lenses focus the beams into a pinpoint of light and when the fuel is injected into the engine, the laser is fired and produces enough energy to ignite the fuel (Fig. 1) [3].

Therefore, laser ignition can enable important new approaches to address global concerns about the environmental impact of continued use of reciprocating engines in vehicles and power plants, with the aim of diminishing pollutant levels in the atmosphere.

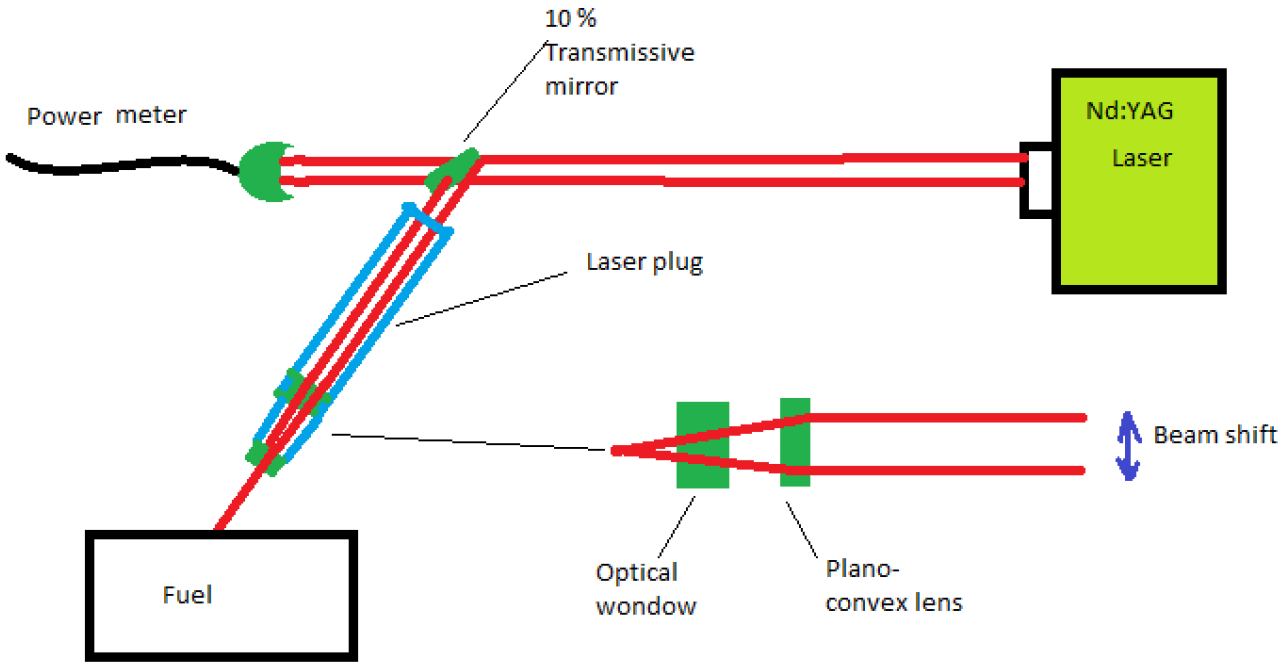

Figure 1 – Laser ignition system

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УДК 004.942

NUMERICAL MODELING OF CHP COMBUSTION PRODUCTS DISTRIBUTION IN THE GROUND LAYER OF THE ATMOSPHERE

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Abstract

The paper presents the results of numerical modeling of the harmful impurities propagation from pipes of thermal power plants, obtained using ANSYS 19.0 (academic) software. The

calculations were performed by a model two-dimensional problem in the framework of the Reynolds averaged Navier – Stokes equations using the ‘k - ω’ turbulence model. The velocity and concentration fields of sulfur dioxide, nitrogen, carbon dioxide and carbon monoxide were obtained. The analysis of the results was made.

Key words
Numerical simulation; stack; harmful emissions; flue gases; speed

Introduction

Currently, environmental protection issues are among the important state tasks. One of the main sources of negative impact on the environment is energy companies.

Thermal power plants make a significant contribution to air pollution (about 27% of the total amount of emissions from the entire industry of Russia). The negative impact on the environment is due to the use of fossil fuels at thermal power enterprises [1].

Today, one of the main tools allowing us to study environmental impacts is mathematical modeling. The effectiveness of computer technology allows simulating numerically the distribution of combustion products of thermal power plants.

The aim of this work is to simulate the local distribution of flue gases at different velocity ratios of their outflow from the chimney.

Experiments

The object of the study is the outflow from the pipe of the Novosibirsk TPP-5, which is one of the largest power plants in the Russian Federation. In this paper, we numerically simulate the flow of sulfur, nitrogen, carbon dioxide and carbon monoxide oxides from a chimney. At the first stage, the stationary model problem is considered in a two-dimensional flat formulation.

The computational domain is a rectangle of 2 kilometers high and 5 kilometers wide. The area includes a chimney of 180 meters long and 8.4 meters in diameter.

The following boundary conditions were set: at the input boundary of the computational domain (left), conditions of type 'velocity inlet' were set, at the output (top and right) - pressure outlet, the condition of adhesion with a given temperature on the underlying surface (lower boundary), at the outlet of the pipe 'pressure inlet' was set, wall condition was on pipe walls.

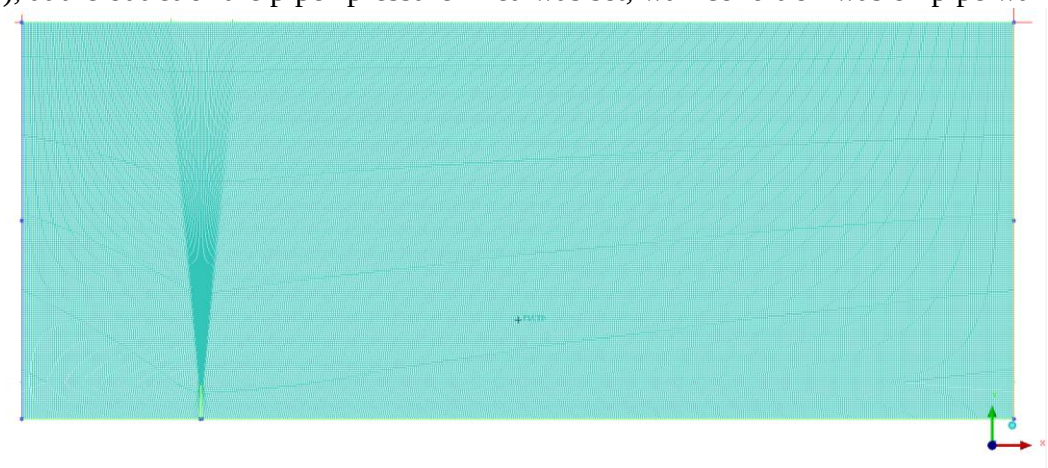

Fig. 1 - Calculation area covered by a grid

The system is solved numerically by the Navier-Stokes equation averaged by Reynolds supplemented by the SST k-w turbulence model. Parameters in the field of solution are atmospheric pressure of 101325 Pa, ambient temperature of 300 ° K, wind speed of 4 m / s.

Pollutants that enter the atmosphere are nitrogen dioxide, nitrogen oxide, sulfur dioxide, carbon oxide (table 1).

Table 1 - The concentration of chemicals in mass fractions

Component	Mass fraction of substance
CO	0,2
CO_2	0,3
NO_x	0,0018
NO_2	0,0009
SO_2	0,0006
Water vapor	0,002

Results and discussion

The results of numerical simulation are the fields of temperature and pressure, velocity and concentration of chemicals (CO, CO2, O2, NOx, water vapor, etc.). An example of the results obtained taking into account pollutants at a speed of 5 m / s can be seen in Figure 2.

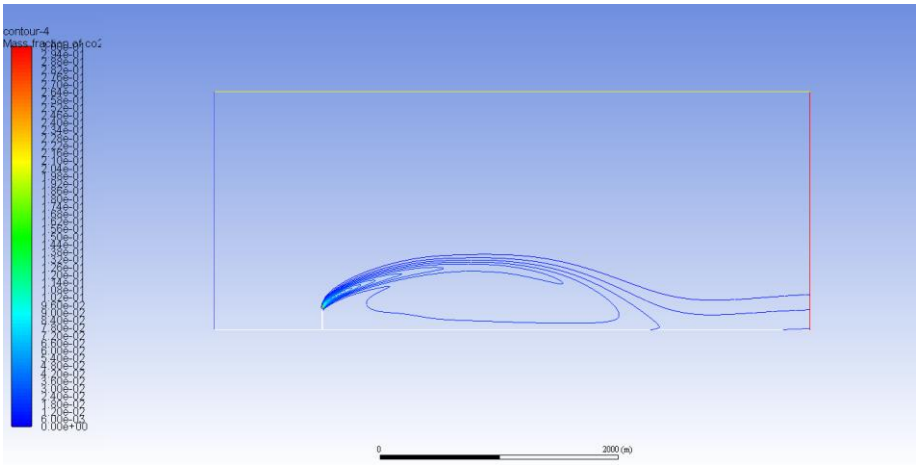

Fig. 2 - The speed of exit from the pipe - 5 m / s

According to the data obtained, it can be concluded that with an increase in the flow rate at the outlet of the pipe, the height of the smoke plume and the concentration of toxic substances increase. The highest concentration of flue gases enters the atmosphere at a speed of 15 m / s, which is provided in table 2.

Table 2 - The amount of harmful substances at the outlet of the chimney (in mass fractions)

Flue gas velocity, m/s	Pollutants			
	SO_2	NO_2	CO	CO_2
5	0,00010	0,00010	0,0312	0,0450
10	0,00015	0,00020	0,0500	0,0700
15	0,00020	0,00030	0,0700	0,0950

An increase in the angular momentum of the jet of emitted gases leads to an increase in the height of the smoke plume and, therefore, should lead to a decrease in the surface concentration of pollutants [2].

Summary

The results of numerical simulation of the distribution of the smoke flow of a CHP pipe were obtained using the ANSYS 19.0 software package (academic). Contaminant profiles were determined by height at different distances from the pipe, as well as zones of flare and smoke transfer if the wind direction is unfavorable for residential buildings in the vicinity of TPP-5.

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УДК 537.226.1

SOME CHARACTERISTICS OF ROUND WAVE GUIDE WITH LONGITUDINAL-IRREGULAR DIELECTRIC FILLING TRANSMISSION

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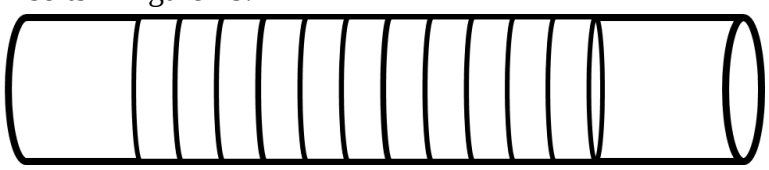
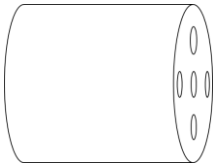
The aim of this work is to study the influence of effective dielectric permeability of cylindrical dielectric inserts with holes on the transmission characteristics of a longitudinal round wave guide by identifying the possible usage of such structures as sensitive sensor for the substance composition. The task was carried out by modeling the structure in CAD ANSYS HFSS. The work of D.A. Usanov and others were based on the study of such structures, but they were included in the rectangular wave guide. The view of this structure is shown in figure 1a, the type of dielectric inserts in figure 1b.



1a



1b

Figure 1: a – Image of a model of round wave guide with dielectric inserts; b – Image of dielectric insert.

Dielectric inserts are made of different materials. The holes in each of these inserts are kept in the same quantity, have the same geometric size and location. While calculating, it was revealed that it takes a lot of time to calculate such geometrically loaded structures. Therefore, HFSS was replaced with a cylindrical insert with holes on solid inserts with effective dielectric permeability in models calculated according to the Maxwell-Garnett formula [2]:

$$\frac{\varepsilon_{eff} - \varepsilon_1}{\varepsilon_{eff} + 2\varepsilon_1} = k\frac{\varepsilon_2 - \varepsilon_1}{\varepsilon_2 + 2\varepsilon_1}, \quad (1)$$

where ε_1 – dielectric permeability of the insert material; ε_2 – the hole's dielectric permeability; ε_{eff} – resultant effective dielectric permeability.

As the length of the inserts increases, the characteristic becomes too rugged, due to rereflections arising from the fenomenon that the wavelength and insertion length are commensurate. Therefore, it was decided to reduce the inserts length. The most optimal dependence (with small losses and a high reflection factor) of pass factor on frequency was obtained at a spastic length of 2 mm.

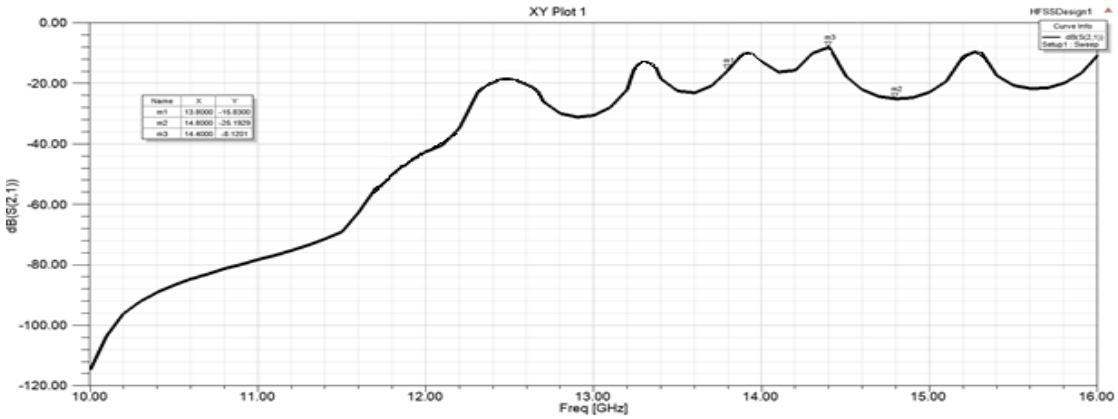


Figure 2 - Frequency dependence of transmission coefficient when the dielectric permeability of the environment changes (ε=2)

Figure 2 shows five frequencies with the lowest passing ratios. The lowest pass ratios correspond to the highest reflection ratios. The reflection on these five frequencies is observed with a certain step. This step depends on how long the wavelengths are in the dielectric inserts and the dielectric permeability of the controlled substance. The dependence of frequency changes on the dielectric permeability of the substance is represented in Figure 3.

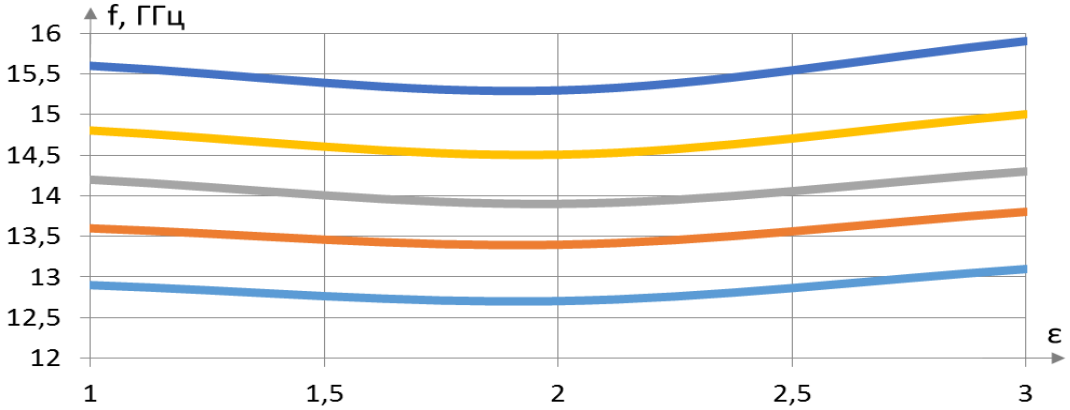


Figure 3 - Frequency change dependence on dielectric permeability

The graph section shown in Figure 3 is used from one to two in order to analyze gases whose dielectric permeability varies from one till two. From two to three section is used to analyze liquids whose dielectric permeability varies from two to three, depending on the heavy fractions presence. Thus, studies have shown the possibility of usage a sensitive element based on a round wave guide with dielectric inserts containing cylindrical holes to control the composition of the substance.

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УДК 67.014

RESEARCH OF THE STRUCTURE OF THE COMBINED DESIGN (E76 AND 12X18H10T) OBTAINED BY THE SURFACE METHOD

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The aim of this work is to study the structure and properties of an inhomogeneous structure obtained by surfacing technology, at the surfacing mode with the current strength of 175 A.

The combined structure, consisting of dissimilar steels, is used as a material for the manufacture of turnouts, where E76 is the end of the rail, steel 12X18H10T is an intermediate insert.

Technology for connecting elements of the railway track is surfacing. This technology allows to minimize the appearance of a high-strength layer in a welded joint with a martensitic structure, which has a low resistance to cracking. Therefore, surfacing improves the reliability of the structure [1].

Surfacing modes determine the quality of the weld. The strength of the welding current directly affects the structure and properties of the deposited layer. The performance of the process, the thickness and width of the deposited layer depend on the strength of the welding current [2]. The current parameter should be selected depending on the thickness of the processed surface. The range of current strength can vary from 80 to 250 A. The fraction of the deposited metal in the weld should decrease, and martensite will be released in smaller quantities with increasing current strength. For this study, samples were selected with a thickness of 20 mm, the arc current was 175 A. Surfacing was carried out in a single layer.

Structural studies were carried out using an optical microscope. The features of the seam are as follows: it has a characteristic shape for surfacing, there is a bulge in the upper part, as well as melting lines on the sides of the seam, which tend to be parallel to the base material. When the layer appears, there is a slight difference in the penetration depth, approximately 1 mm (Fig. 1).

Figure 1 - The microstructure of the sprayed layer at a magnification of 10 times.

Figure 2 shows the structure of the deposited metal: (1) dendritic structure (columnar), region (2) indicates the place where surfacing defects, i.e. flows, are formed. In the heat-affected zone (3), new components are being formed, which were absent in the steels before welding and correspond to the martensitic structure. Thus, quenching structures are inevitably formed in the weld. In region (4), there are pearlite platelet colonies, which correspond to the structure of E76 pearlite steel.

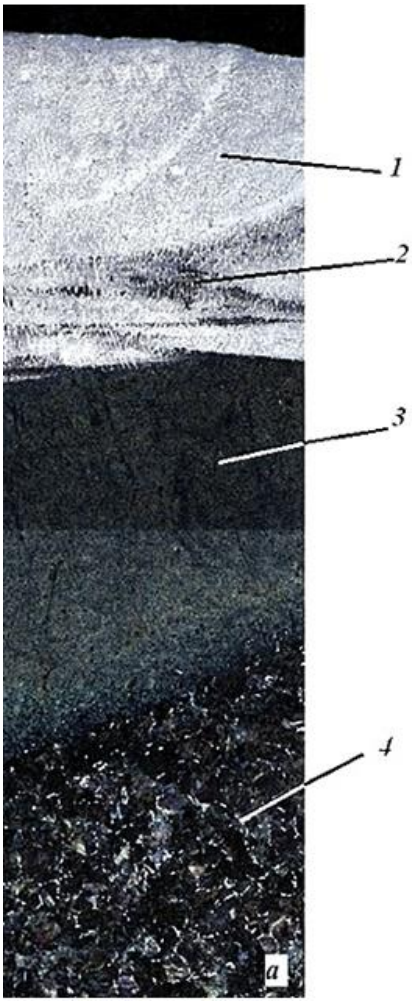

Figure 2 - General view of the compound at a magnification of 100X.

The main defect found in the seam was the influx of E76 into the deposited layer. This happened due to diffusion processes and led to the development of chemical heterogeneity (Fig. 3).

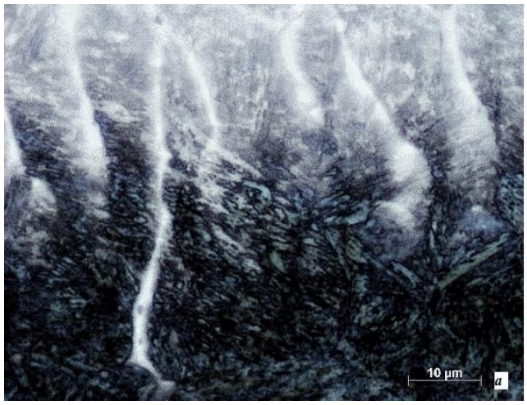

Figure 3 - The interface between the steels.

Also in the heat affected zone, separate, insoluble during melting large inclusions of chromium carbonitrides are observed. The presence of inclusions of this type is determined by the presence of chromium in the austenitic steel metal.

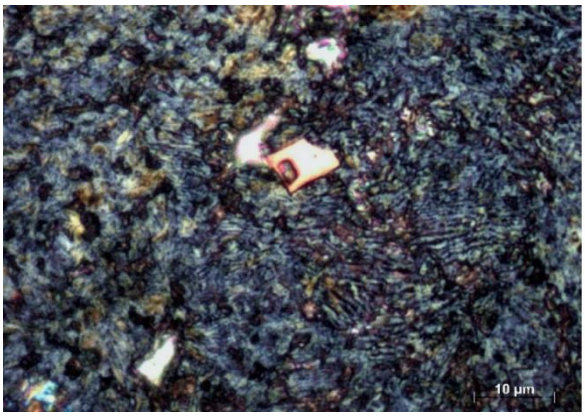

Figure 3 - The formation of carbides in the heat affected zone.

Thus, in this work, the study of the structure and the detailed description of its components were carried out. Combined structures obtained by surfacing are very reliable and quite applicable for the manufacture of railway track elements.

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INCREASE WEAR RESISTANCE OF PARTS COMPRISED OF TITANIUM ALLOYS

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The production of a number of parts and constructions of responsible machines is impossible without the use of titanium and titanium-based alloys. The most widely used titanium alloys are used in medicine, chemical industry, astronautics, aircraft and shipbuilding, as titanium has a complex of unique properties, such as high specific strength, high corrosion resistance in many corrosive environments, low density. However, one of the significant drawbacks of titanium is the low level of antifriction and tribotechnical properties, caused by low hardness and tendency of titanium to setting when working in friction units. This limits their use in the manufacture of friction and wear parts.

Many experts have tasked themselves with developing effective titanium lubrication to reduce friction and increase setting resistance. However, none of the proposed materials are universal and do not guarantee that there is no adhesion in the friction points.

Thus, an actual scientific task of great importance is the development of methods for improving tribotechnical properties of titanium and its alloys, which will significantly expand the scope of their application.

All metallic hardening methods can be divided into two groups: volumetric and surface. Volumetric hardening methods include heat treatment, rolling, and severe plastic deformation methods. Volumetric methods do not lead to significant changes in the wear resistance of titanium alloys. Therefore, one of the effective solutions to this problem is the formation of high-strength surface layers with high wear resistance on titanium alloy parts.

Laser cladding provides coatings characterized by different degree of dilution of the welded materials with the base metal. The metallic bonding that occurs during surfacing contributes to the high adhesion properties of the coatings. Their quality and thickness largely depend on the parameters of laser processing, composition and size of the cladding mixture particles, as well as the composition and properties of the matrix material. The disadvantage of the method is the high reflectivity of metals, which leads to a decrease in the thickness of the hardened layers and to a decrease in the performance of laser surfacing.

In the paper [1], for improving wear resistance of titanium in the conditions of dry friction of sliding at contact with ceramics, technology of laser cladding of graphite has been used. The thickness of the graphite layer was 18-22 microns. Tests of clad materials were conducted under conditions of dry sliding friction. The authors have shown that inclusions of titanium carbide and graphite present in the molten zone improve tribological properties of titanium. The friction graph acts as a solid lubricant.

Electron-beam surfacing can be vacuum or extra-vacuum. The use of vacuum chambers significantly increases the cost and complexity of machining large parts. In addition, the processing of some materials may produce metal vapours that adversely affect the process equipment. Therefore, extra-vacuum electron-beam cladding is more promising.

It was shown in [2] that in the process of extra-vacuum electron-beam treatment, the alloying elements dissolve completely and during crystallization form a nonequilibrium zaetectic or eutectic structure consisting of primary crystals and eutectics based on TiC, TiB or TiN. When SiC silicon carbide is added to the cladding mixture, a new phase of Ti5Si3 is formed [2]. The hardness of the coatings obtained is 2 times higher than the hardness of the base metal and decreases in the direction from the surface to the interior of the material. The coatings hardened with carbide and titanium silicide have maximum wear resistance. Further on, the level of wear resistance is followed by the coatings obtained during the cladding of boride and titanium nitride powders. The authors have shown that the level of wear resistance of coatings largely depends on the volume fraction of high-strength inclusions present in them.

Such methods of increasing the wear resistance of titanium alloy VT23M as oxidation, detonation and ion-plasma spraying were considered in [3]. Anodic oxidation in pulse mode increases surface hardness, prevents contact corrosion and helps to retain lubricant. This coating does not reduce the purity of the surface and does not adversely affect the mechanical properties of the titanium alloy. In this paper, anodic oxide coating 18-20 microns thick was applied in pulse mode for 1 hour, with a maximum voltage of 200 V. Relatively low wear resistance of the resulting anode oxide coating is related to its porosity, which increases with the thickness of the coating. Obviously, the thickness of the coating should be slightly reduced to increase wear resistance.

The method of ion-plasma sputtering is used for surface hardening of parts operating under conditions of contact interactions at elevated temperatures. The high and widely adjustable energy of the applied particles allows to obtain coatings from various materials with high adhesion to the base. The TiN coating obtained on the MAP-3 ion-plasma unit has a thickness of 10 μm and linear wear ≤1 μm [3]. This coating is characterized by high hardness (2500 HV50), low roughness (Ra <1 micron), high inertness of the compound and the value of adhesive strength to the substrate (>100 MPa). The disadvantage of this method is the technological limitation on the size of the workpiece, as the process takes place in vacuum chambers.

Detonation spraying is a type of thermal spraying. One spraying cycle allows to apply coatings with thickness not exceeding 5-6 microns. Detonation spraying is designed to produce hard coatings based on high-temperature compounds: carbides containing small amounts of metal binders, various oxides and their mixtures. In this paper [3], spraying of the WC-Co coating was carried out on a CCDS2000 machine. The WC-Co coating is 80-100 μm thick and has a linear wear rate of ≤1 μm. The

coating hardness is 1400 HV50. Increasing the wear resistance of the WC-Co coating is achieved by forming an optimal coating structure: a soft Co matrix and solid tungsten carbide inclusions. The disadvantage of the WC-Co metal-ceramic coating is the necessity of machining the product after coating, as the roughness after coating is Ra = 2.5-6.3 microns, which leads to increased wear, compared to a smooth (Ra < 1 microns) surface.

While choosing a method to increase wear resistance of details from titanic alloys, it is necessary to consider durability of coupling of a covering with a surface, adaptability of a method, its influence on the change of the detail sizes. Despite the large number of scientific publications in the field of increasing the wear resistance of titanium alloys, a single method to be used in industry has not been found. But the production of antifriction coatings from other materials is a promising way to create a wear-resistant titanium alloy.

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УДК 553.98.04.003.13

METHODS AND MEANS OF DESIGNING AND DEVELOPING AN INFORMATION SYSTEM FOR ACCOUNTING AND MANAGEMENT OF GAS INDUSTRY FACILITIES

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ABSTRACT

The article is devoted to the research of existing methods, models, algorithms for constructing information systems (IS). A comparative analysis of existing systems with the identification of advantages and disadvantages has been done. The aim of the development is to increase the efficiency of gas supply systems. An interactive diagram of the transport objects and gas distribution is considered.

KEYWORDS

Information systems, objects of the gas industry, accounting and control of objects, interactive diagram, network visualization, optimal connection point.

The role of the gas industry is great and obvious. Currently, paper technologies are used for accounting and control, distribution, and search, which requires temporary human resources, therefore the development of a universal information system for accounting and control of gas

industry facilities is an urgent task. The aim of the development is to increase the efficiency of gas supply systems by improving their organizational structure and management methods. In our research we will focus on development of an interactive diagram of gas transportation and distribution facilities. An interactive diagram of gas transportation and distribution facilities will provide the implementation of the following functions: automatically accumulate information on gas distribution networks; develop a predictive model of gas consumption in the gas distribution network; evaluate the technical capability of gas supply to potential consumers; define the optimal connection point of the consumer to the gas distribution network; provide visualization of information about the capacity of the gas pipeline network in the regions of the Republic of Tatarstan, in real time.

When considering the methodology for building information systems, it was decided to collect the necessary information on consumers and to employ the bottom-up method and the principle of "dualism" and multicomponent. Methodology such as SADT. I propose to use the Spiral Strategy (Evolutionary or Iterative model developed by Barry Bohem, 1988) which considers development as a sequence of versions, but not all requirements are defined at the beginning. Requirements are specified as a result of development.

Information system of gas transportation and distribution facilities (IS GTDF) consists of the following components: Web portal that provides interaction with users; application and document management subsystem that is the central subsystem responsible for registering an application and for ensuring the operation of a given business process for fulfilling an application; storage is a component responsible for storing geodata, metadata, documents, applications; security zone verification subsystem is a subsystem responsible for checking the intersection of a land plot taken from Roskadastr (State Land Registry) with security zones; subsystem for calculating connection options and managing gas reserves is a subsystem responsible for checking the technical feasibility of connecting; technical conditions (TC) development of subsystem is a subsystem responsible for compiling a TC document.

The implementation will significantly reduce the time and administrative costs of managing IS, increase the security and reliability of the data. It will also significantly reduce user overhead associated with the need to use a large number of IS. It will allow to take rational decisions on the directions of development of the gas distribution network. It will provide an opportunity to apply technical requirements through the web portal of applications, as well as it will allow an automated testing of the possibility of gas supply to new consumers. The development of an interactive informational diagram of gas transportation and distribution facilities as a method of reducing information distortion is a priority in the gas industry.

УДК 678.7-1

APPLICATION OF WETTING ANALYSIS TO STUDY THE POLYMER SURFACES

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A property that is of great importance for practical application, namely for processes such as adhesion, surface resistance to various liquids, coating, etc., is the wettability of solid surfaces with various liquids. Wettability is typically characterized by surface free energy (SFE) and surface structure. If the surface structure of the material can be adjusted, giving the surface a smooth or

roughened appearance, using various tools and equipment, for example, grinding disks of a grinding and polishing machine, then the SFE is mainly regulated by the composition of the components used in the material. Thus, surface properties can be changed by alter one of these factors, or by combining them [1]. Some special surface properties, such as hydrophobicity, can be achieved by incorporating various dispersed particles with low surface energy into the composition of the material. This trend is often observed in composite materials obtained by a combination of a matrix and filler, where liquid resin acts as a matrix, and fibers, dispersed powders, flakes, etc. act as reinforcement [2].

Today, there are several methods for determining the SFE material, differing in their complexity, equipment used and applicability to certain objects of study: reverse gas chromatography (GC), atomic force microscopy (AFM), measurement of contact angles of wetting, Wilhelmy plate weighing method. The most suitable method for measuring the SFE of flat surfaces is the contact angles method, with which excellent research results are obtained in combination with the low complexity of the experiment.

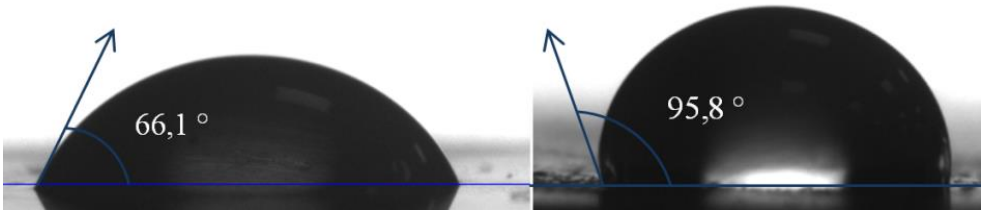
In this work, we studied the surface properties of composite materials based on epoxy resin brand ED-22 (GOST 10587–84) and hardener brand polyethylene polyamine (PEPA) (TU 6-02-594–85), filled with dispersed particles, namely, crystalline graphite brand GL-1 (GOST 5279-74) in the amount of 1, 3 and 5% of wt.

For research, samples with a smooth surface were used, which were achieved on a LaboPol-35 grinding and polishing machine (Struers). Structural studies of the materials were carried out on a GX-51 benchtop scanning electron microscope (Olympus). The structure of the filled samples, during the study under a microscope, appears to be homogeneous - graphite particles are evenly distributed over the entire volume of the resin. This ensures stable results during various tests.

To evaluate the SFE, the contact angle θ was measured on a KRÜSS DSA 20 (Easy Drop) setup using the lying drop method. The essence of the method is that a drop of liquid with a known surface tension is placed on a solid surface with a syringe. To assess the shape of a lying drop, the length-width method was used — the spreading length of the drop and its height were estimated, and the circle method — the drop is represented as part of a circle. The results of measuring the surface properties of the composites are presented in table 1, which shows that the introduction of dispersed particles of graphite brand GL-1 made it possible to reduce the SFE and increase the contact angle of the base polymer without filler. The highest contact angle is achieved at 5% of the mass. graphite (Figure 1), which makes the surface of the composite hydrophobic.

Table 1 - The values of the energy characteristics for polymer samples

№	Name of polymer sample	SFE values, mJ/m^2			The average value of contact angle of distilled water with samples, º
		γ_{sv}^{d}	γ_{sv}^{p}	γ_{sv}	
1	ED-22+PEPA	10,09	24,76	34,85	66,1
2	ED-22+PEPA+GL-1 (1% wt.)	14,29	12,03	26,32	81,3
3	ED-22+PEPA+GL-1 (3% wt.)	17,51	2,61	20,12	97,3
4	ED-22+PEPA+GL-1 (5% wt.)	19,12	3,07	22,19	95,8



A b

Figure 1 - Drops of distilled water on the surface of the substrate from:
a - ED-22+PEPA, b - ED-22+PEPA+GL-1 (5% wt.)

Thus, all filled samples have a uniform structure; hydrophobic surface is achieved at 5% wt. graphite filling: maximum contact angle is 97,3º.

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УДК 622.691.4.054

AUTONOMOUS DC POWER SUPPLY SYSTEM BASED ON RESONANT STRUCTURES WITH SWITCHABLE CAPACITORS

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The article considers a two-level DC power supply system based on resonant structures with switched capacitors, designed to power autonomous consumers with different voltages. The relevance of the development and application of such systems is justified by the real possibility of a comprehensive improvement of its energy and mass-size indicators due to the replacement of non-technological transformers and throttles with multilayer ceramic capacitors and soft switching of transistor switches.

Since the specific energy performance of modern multilayer ceramic capacitors is approximately 100 times higher than that of non-technological transformers and reactors, when creating Autonomous power supply systems powered by low-voltage primary current sources (batteries, fuel cells, etc.), it is advisable to use step-up multi-level DC power supply systems based on resonant structures with switchable condensers (Fig. 1) [1].

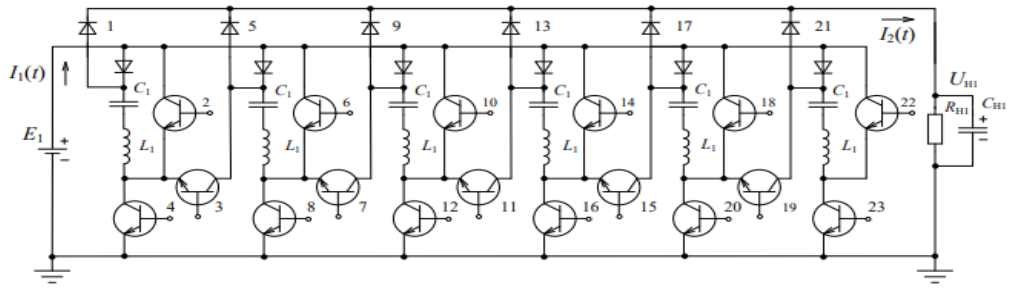

Figure 1-schematic diagram of the power circuit of the increasing two-level DC power supply system

Power circuit multilevel DC power supply system is an array of N identical transistor-diode inductive-capacitor circuits, combined into subsystems that work on the load of the consumer. In the general case, a separate subsystem as a part of multilevel DC power supply system is one or several multi-cycle DC-DC converters with given values of conversion coefficients.

The choice of structure is carried out depending on the required conversion factor and the value of the load current. Changing the structure of two-level DC power system is carried out by switching transistor keys (3, 7, 11, 15, 19), (2, 6, 10, 14, 18, 22) [1].

The two-level DC power system can be in different States characterized by a set of independent parameters m_j, k_j, N_j, where m_j is the number of parallel connected identical step-up multi-cycle DC converters, which determines the multiplicity of discrete time symmetry, each of which includes a certain number of k_j, identical Converter modules containing each N_j transistor-diode inductive-capacitor chains. In this case, the order of discrete time symmetry of the two-level DC power system is determined by the expressions

$$k_c = m_j \cdot k_j \text{ для } k_j = 1 \text{ and its even values;}$$
$$k_c = 2 \cdot m_j \cdot k_j \text{ for odd values } k_j \geq 3.$$

In particular, a two-level DC power system consisting of six inductive-capacitor circuits can be in nine different States, described by the following sets of parameters

$$\begin{gathered}
(m_{1,1} = 1, k_{1,1} = 1, N_{1,1} = 6, K_{п1} = 7, k_{c1} = 1),\\
(m_{1,2} = 1, k_{1,2} = 6, N_{1,2} = 1, K_{п2} = 2, k_{c2} = 6),\\
(m_{1,3} = 1, k_{1,3} = 3, N_{1,3} = 2, K_{п3} = 3, k_{c3} = 6),\\
(m_{1,4} = 1, k_{1,4} = 2, N_{1,4} = 3, K_{п4} = 4, k_{c4} = 2),\\
(m_{1,5} = 2, k_{1,5} = 1, N_{1,5} = 3, K_{п5} = 4, k_{c5} = 2),\\
(m_{1,6} = 2, k_{1,6} = 3, N_{1,6} = 1, K_{п6} = 2, k_{c6} = 12),\\
(m_{1,7} = 3, k_{1,7} = 2, N_{1,7} = 1, K_{п7} = 2, k_{c7} = 6),\\
(m_{1,8} = 3, k_{1,8} = 1, N_{1,8} = 2, K_{п8} = 3, k_{c8} = 6),\\
(m_{1,9} = 6, k_{1,9} = 1, N_{1,9} = 1, K_{п9} = 2, k_{c9} = 6).
\end{gathered}$$

In this case, the first four States have a unit multiplicity – $(m_{1,1} = m_{1,2} = m_{1,3} = m_{1,4} = 1)$, two States $(m_{1,5} = m_{1,6} = 2)$ have a multiplicity equal to two, two States $(m_{1,7} = m_{1,8} = 3)$ have a multiplicity equal to three and one state has a multiplicity $(m_{1,9} = 6)$. In this case, the second and ninth, as well as the fourth and fifth States are identical. Thus, in this case, a two-level DC power system can be in seven independent States [1].

Their implementation is carried out by cutting off a group of transistor keys as part of the power circuit two-level DC power system.

The advantage of two-level DC power system is also that it provides reliable power supply due to the possibility of reserving elements of its power circuit.

Transistor switches commute identical Converter modules consisting of inductive-capacitor circuits.

Conclusion: we have considered a two-level DC power system based on resonant structures with switchable condensers, the state of which varies depending on the required conversion coefficient and the load current of the consumer.

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УДК 519.2

DETERMINATION OF CRITICAL PARAMETERS OF SOME MODELS OF BINARY IMAGES DESCRIBED BY GIBBS RANDOM FIELDS

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The modeling of binary texture images described by Gibbs random field with given distribution, is founded on a stochastic relaxation procedure which is realized, for example, in the iterative Metropolis–Hastings algorithm [1]. To devise a Gibbs model of a digital image, a random field is represented in a form of a set of discrete random values associated with points of a rectangular lattice [2]. Each image element $x_{i,j}$ in a lattice point with coordinates i, j interacts with neighboring elements, and it determines their probabilistic dependency. A set of lattice points assumed to be pairwise neighboring is called a clique [3]. Gibbs distribution is given by the following expression

$$P(X = x) = Z^{-1} exp(\sum_{c \epsilon C} V_c)$$

where $V_c(\cdot)$ is a clique potential, $C=\{c\}$ is a clique system, Z is a normalizing constant.

In texture image modeling on the basis of Gibbs probability distribution, an occurrence of a phase transition has a strong impact on the nature of images. Thus, for correct use of the procedures and proper interpretation of modeling results it is necessary to know critical values of parameters of probability distribution.

Some models of Gibbs random fields were investigated such as Ising model, anisotropic Ising model and a model of a binary field with vertical, horizontal and diagonal cliques. Qualitative changes of images nature while modeling on the basis of such models were experimentally observed. Critical values of probability distribution parameters when the nature of the modelled realizations sharply changes that corresponds to phase transition are determined.

Thus, from the undertaken researches it is obvious that the problem of determination of critical distribution parameters values is relevant as critical parameters of distribution influence a qualitative nature of field realizations. This task remains still topical for more complex Gibbs models with more complex geometrical structure of cliques.

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УДК 621.373.8.

SCHEMES OF INTRODUCTION OF LASER RADIATION IN LASER-ELECTROCHEMICAL MACHINING

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Laser-electrochemical dimensional machining is one of the promising methods of machining hard-to-process materials and materials with special (unique) properties. The perspectivity of this treatment is confirmed by a number of works [1-3], which showed that this method allows to increase the rate of electrochemical dissolution of materials such as tungsten-free hard alloys, stainless steel, tungsten-cobalt alloys, amorphous nanocrystalline alloys. However, these works are of a research nature, that is, they were performed using an electrochemical cell, specially manufactured for the implementation of polarization techniques used in electrochemical processing. Further development of this subject requires the development of technological schemes for the implementation of this method of treatment. And initially it is necessary to determine the location of the treated surface in space (Fig. 1).

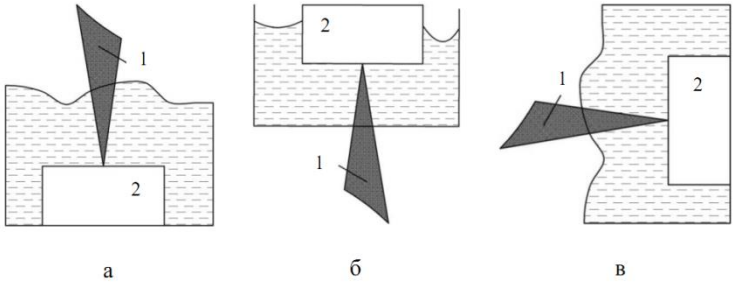

Fig. 1. - The location of the treated surface in space
a - horizontal, b - from above horizontally, V - vertically,
1-laser radiation, 2-workpiece

In case a (Fig.1) laser radiation hits the surface from above, passing through the electrolyte layer during processing. The advantage of this variant of introduction of laser radiation is the simplicity of its implementation. However, in the case of application of aqueous solutions of salts using potentials close to 5 V on the treated surface begins the process of oxygen recovery, accompanied by intense gas formation on the surface. Bubbles in turn will rise from the surface and fall into the zone of propagation of laser radiation, causing it to dissipate. This will lead to the subsequent uncontrolled distortion of the trajectory of the laser radiation. In addition, it is possible that the products of the electrochemical dissolution reaction (oxides, films) under the influence of gravity will be deposited on the treated surface. All this makes such a mutual arrangement of the treated surface and the trajectory of laser radiation is not promising.

In case b (Fig. 1) laser radiation is supplied from below through the liquid. In this case, the reaction products will be under the action of the forces of gravity to settle down, continuously falling into the zone of passage of laser radiation through the electrolyte. Gas bubbles released as a result of electrochemical processes will accumulate on the treated surface under the action of the pushing forces. This will lead to the fact that the laser radiation will be scattered on them, and pre-broken, which will inevitably lead to uncontrolled changes in the trajectory and geometry of the laser beam. Constant pumping of the electrolyte could correct this situation, but will complicate the design of the equipment. Therefore, this option is also not promising.

In the vertical position of the workpiece (Fig. 1, C) the products formed during electrochemical reactions move downwards under the action of gravity and are not delayed in the zone of laser radiation, and the gas bubbles rise up because of the pressure difference in the liquid volume and inside the bubble. This will allow without the use of additional means of mixing the electrolyte to update the treatment zone. Therefore, the use of this mutual arrangement of the laser radiation propagation trajectory and the treated surface is the most attractive.

Thus, in the implementation of laser-electrochemical treatment, the most promising in terms of simplicity of implementation is the vertical arrangement of the treated surface, when the purification of the surface from oxides and formed bubbles occurs due to natural physical processes.

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УДК 620.178.1

INFLUENCE OF ELECTRON BEAM CURRENT ON MECHANICAL PROPERTIES AND STRUCTURE OF WEAR-RESISTANT COATINGS BASED ON NICKEL DOPED BY BORON

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In modern materials science one of the important tasks is to increase the durability (service life) of machine parts operating in conditions of intense wear. It is possible to increase the service life of a part using methods of surface hardening, such as plasma spraying, laser cladding, electron beam processing, and others. Among them, one of the promising methods of surface hardening is non-vacuum electron beam surfacing. The main advantages of this technology include the ability to process large parts due to the withdrawal of the electron beam into the air, high accelerator power (up to 100 kW) and high speed of coating formation [1].

The purpose of the work was to study the effect of the electron beam current on the properties and structure of coatings obtained by non-vacuum electron beam surfacing of the self-fluxing PN77X15C3P2 alloy additionally doped with boron. Surfacing of powder coatings was carried out on stainless steel plates.

Powder coatings were deposited on stainless steel plates 100 × 50 × 12 mm in size. A self-fluxing alloy of the PN77X15C3P2 with the addition of boron in a volume of 10% was used as the

coating material. Powder mixture was deposited using the following parameters of the electron beam exposure: the beam current (I) was 24 and 25 mA, the electron beam velocity (v) was 15 mm/s. Structural investigations were carried out using Carl Zeiss Axio Observer Z1m and Carl Zeiss EVO 50 XVP microscopes. Microhardness level of face-hardened materials was measured using half-automatic Vickers microhardness tester Wolpert Group 402 MVD. Load on diamond indentor was 0.98 N. Relative wear resistance of samples was tested in conditions of friction against fixed abrasive particles according to the procedure, described in Russian National Standard GOST 17367-71. Stainless steel 12X18H9T was used as the reference material. During the tests, samples were pressed with a load 4 N against rotating abrasive paper, simultaneously moving in the radial direction. The mass loss and wear resistance of the samples was estimated according to the procedure described in the aforementioned standard.

Metallographic studies have shown that when surfacing a self-fluxing powder with the addition of boron, surface modified materials with a dendritic structure are formed. It should be noted that the thickness of the deposited layer obtained by surfacing with a beam current of 24 mA was 2.5 mm. The coating obtained by surfacing with a current of 25 mA had a larger thickness of 3 mm. This is due to the fact that with an increase in the beam current and, accordingly, with an increase in the energy input, the temperature increases to which the surface is heated, and therefore the penetration depth of the material also increases. An analysis of the results of durometric studies has shown that the microhardness of the samples obtained at 24 and 25 mA currents does not differ significantly and amounts to 650 - 700 HV. According to the results of the friction test on rigidly fixed abrasive particles, the maximum level of relative wear resistance was demonstrated by the material formed by surfacing a powder mixture of self-fluxing nickel alloy with 10% of boron obtained at a beam current of 24 mA (Fig. 1). Its wear resistance exceeds the wear resistance of the standard 1.7 times. A sample obtained at a beam current of 25 mA showed less wear resistance. This is due to the fact that with an increase in the beam current, the penetration depth of the material increases and, therefore, the dilution of the deposited material with a less durable base material increases too. In this case, the microhardness of the sample obtained by surfacing self-flux PN77H15C3P2, not doped with boron, is only 350-400 HV.

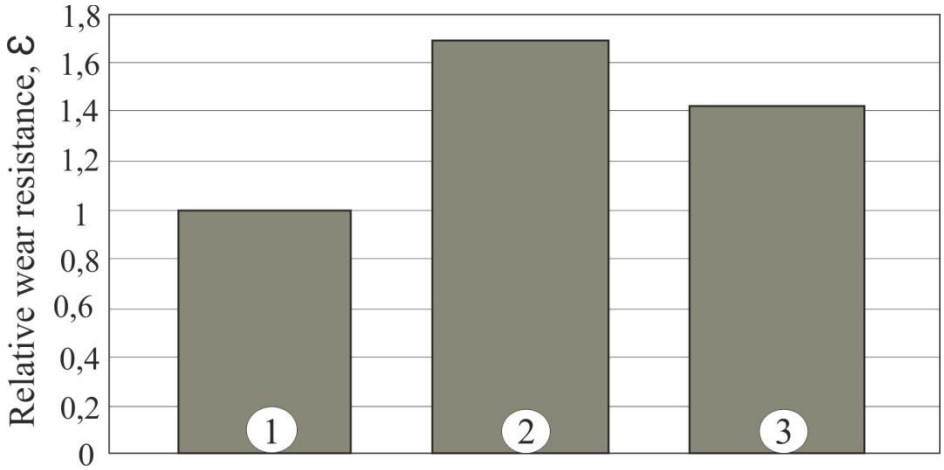

Fig. 1 - Relative wear resistance of materials under the influence of fixed abrasive particles:
1 - standard (steel 12Kh18N9T), 2 - PN77Kh15S3R2 + 10% V (I = 24 mA),
3 - PN77Kh15S3R2 + 10% V (I = 25 mA)

Thus, a change in the electron beam current affects the thickness of the obtained layers, as well as the level of their wear resistance.

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УДК 621.396.96

DEVELOPMENT OF ALGORITHMS FOR DETECTING COHERENTLY PULSED BROADBAND SIGNALS AGAINST A BACKGROUND OF PASSIVE INTERFERENCE.

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The purpose of the work is to investigate and develop algorithms for detecting coherent pulsed broadband signals against a background of passive interference. The study is based on various works on radio engineering and radar systems. For example [1-2]. The properties and features of the signals received at the input of the adaptive antenna processor depend on the number of beams simultaneously generated by the antenna. Adaptive antennas are divided into

• single beam;
• multipath.

We studied the simplified classification of detection algorithms, sounding signals, and features of multipath radars according to the following criteria:

1. Improved detection performance
2. Increased noise immunity acting on the side lobes of the radiation pattern

In addition to the simultaneous formation of several DNDs, multi-beam radars performing, a parallel survey of space can be conditionally divided by the number of carrier frequencies of sounding signals (ZS):

• multi-frequency signals;
• single frequency signals.

Multi-frequency signals can be generated and emitted

• when the carrier frequency changes from pulse to pulse;
• with direct simultaneous emission of sounding signals on different carriers.

In the first case, a multi-beam antenna is not used, and processing is carried out in the main and only beam of the DND (single-lobe DND). The second method of applying multi-frequency signals can be directly used in multi-beam DNDs.

An additional advantage of multi-frequency signals is the effectiveness of their use in multipath reception due to the statistical independence of the signals.

Signal processing at a single carrier frequency in multipath radars can outperform the previous version due to the cost of the antenna.

In addition, when probing with single-frequency or multi-frequency signals, space scanning can be carried out

• in one angular direction;
• in different angular directions (or in the sector).

Multipath antennas can form spatially separated

• Bottoms of the same shape (usually pointed);
• DNDs of various shapes (pointed and non-directional DNDs to compensate for interference received by the DNDL in the so-called compensation channels).

The algorithms for detecting signals from targets against the background of interference in the considered coherent-pulse radars given below, in addition to the classification already introduced according to the features of multipath radars, are conventionally divided into more enlarged groups by the type of interference (which is more convenient for comparison and analysis):

• extended passive interference;
• point passive interference,
• active noise and impulse noise (in direction);

Among the detection algorithms used in the radar, we can distinguish interference compensation algorithms in the main channel

• without the use of additional compensation channels;

• using additional compensation channels generated digitally from signals in the CAR elements.

Spatial filtering of signals is mainly used when exposed to active masking interference along the side lobes of the antenna radiation pattern (BOTTOM). Polarization filtering is used to protect radar from interference acting in the direction of the main beam of the bottom.

• active interference is a point source of noise and does not have a time correlation, but posses a spatial correlation (between signals from PAR elements).

• passive interference is a reflection from the underlying surface, has both temporal and spatial correlation.

For single-beam radars that perform a scanning survey of space, for the entire variety of interference (pointy passive (local objects, "angel-echo"), pointwise extended (reflections from the underlying surface, clouds of dipoles, etc.), the corresponding detection algorithms are known, which with some additions can be extended to multi-beam radars that provide a parallel view of the space.

At the same time, for multipath radars with compensating channels, it becomes possible to compensate for interference received by the DN base station (active and passive, point and extended), which was impossible for single-beam radars and multipath radars without such additional channels.

As a result of the study, further research and work on the development of algorithms are planned, in order to assess the feasibility and to evaluate the characteristics taking into account hardware errors. In addition, the study of algorithms for detecting signals from targets against the background of interference in multipath radars is a promising area of research that is able to work effectively in some industries.

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УДК 661.725.823

HYDROLYSIS-HYDROGENATION OF CELLULOSE TO ETHYLENE AND PROLYLENE GLYCOLS FOR OVERCOMING ECOLOGYCAL PROBLEMS

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Abstract

One-pot hydrolysis-hydrogenolysis of cellulose in the presence of solid bifunctional catalysts based on tungsten carbides and nickel nanoparticles supported on carbide supports (CW and Ni/CW) was investigated. The catalysts were characterized by X-ray diffraction, PEM, nitrogen adsorption, pH and tested in the cellulose processing in an autoclave at 245 ° C and a hydrogen pressure of 50 atm. Ethylene and propylene glycols were established to be the main products of the reaction. A noticeable activity of carbides in the process was shown, with the activity of tungsten carbides increasing with an increase in the content of metallic tungsten and tungsten carbide (I)

phases (W and W_2C). The deposition of nickel significantly increases the catalytic activity of the developed systems. Total yield of ethylene and propylene glycols achieved 45.1%.

Key words

Cellulose, Hydrolyis-Hydrogenolysis; Ethylenglycol; 1,2-propylenglycol; Tungsten carbide; Nickel

Introduction

Ethylene and propylene glycols (EG and PG) are valuable chemicals widely used in industry (polymer production, antifreeze, pharmaceuticals). To date, glycol consumption is about 30 million tons per year and is growing by about 5% [1]. Currently, EG and PG are obtained from non-renewable fossil raw materials (ethylene and propylene) [2]. The constant depletion of the non-renewable raw material base and the environmental risks associated with its use make it necessary to search for new sources of raw materials and ways to process them into valuable compounds such as EG and PG. This work shows a one-stage method for producing EG and PG from cellulose, the main component of plant biomass, which is a promising renewable source of raw materials, an alternative to traditional fossil resources. For effective conversion of cellulose into the claimed products without isolation of intermediate compounds, it is necessary to create bifunctional catalysts. We propose using bifunctional systems based on tungsten carbides and nickel nanoparticles deposited on carbide supports as catalysts. The aim of the work was to test the developed catalysts in hydrolysis-hydrogenolysis of cellulose in EG and PG and determine the optimal composition of the catalytic system.

Experimental part

Four samples of tungsten carbides (CW-1, CW-2, CW-3, CW-4) differing in the ratio of components used in high-temperature self-propagating synthesis of carbide systems were studied. Nickel is applied to the surface by impregnation of the carrier by moisture capacity with a solution of the precursor-Nickel nitrate $Ni(NO_3)_2$ followed by programmed reduction of the catalyst in a hydrogen current at 400 °C to form Nickel nanoparticles. The catalysts were tested in a high-pressure autoclave with intensive stirring (1000 rpm), at the temperature of 245 °C, and the hydrogen pressure of 50 ATM in the presence of calcium hydroxide $Ca(OH)_2$ as a co-catalyst.

The reactor was charged with 50 ml of water, 0.5 g of activated microcrystalline cellulose, 0.5 g of catalyst and 0.04 g of $Ca(OH)_2$. During the reaction, samples of the reaction mixture were taken at regular intervals for analysis by HPLC and OO analysis. HPLC analysis was carried out on Shimadzu Prominence LC-20 chromatograph equipped with refract and diode-matrix detectors. The determination of TOC was carried out on a carbon analyzer of the multi N / C 2100 s series (Analytik Jena).

Calculation of yields of products of one-stage process of hydrolysis/hydrogenolysis of cellulose was carried out in molar percentages (%) according to the formula:

$$Y = \frac{C_{product} V}{N_c(\frac{m_{cellulose}}{M_{glucan}})} \cdot 100\%$$

where Y is the yield of product, $C_{product}$ - product concentration (mol l^{-1}), V - volume of reaction mixture (l), NC - coefficient taking into account a molar ratio of the carbon between the product and glucan, Mall - the mass of cellulose (g), Glucan is the molar mass of glucan in cellulose (162 $g \cdot mol^{-1}$).

Results and discussion

The study of the specific surface value by the method of low-temperature nitrogen adsorption showed that the developed CW-n systems have a low specific surface value (27-46 m2/g), micropores are practically absent. The introduction of Ni into the CW-2 sample leads to an increase in the specific surface area, which increases with the metal content in the sample. According to x-ray phase analysis (XRD), the resulting materials are a mixture of W / W2C with small admixtures of WC. The phase composition of materials strongly depends on the amount of additives introduced. Application of Ni does not cause changes in the phase state of the tungsten carbide carrier. The surface acidity of the samples based on tungsten carbide (pHTH3) turned out to be

fairly close for all catalytic systems and was in the range 4.1 - 4.9 and increased sharply with Ni deposition to 9.32-9.67.

The catalytic properties of CW-n were investigated in the process of hydrolysis-hydrogenolysis of activated cellulose. The main reaction products are EG and 1,2-PG, the by-product is glycerin. Among the tested systems based on CW-n carbides, in the process of hydrolysis-hydrogenolysis, CW-2 has the highest activity (Fig. 1). In the presence of CW-2, the yield of EG and 1,2-PG amounted to 11.5 and 18.5 mol%, respectively. It was found that the high activity of CW-2 in comparison with other carriers is associated with an increase in its composition of the proportion of phases of tungsten metal and tungsten carbide (I). The deposition of Ni on the surface of the most active carrier CW-2 leads to an increase in the yields of both EG and 1,2-PG. In the presence of a 1% Ni / CW-2 catalyst, 16.8% EG and 28.3% 1,2-PG (total yield of target products 45.1%) can be achieved (Fig. 1).

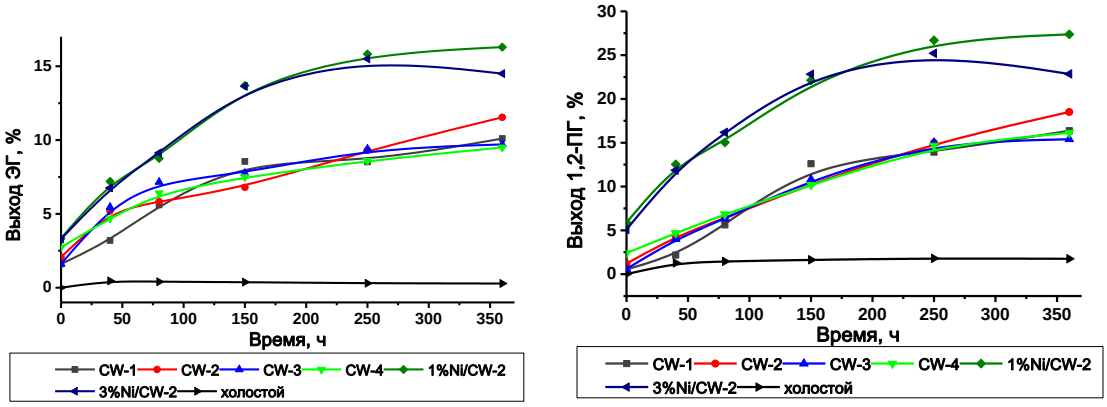

Fig1. Kinetic accumulation of EG and 1,2-PG in the process of hydrolysis-hydrogenolysis of cellulose in the presence of systems based on tungsten carbide (conditions: concentration of cellulose and catalyst-10 g l^{-1}, pressure H_2-50 ATM, temperature-245°C, mixing-1000 rpm).

Summary

In the process of hydrolysis-hydrogenolysis of cellulose, catalytic systems based on tungsten carbide, differing in the ratio of phases W/W2C and W2C/WC, as well as Nickel-containing catalysts obtained by applying metal nanoparticles to the surface of the most active carrier, were tested. The optimal composition of the catalyst was determined: 1%Ni/CU-2. In the presence of the most promising catalyst, the yields of ethylene and propylene glycols, which were the main products of the process, reached 16.8% and 28.3%, respectively (the total yield of the target products is 45.1%).

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УДК 621

CONNECTION OF FUNDAMENTAL AND APPLIED RESEARCH

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Theses:

1) The results of fundamental research form the necessary knowledge, without which technical progress is impossible.

2) Fundamental Sciences contribute to the formation of scientific worldview.

3) Applied research deals directly with all stages of production organization.

4) The connection between fundamental and applied research can be traced in the joint work of scientists in completely different fields of knowledge.

As practice shows, any stage of scientific and technological progress is primarily associated with the development of science. Scientific research, in turn, is divided into fundamental and applied research.

According to the results of fundamental research, the most general, promising scientific directions are formed, a kind of scientific baggage is created, without which the scientific and technical progress of society is not conceivable. Modern engineering requires not only short-term research aimed at solving special problems, but also a broad long-term program of fundamental research in laboratories and institutes specifically designed for the development of technical Sciences. Modern basic research is more closely related to applications than it was before. The specificity of fundamental research lies in the complexity of planning, in the probabilistic nature of their results. Probabilistic vision of the world, the development of the basic model of the world order is based on new methods of research, on special ways of setting and solving research problems, on new forms of expression of knowledge [1]. That is, fundamental sciences largely form the ideological system of modern society. Their general orientation is expressed by the concept of "scientific discovery", which is legally fixed and formalized by legal norms.

The main function of fundamental science is the creation of theoretical models, their mathematical and theoretical justification.

In order for any scientific discovery to become a prerequisite for its practical implementation, it is important to reformat it so that a specific field of application is viewed, that is, the discovery must be transformed into an invention, into a project expressing human interest and his need.

Applied research and development have specific goals to improve the organization of production, the development of norms and standards, the design of advanced technical systems, the manufacture and testing of prototypes, the search for better technological processes [2]. Inventions in the field of applied science are registered and protected by patent law. State-legal registration and legal registration of discoveries and inventions provide them with the status of intellectual property.

This is how the method of ascent from the abstract to the concrete is implemented, as a way of theoretical reconstruction of the projected object, reducing the gap between fundamental research and applied development.

Questions of interrelation of fundamental and applied researches in many respects depend on the adjusted, steady cooperation of scientists of the most various branches of knowledge. Indeed, today it is almost impossible to create a fundamentally new technical device or develop the latest technology without the active participation of mathematicians, physicists, chemists, economists, designers, representatives of technical aesthetics, economic Cybernetics, engineering psychology and many others [3]. An important factor is the participation of social scientists in technical

creativity. For example, the philosophy of science and technology contributes to the enrichment of natural and technical sciences fundamentally important conceptual and categorical apparatus of the development of nature, society and human thinking, because any process is based on the material unity of the world. At present, fundamental and applied research, fundamental and applied aspects are inherent in all sufficiently developed branches of social and natural sciences.

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УДК 621.313.823.3

MOTOR WHEEL FOR AIRCRAFT

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(Kazan National Research Technical University named after A.N. Tupolev)

Modern aircrafts have different electric machines as part of the equipment. Electric motors are used to drive pumps that pump fuel. They are needed to drive pumps and compressors in electro-hydraulic and electropneumatic systems, as well as to drive their spools. Electric motors are used in various electrical mechanisms containing gearboxes [1, 2].

A relatively new field of application of electric motors is the motor-wheels for the chassis of the aircraft. They allow you to carry out environmentally friendly taxiing on the territory of the airfield and hangars, spin the wheels before landing to align their speeds with the speed of the aircraft to reduce strikes when the runway touches, to brake after landing and to help accelerate the aircraft before takeoff.

Recently, a number of technical solutions for synchronous electric motors with excitation from permanent magnets and with a magnetic gearbox having a multilayer lattice design of a magnetic system [3] have appeared. Such units have high reliability due to the transmission of movement through a magnetic field and the absence of lubricant in the gearbox.

In fig. 1 shows a longitudinal section of a motor-wheel, where 1 is the landing gear; 2 - hollow axis; 3, 4 - supports; 5, 6 - wheel bearings; 7, 8 - wheels; 9 - wheel rim; 10 - tire; 11, 12 - magnetic circuits; 13 - 16 - rings of magnetic circuits; 17, 18 - teeth; 19, 20 - coils; 21, 22 - stator discs; 23, 24 - rotor discs; 25, 26 - elastic stator rings; 27, 28 - elastic rings of a rotor; 29 - permanent magnet; 30 - bearing; 31, 32 - stator rings; 33 - 35 - rotor rings; 36 - pipeline; 37 - tow; 38, 39 - pneumatic tanks; 40, 41 - brake discs; 42 -a ferromagnetic element of the rotor position sensor.

The presence of several disks of the stator and rotor causes multiple deformations of the magnetic field in the area of the disks, which increases the developed moment and allows to improve the weight and dimensions.

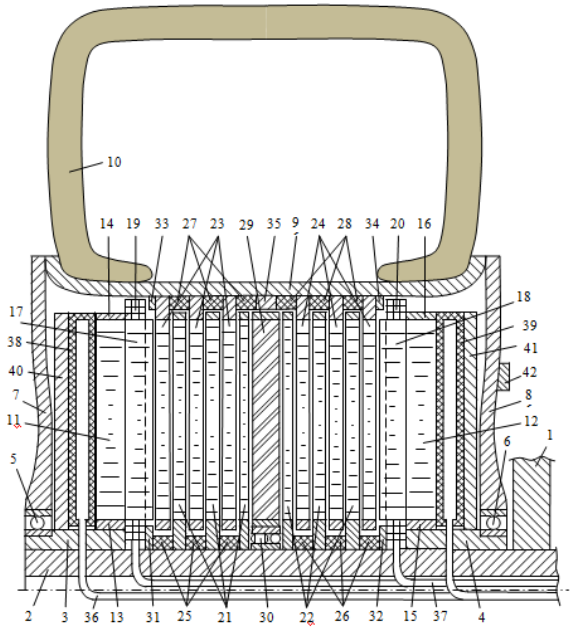

Fig. 1. Longitudinal section of the motor wheel

When compressed air is supplied through conduit 36 to pneumatic containers 38, 39, the magnetic cores 11, 12 are subject to forces moving them to the middle by 1 - 2 mm. When this teeth 17, 18 and the disks 21 to 24 come into contact, and mechanical braking occurs.

At the same time, the electric motor is transferred to the generator mode, which converts the kinetic energy of a moving plane into electrical energy. The three-phase voltage system of the generator is rectified and provides charging of the onboard battery.

The motor-wheel works as follows. In the absence of overpressure in pneumatic containers 38, 39, elastic rings 25 to 28 push the stator and rotor discs apart, providing gaps of 0.1-0.2 mm between them. According to the signals of the rotor position sensor, the onboard frequency converter produces a three-phase voltage system.

When applying the harness 37 to the coils 19, 20 of the stator winding of a three-phase voltage system, a rotating magnetic field with four poles occurs. It carries along a rotor inductor. Along with it, areas of large magnetic induction in the stator and rotor discs rotate. As a result, the rotor is rotated.

Thus, due to the introduction of two pneumatic tanks and two brake discs, a set of elastic rings of the stator and rotor, and the installation of the rings of the magnetic circuit, the disks of the stator and the rotor with non-magnetic carbon the functionality has been expanded motor-wheel and increased its energy performance.

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УДК 629.7.083

IMPROVING OF NON-DESTRUCTIVE CONTROL METHOD OF CIVIL PASSENGER AIRCRAFTS COMPOSITE HONEYCOMB CONSTRUCTIONS

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The problem of the integrity of composite honeycomb constructions monitoring is one of the most important problems of technical support for flight safety today. Honeycomb panels are used for the aircraft skin, walls of structural elements, floors, rudders and elevators, ailerons and doors of landing gear compartment. The ultrasonic non-destructive testing method and the TapTest method (tapping method) are most often used to identify defects such as peeling, cracking of the skin. But recently, there is a new problem of non-destructive testing methods to obtain all information about the integrity of honeycomb constructions. Water in cells and subsequent jamming of cells are possible in honeycomb constructions. All this leads to serious destruction of the honeycomb core and the all controlled object.

The aim of this investigation is to select a new set of non-destructive testing methods to detect various defects using the example of the honeycomb constructions of the Boeing - 737 (800) and the Airbus A-320 family [1-2].

The objectives of this investigation are:

1. Selection and analysis of the most effective non-destructive testing methods.
2. Development of a technological algorithm for carrying out a new complex of non-destructive testing.
3. The selection of devices that will help perform a new complex of non-destructive testing methods

in the facilities of the aircraft maintenance organization.

The complex of three non-destructive testing methods is used for the most effective implementation to identify defects on critical aircraft surfaces (rudders and elevators, ailerons and doors of landing gear compartment). There is the phased array method, the thermal imaging method and the vacuum method. Each non-destructive testing method has advantages and disadvantages.

The phased array method detects cracks and discontinuities in the skin, the thermography method detects water in the honeycomb structures, and the vacuum method detects the adhesive bond between the skin and the honeycomb core.

The rudder was reviewed as an example, which has a standard honeycomb design: two composite panels and the honeycomb core (Fig. 1, Fig. 2).

The technical algorithms present the necessary consumables, equipment and some steps for performing of non-destructive testing. The necessary special equipment for each method is selected that satisfy to modern requirements for performing effective diagnostics of test objects. These are OMNISCAN MX2 phased array ultrasonic detector, FLIR T250 thermal detector and MBBBT100 vacuum unit.

The developed methods will make it possible to most effectively carry out non-destructive tests for airlines that own a large number of aircrafts. It provides a high level of flight safety in local and international flights [3].

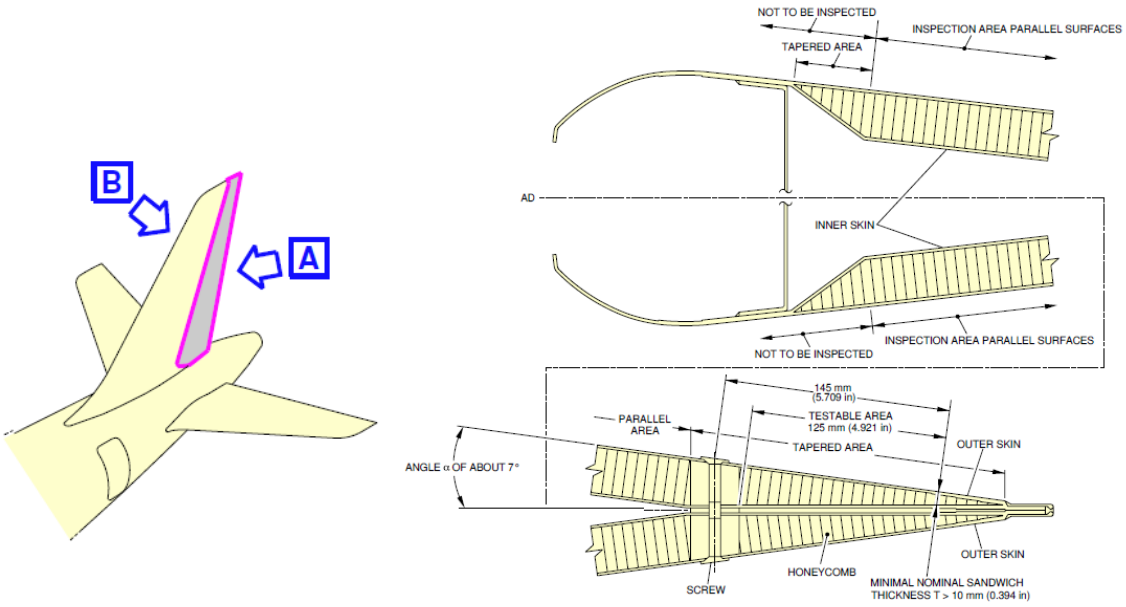

Fig. 1 - General view and construction of the rudder

An analysis of non-destructive testing methods allowed us to develop a new methodology for performing the complex of diagnostics of honeycomb structures. The complex has three methods: the phased array method, the thermal method and the vacuum method. Individually, these methods do not allow a complete and reliable diagnosis of the controlled object. Therefore, it is proposed to apply these methods in one complex. The selected special equipment can be used by large airlines and the aircraft maintenance organization. This is due to the high cost of equipment and the need for personnel technical training.

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УДК 537; 629.194.34:536.468

PERSPECTIVE WAYS OF PREVENTING DEPOSIT FORMATION IN UNMANNED AERIAL VEHICLE ENGINES

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Nowadays there are a lot of different ways of removing deposits from unmanned aerial vehicle (UAV) engines: the use of various detergents and other aggressive cleaners; sandblasting and other kinds of mechanical treatment; annealing. However, these methods are expensive, environmentally dangerous, and most importantly - inefficient because the operation of an aircraft is stopped and the engine is sent to the repair factory. Moreover, the cleaning process results in defects (micro-cracks) but the deposit is not completely removed. In most cases it leads to the replacement of many parts, such as injectors, at the factory. Flushing the engine at a station is uneconomical and

environmentally harmful, due to the problems of disposal of aggressive liquids, and does not solve the problem of complete cleaning of all the channels and injectors of the engine [1-2].

The process of deposit formation is easier to prevent than to deal with it with the use of expensive and environmentally harmful ways. One of the promising methods of preventing deposit formation is the use of electrostatic fields, which do not have deposit formation on any metal surfaces in the area of power lines.

Experimental studies of thermal processes in liquid hydrocarbon fuels without and under the influence of electrostatic fields showed that electrostatic fields (E) can significantly enhance heat transfer and prevent the process of deposit formation. It was also found that E provides a complete preliminary preparation of fuel: ionization of hydrocarbon fuels, which provides better atomization and complete combustion; mixing two, three or more hydrocarbon fuels and bringing them to one new hydrocarbon fuel with new characteristics, which gives the possibility (for example, in difficult combat and climatic conditions) to use two or more types of liquid hydrocarbon fuels at the same time, which increases the combat capabilities, efficiency and survivability of such a military techniques like UAVs for various purposes.

Fig. 1 shows an injector with an increased number of inlet holes (up to three at the bottom and top) and an increased number of pairs of coaxial working needles with E, which provides deposit prevention on the holes themselves and on most of the injector filter [3].

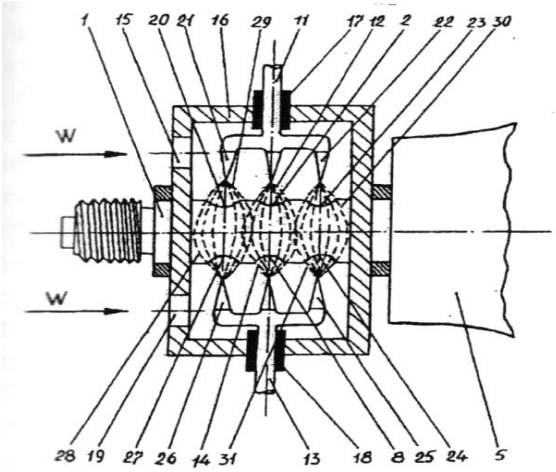

Figure 1 - Injector with three pairs of coaxial working needles with electrostatic fields.

The graphs made on the basis of the experimental research results (Fig. 2) show the efficiency of injectors with application of E. These perspective injectors are more efficient and provide more resource, than injectors without electrostatic fields.

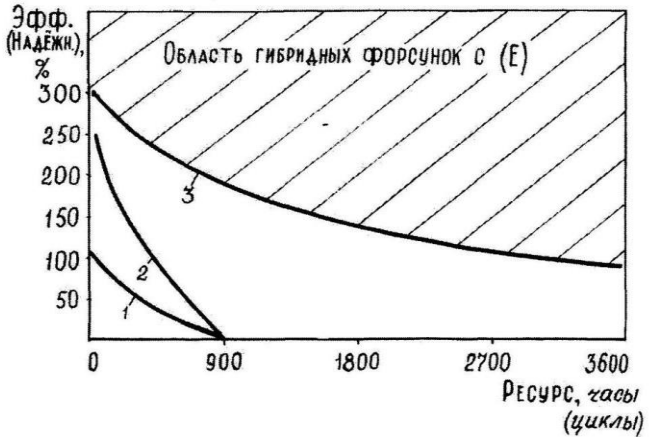

Figure 2 - Influence of the methods of sludge formation control on the efficiency and service life of the standard injector of WFD NK-8-2U "Tu-154": 1 - Standard injector; 2 - Injector with E in the zone of fuel inlet channels and injector filter; 3 - Injector with E in the zone of top-drainage inlet channels, injector filter and atomizer.

The analysis of the efficiency of the developed new constructive schemes of aerojet engine injectors (Fig. 2), as well as the analysis of the resource and reliability of various injectors for single- and reusable UAVs show that the most effective are the injectors with application of E.

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PRODUCTION OF A BINDER COMPONENT FROM REFRACTORY SCRAP

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Abstract

The method of direct low-temperature synthesis of silicate binder from technogenic waste - silica refractory (dinas) has been developed. The possibility of using the resulting binder for the manufacture of construction products based on cheap mineral raw materials (sand, sandy loam) and waste refractories (chamotte). The developed products have physical and mechanical properties recommended for structural products:: compressive strength, MPa, of samples based on chamotte – 95,9; sandy loam – 62,7; sand – 67,8; bending strength, MPa – 19,2; 7.4; 8.5; abradability, g / cm^2, - 0,36; 0,50; 0,15 accordingly.

Keywords

Dinas; abrasion; sand; compressive and bending strength; silicate binder, sandy loam; chamotte.

One of the promising directions that can reduce the consumption of material and energy resources of the construction complex is the development of new types of construction binders using waste, since raw materials from waste are 2-3 times cheaper than natural [1].

Of particular interest are waste (scrap) refractories, most of which, despite a wide range of areas of disposal, is not reused. At the same time, if in developed countries (Japan, China, USA) the degree of its utilization is on average 50%, in Russia it does not exceed 30% [2, 3].

In this work, as a raw material for the production of binder used Dinas-scrap Dinas refractory resin-magnetite shop LLC " ZSMK "(Novokuznetsk). The method of production is as follows: in a porcelain drum, Dinas was ground using a roller mill to a grain size of ≤ 0,14 mm. Then, to obtain a binder with a different silicate module, the crushed Dinas was poured with a 17% solution of sodium hydroxide at the rate of S: L = 1: 1,5 - 6 mass parts. The resulting mixture was subjected to heat treatment at 100ºC and atmospheric pressure for 6 hours with periodic stirring. The unreacted residue was removed by centrifugation. Next, the resulting solution was evaporated to obtain a binder density of 1,3 g / cm^3.

The chemical composition was determined using a Hitachi TM-1000 scanning electron microscope equipped with a TM1000 EDS detector. The silicate module (M) of the binder was calculated based on the data on its chemical composition. The density of the silicate binder (p) was determined using a hydrometer according to GOST 13078-81.

The yield of the binder (W) after centrifugation of the mixture was calculated at 1 kg of Dinas.

As fillers for samples of construction products used quarry sand, sandy loam, chamotte (fireclay refractory resin shop LLC "ZSMK" (Novokuznetsk)), the grain size of which was ≤ 0,14 mm.

Samples of construction products were obtained by slip casting. The filler was poured into the mixer, then an astringent was added (S:L= 3,3:1). The mixture was thoroughly mixed to obtain a homogeneous mass, placed in steel, pre-oiled molds, and kept in the air until a constant mass. The samples were then heat treated at 700 ^{o}C.

Physical and mechanical parameters of samples of building products were determined in accordance with the standards: tensile strength in bending and compression-GOST 8462-85, abrasion-GOST 13087-81.

At the first stage of the work, the quality of Dinas was evaluated to obtain a silicate binder. Chemical analysis showed that the total content of silicon oxide in Dinas is quite high-88,4%. The content of the coloring oxide (Fe_2O_3) is 4,8%, which is a high indicator and is a consequence of the yellow hue of the binder obtained from this type of raw material.

Table 1 shows various examples of the S:L ratio used in the work to obtain a binder. As a result of the synthesis, silicate binders were obtained, the characteristics of which are also presented in table 1.

It is established that the higher the ratio S:L, the more the actual silicate module differs from the theoretical one, which is most likely due to the approach to the so-called coagulation threshold. For sodium silicate solutions, it approximately corresponds to achieving pH=10 and M=4 [4].

Table 1 – Characteristics of silicate binders

S:L, mass. p.	Theoretical silicate module	Chemical composition of the binder, mass. %			Actual silicate module	Binder output *, kg
		Oxide				
		Na_2O	SiO_2	Fe_2O_3		
1:6	1,2	45,4	46,0	8,6	1,0	6,4
1:3	2,4	31,9	63,1	5,0	2,0	2,3
1:1,5	4,7	24,1	75,9	-	3,3	1,4

* The yield of the solution was calculated on 1 kg of Dinas

The second stage of the work was to obtain samples of construction products based on the binder C module 2,0 and determine the physical and mechanical characteristics. Table 2 presents a comparative analysis of the strength characteristics of the obtained products with the characteristics of silicate and ceramic bricks, which showed that the samples based on the synthesized binder can be recommended as structural products.

Summary

The technique of direct low-temperature synthesis of silicate binder with modulus from 1,0 to 3,3 and density of 1,3 g / cm^3 on the basis of technogenic waste-Dinas refractory has been developed.

On the basis of synthesized binder and aluminosilicate raw materials of different origin (waste fireclay, mineral raw materials (sandy loam, sand)), construction products for structural purposes were obtained.

The values of physical and mechanical parameters of the developed products are not inferior to the characteristics of materials used in modern construction.

Table 2 – Comparative characteristics of building products

Building product		Tensile strength, MPa		Abradability, g / cm^2
		at compression	in bending	
Brick silicate M300 (GOST 379-95)		30,0	4,0	-
Brick ceramic ordinary M100-M300 (GOST 530-2012)		10,0-30,0	2,2-4,4	-
Brick ceramic clinker M300-M1000 (GOST 530-2012)		30,0-100,0	4,4 and more	no more than 1,5
The results* obtained in this paper are based on	chamotte's	95,9	19,2	0,36
	sandy loam	62,7	7,4	0,50
	sand's	67,8	8,5	0,15

*Samples of silicate binder with a module of 2.0, after heat treatment at 700 ° C

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USE OF THE BILATERAL BOUNDARY CONDITIONS METHOD FOR CALCULATING A MULTILAYER FLAT-PARALLEL STRUCTURE

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For protection against electromagnetic radiation, plane-parallel multilayer structures can be successfully used. An important point in creating multilayer structures is the selection of pairs of materials from which a multilayer structure is formed [1-2].

The calculation of the transmission and reflection coefficients of waves in multilayer structures is possible based on the rigorous method of bilateral boundary conditions [3], when the dielectric layer is considered as a layer of finite thickness with complex permittivity.

The multilayer structure consists of several plane-parallel dielectric layers for each, from which two-sided boundary conditions can be written. Figure 3 shows a plane-parallel structure, with the image of the incident, reflected and transmitted rays.

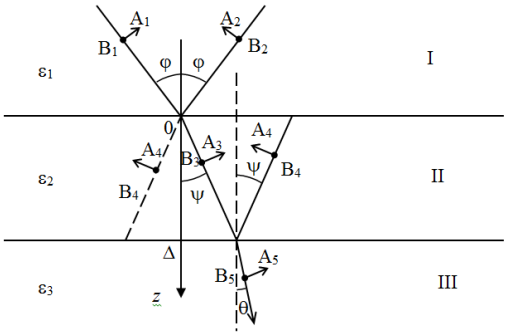


Fig. 1. Multilayer plane-parallel structure

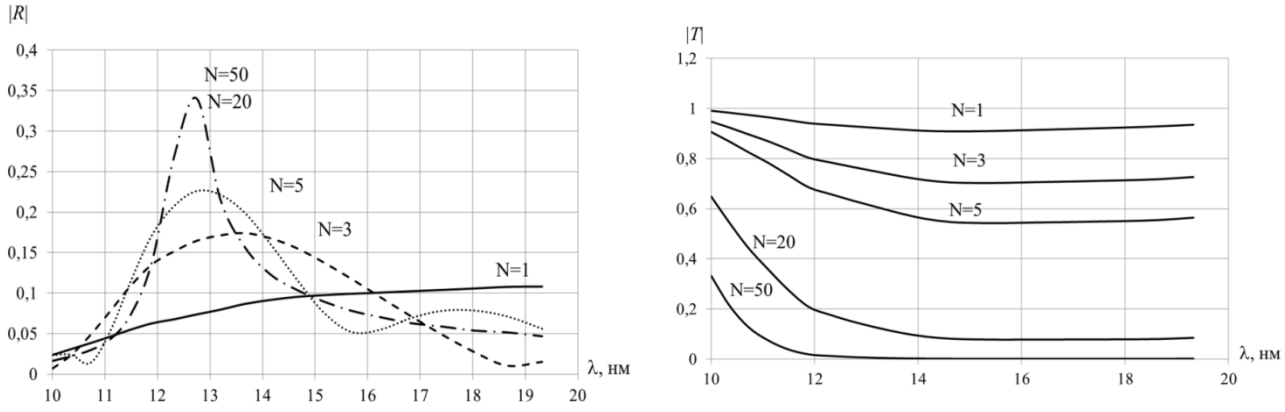
The article deals with a plane-parallel dielectric layer, which divides two regions characterized by the parameters ε_1, μ_1 и ε_3, μ_3.

The boundary conditions at z = 0 and z = Δ are carried out to eight algebraic equations for eight unknowns: A_2, B_2, A_3, B_3, A_4, B_4, A_5, B_5.The amplitude coefficients of the incident wave A_1 и B_1 are assumed to be given.

Using the coefficients A_1 and B_1, we find the remaining unknown coefficients. Using the found amplitude coefficients, we calculate the components of the electric and magnetic field strengths. From the calculated strengths of the transmitted and reflected waves, we find the coefficient of reflection (R) and the coefficient of transmission (T).

For a multilayer structure, each layer was represented as a quadrupole with a scattering matrix. The scatter matrix is converted to a transfer matrix. To obtain the transfer matrix of the multilayer structure, the transfer matrix of the each layer is multiplied. Using the elements of the common transfer matrix, the elements of the scattering matrix are calculated.

Figure 2a shows the dependences of the reflection coefficient on the wavelength, and Fig. 2b shows the dependences of the transmission coefficients for a different number of layers of the Sb/B_4C substance pair. The layer thickness $d = 3.30 \cdot 10^{-9}$ m, the case of a normal angle of incidence is considered.



a) b)

Fig. 2. The dependences of the coefficients on the wavelength for a different number of layers of a pair of substances Sb/B_4C:
a – the reflection coefficient; b – transmission coefficient

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УДК 621

THE 4 C'S OF 21ST CENTURY SKILLS

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For students of non-linguistic specialties, foreign-language communicative competence may not be sufficiently formed to create complex speech works of professionally demanded genres. In this regard, this study is primarily focused on students whose level of language training is above the initial, but below average. At this level (from elementary to pre-intermediate), there is already the minimum necessary base for the development of those speaking skills that students can apply in their future work. [2] We believe that after mastering basic conversational skills, it is advisable to begin teaching speaking in the professional field with prepared monologic speech. You can learn hundreds or even thousands of new words and remember all the rules and times. However, even this will not guarantee that you can communicate in English as fluently as a native speaker. Only constant practice can improve communication skills.

The aim of this work is to describe the methods of teaching a particular type of speaking in prepared monologic verbal speech developed for students of the pre-threshold level of English proficiency in the process of forming their competencies. The topic of preparing an oral statement in a foreign language is very voluminous, and it is not possible to cover all theoretical and practical aspects within the framework of one article. [2] Therefore, our study addresses only language problems that arise in students at the stage of creating a speech work.

There are many types of prepared speech. One of the classifications is their division according to the pragmatic principle into informational, demonstrational ones, with a variety of subtypes of speeches. Examples of prepared monologue statements necessary for professional work include: an official presentation of a foreign colleague to employees, a thank you note, motivational speech, a commendable speech about the merits of the employee or the entire work team, a report on the results of a business trip, a presentation of the company (company department) at the exhibition, solemn congratulation of the employee with promotion and presentation of a new project. [1]

At the ascertaining and control stages of the experiment, the method "Test of communicative skills" developed by L. Michelson was used. This technique is intended to determine the level of communicative competence and the quality of the formation of basic communicative skills. As a basis for identifying the quality of communicative skills, we take the methods of communication: dependent, competent, aggressive, which was the focus of the study.

The results of the study of communicative skills by the method "Test of communicative skills" (by L. Michelson) before the formative experiment

Name of communication method	Experimental group %	Control group %
Dependent	**26,6**	**20**
Competent	**66,6**	**73,3**
Aggressive	**6,6**	**6,6**

As can be seen from the table, the groups differ little from each other. Using the Mann – Whitney U test, we compared the experimental and control groups according to the dependent, competent, and aggressive methods of student communication for differences. It was found that the experimental and control groups did not statistically differ in communication methods. Therefore, before the training, the experimental and control groups in terms of the level of development of communicative skills are equivalent. Students have trouble in communicating with clients: they do not know how to ask a question correctly, clarify a consumer's request, have difficulty understanding, do not always pay attention to non-verbal signals, do not know how to listen and control their emotional state.

For students to successfully master their future professional activities, it is necessary to master practical methods, skills and abilities for developing individual personality, which will allow the use of a more flexible model for the organization of the educational process, in addition, conditions are created for studying the orientation of the future specialist's professional activity.

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ADAPTIVE PLATE MADE OF POLYMER COMPOSITE MATERIAL

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Intelligent Composite Materials

One of the most important aspects of the study is the creation of materials with specified requirements and properties. In this regard, the most promising are the components, which consist of heterogeneous components (filler and matrix). The combination of different types and types of components allows you to get completely new characteristics of these components. In addition, composite materials have a pronounced anisotropy - the difference in material properties in different directions. However, such materials have only fibrous polymer composite materials, where the fillers are continuously continuous fibers (smooth, tow, tape). It can be maximally adapted and optimized for certain conditions of its work. Such designs are called self-adaptive, which can be considered the first stage in the creation of intelligent designs [1].

Intellectualization for structural PCM is the most important stage in the development of materials science, since their application is becoming more extensive in almost all areas of science and technology: aviation, space, automobile and shipbuilding, construction, medicine, etc. Materials are created that can not only work under conditions of high mechanical loads, aggressive environments, but also independently adapt to given conditions, changing their structure or configuration. In other words, it is possible to "teach" the material to "feel" external factors, its physical state, and independently "respond" in response to them - eliminate defects and stabilize to maintain operability [2]. This can be achieved, as mentioned above, by selecting a special reinforcement scheme (laying fibers at different angles to the axes of symmetry or rigidity of the structure) and / or by introducing functional elements, of which there are now many. With the help of creating intelligent designs, automation and optimization of processes is achieved, the resource of systems is increased, and most importantly, reliability.

The key role of the practical application of intelligent composite materials and structures from them is the conversion of one type of energy into another with the distinctive feature that this energy conversion can be controlled. Therefore, interest in this topic is only growing, development to create such materials and structures from them does not stop, and, according to experts, it is the intellectualization of materials that will determine technological progress in the 21st century.

The aim of this work is to develop an adaptive PCM plate with minimal twisting when exposed to an asymmetric point load. For this, it is necessary to determine the dependences of the plate twisting on its reinforcement pattern and aspect ratio, make samples for testing and compare the calculations with experimental data.

Determination of plate twisting dependencies using the finite element method

The object of study is a composite rectangular plate reinforced at various angles; the subject of study is their twisting under the action of an asymmetric load. Plate modeling is performed using the finite element method (FEM) in the ANSYS program.

ANSYS refers to CAE products for mathematical modeling of various physical processes. This method contains universal algorithms for solving various boundary value problems with efficient computer implementation of calculations.

Using the FEM, it seems possible to solve a wide range of physical problems in an approximate numerical form. In this case, the analysis of the stress-strain state (VAT) of the calculation plates was carried out.

The initial object for FEM is a material body (the region occupied by a continuous medium or field), which is divided into parts — finite elements (FE) (Fig. 1), as a result of which a grid of FE boundaries forms. Border crossing points are called grid nodes. Additional nodal points located on the boundaries or inside the elements can also be created. The basic finite element model of a deformable body is the totality of all FEs and nodes. The discrete model should cover the area of the studied object as fully as possible [3].

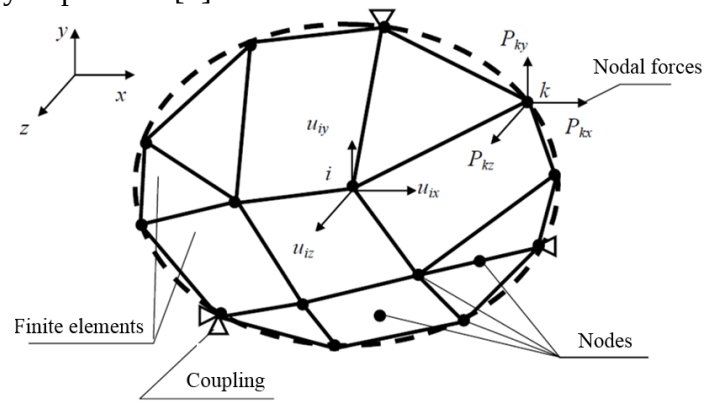

Fig. 1. The finite element model of the material body

Boundary conditions for a rectangular plate: cantilever fixing of one edge and point loading at the end of the opposite edge: 1) at point 1; 2) at point 2 (Fig. 2). In fact, the deflections of the plates reinforced at angles ± α under the action of an asymmetric point load were calculated (Fig. 3).

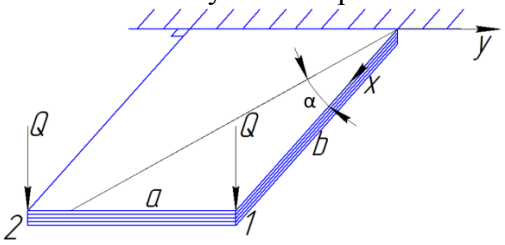

Fig. 2. The boundary conditions of the investigated composite plate

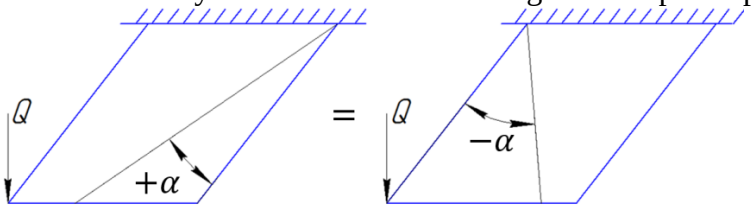

Fig. 3. Loading of the studied reinforced plates

The approximate numerical value of the deflections of these plates under load at point 1 and point 2 are presented in table 1 and 2, respectively, where:

dU1 is the deflection value at the loading point;

dU2 is the deflection value at the opposite end of the loaded edge;

ΔU is the difference between dU1 and dU2 (ΔU = | dU1 - dU2 |);

ΔU% - ΔU value as a percentage of the largest deflection dU1 or dU2.

Table 1. The numerical value of the deflections of the plates at a load of t. 1, depending on the angle of laying

Sample type	dU_1	dU_2	ΔU	ΔU%
0°	18,998	0,294	18,7042	98,4535
15°	7,032	0,82	6,212	88,339
30°	18,317	5,943	12,374	67,553
45°	17,734	9,48	8,254	46,544
60°	14,307	9,7088	4,598	32,14
75°	14,342	10,646	3,696	25,771
90°	11,818	8,996	2,821	23,875

Table 2. The numerical value of the deflections of the plates at a load in t. 2 depending on the angle of laying

Sample type	dU_1	dU_2	ΔU	ΔU%
0°	17,112	0,265	16,847	98,454
15°	11,128	3,689	7,439	66,846
30°	15,971	17,499	1,528	9,567
45°	37,883	43,403	5,52	14,571
60°	74,578	71,547	3,031	4,064
75°	105,39	86,723	18,667	17,712
90°	116,37	88,586	27,784	23,876

Based on the tables, scatter plots of the dependences of the deflection ΔU% on the stacking angle α and the trend line with their approximate equation under load in vol. 1 (Fig. 4) and in vol. 2 (Fig. 5) were compiled:

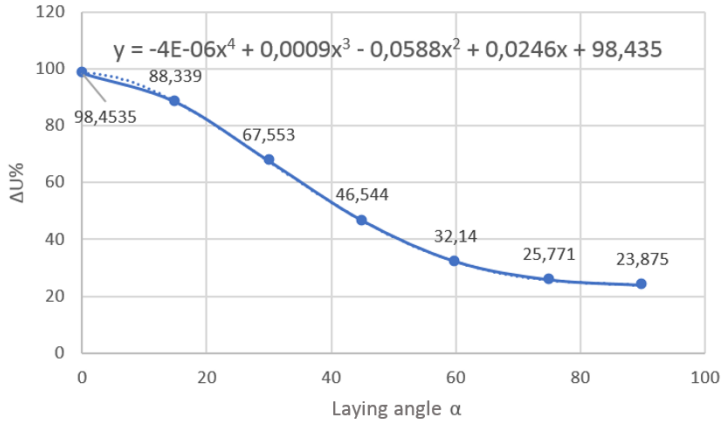

Fig. 4. The graph of the dependence of the difference of the deflections ΔU% from the laying angle α and the trend line with an approximate equation at a load in t. 1

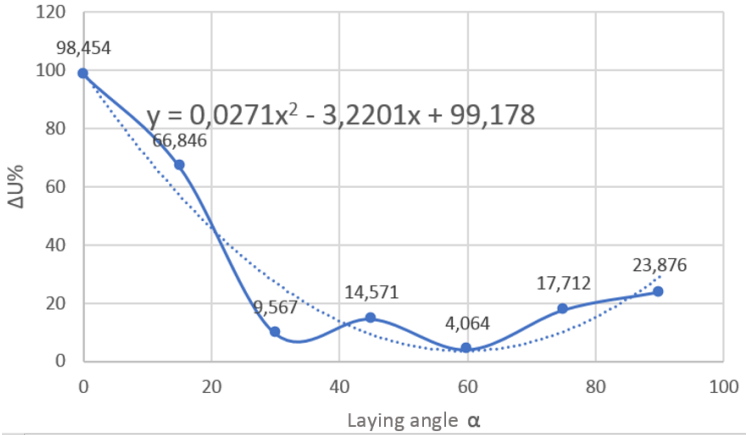

Fig. 5. The graph of the dependence of the difference of the deflections ΔU% from the laying angle α and the trend line with an approximate equation for the load in t. 2

Based on the values of the first table, it is seen that the smallest torsion (difference in deflections) has a plate with a fiber laying angle of 90 °, and the largest - 0 °. Those. at a load of t. 1, there is an obvious tendency to an almost uniform decrease in twisting with an increase in the laying angle, but in any case, with such loading and the pattern of laying the fibers, twisting of less than 20% cannot be achieved. For a greater load perception, the fibers should be oriented towards its application.

Based on the values of the second table, it is seen that the smallest torsion (difference in deflections) has a plate with a fiber laying angle of 60 °, and the largest - 0 °. Those. the most rational is the reinforcement scheme in which the fibers are oriented strictly in the direction of application of the load.

In order to evaluate the effect of the aspect ratio on the deflection of a rectangular plate, similarly to the previous paragraph, plate models with different aspect ratios were created: b = ½ a, b = a, b = 2a, b = 3a, b = 4a; the orientation of the fibers is the same for all plates — α = 60 ° (Fig. 2). The approximate numerical value of the deflections is presented in table 3.

Table 3. The numerical value of the deflections of plates with different aspect ratios

Sample type	dU_1	dU_2	ΔU	ΔU%
b = 4a	9,097	3,964	5,133	56,421
b = 3a	16,126	13,664	2,462	15,267
b = 2a	20,461	20,434	0,027	0,132
b = a	28,977	29,585	0,608	2,055
b = ½ a	88,221	90,376	2,155	2,384

Based on the table, a graph of the dependence of the deflections ΔU% on the aspect ratio of the plate is made (Fig. 6).

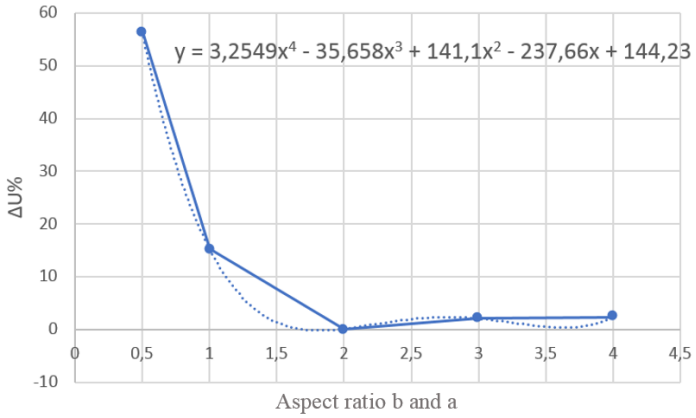

Fig. 6. The graph of the dependence of the difference of the deflections ΔU% from the aspect ratio of the plate and the trend line with an approximate equation

Based on the above, it can be seen that the most optimal aspect ratio for fiber orientation α = 60 ° is b = 2a, and plates with b = 3a and b = 4a also have a relatively small deflection. The least optimal option is b = ½ a.

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УДК 537.39

AIRCRAFT ELECTRICITY SYSTEM

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The high requirements for the next generation of aircraft, in terms of operating costs, environmental friendliness and fuel efficiency, pose a number of problems for aviation specialists that require the search for fundamentally new approaches to building an aircraft energy system associated with the refusal to use pneumatic and hydraulic power systems and the transition to a single electric power system. A similar transition is envisaged by the program for the creation of the so-called all-electric aircraft (AEA).

According to domestic and foreign data, replacing all types of auxiliary energy on board only with electric energy reduces the take-off mass of aircraft equipment, simplifies and reduces the cost of its operation and ground handling, simplifies on-board systems, etc. Studies show that electrical systems for AEA of various classes at the installed mass are not inferior to hydraulic and pneumatic equipment, but at the same time in terms of take-off mass, operational reliability, manufacturability and cost of maintenance in operation, increase the level of automation significantly exceeding it.

The implementation of the PES concept, in turn, requires specialists in the field of aviation electrical engineering to radically change the structure and principles of operation of the entire electric power complex (EEC) of an aircraft, which includes the entire set of sources, converters and receivers of electric energy, as well as electrical networks connecting them. The solution of these problems will open the prospects for the fullest use of the capabilities of electrical equipment to improve the flight-technical, operational and economic indicators of aircraft.

The rational structure of the AEA and the requirements for its functional capabilities completely depend on the tasks entrusted to aviation technology, taking into account the prospects for its development. The most significant trends in the development of aviation technology that determine the appearance of promising electric power complexes should be considered as:

- increasing the complexity and volume of tasks;
- the desire to improve the economic efficiency of operating aircraft;
- Automation and integration of airborne equipment;
- Transition to remote control flight control systems with widespread use of electric drives;
- an increase in the installed equipment capacity and complication of the nature of the load it creates;
- increased attention to environmental problems associated with the production and operation of aircraft.

The main element of the EEC, which will undergo the most serious changes in the process of increasing the electrification level of on-board equipment, will be the power supply system (PSS).

It should be noted that at present, the choice of the type of power supply system does not have a decisive influence on the energy consumption system. This is due to the fact that the strongest power receivers are electric drives for various purposes, and electronic equipment in any case receives power through secondary energy converters. For the considered types of electricity, effective principles have been developed for constructing both electric drives and secondary power sources. In AC drives, it is advisable to use asynchronous motors with frequency control, and in DC drives - valve motors with high-energy permanent magnets or valve-induction motors.

Under such conditions, the ability to electrically launch the aircraft engine using the generators installed on them may be crucial. In this regard, PSSs that use single-stage generators are gaining advantage. Among them, magnetoelectric generators are of great interest for launching. However, when using them, it is difficult to influence the excitation of the generator, which complicates the regulation of its voltage in the generator mode at a variable speed.

Based on the analysis, we can conclude that the on-board power supply systems in their existing form have already largely exhausted the possibilities for further improvement in terms of increasing capacity and improving the quality of generated electricity. Ensuring compliance with the requirements for power supply systems and for electric power complexes of airplanes as a whole, which is constantly increasing with the development of aviation technology, is connected with the search for radically new approaches to building their power and information structures. Certain prerequisites for solving the problems have already been created in previous years in our country by a number of leading organizations and specialists in the field of aviation power industry.

The analysis of the current state and development trends of the onboard electric power industry shows that the most important areas for improving electric power complexes within the framework of the AEA concept include:

- development of new types of power supply systems, as well as promising structures with advanced adaptation capabilities;
- development of more advanced sources of electric energy of increased power;
- development of highly efficient DC and AC motors, as well as the creation of electromechanical drives of various on-board systems on their basis;
- creation of systems for the electric launch of aircraft gas turbine engines.

Thus, the creation of highly efficient electric power complexes for promising aircraft, according to most experts in the field of aviation electrical engineering, will require:

- increase the level of electrification of equipment and the gradual transition to complete electrification of the aircraft;
- a comprehensive solution to the problem of matching the characteristics of receivers and sources of electrical energy;
- ensuring the unity of the power and information structures of the EEC.

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УДК 621.311

DEVELOPMENT OF DISTRIBUTED ENERGY IN RUSSIA

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Currently, in our country, the main part of electricity is produced at large power plants, that is, a centralized system of energy supply is used. This system allows you to transfer a very large amount of electricity to consumers over long distances. But there are also disadvantages of a centralized system the most significant of them is that due to various factors (environmental, economic, geographical, etc.) power plants are "far" from consumers, so part of the produced energy is lost during transmission, especially significant losses are of thermal energy, which is difficult to transfer over long distances because it is mainly simply dissipated into the environment. In this regard, the system of distributed energy, which allows to obtain additional electricity, has recently acquired significant development.

Distributed energy is a direction of energy in which the use of small, compact sources of electricity are in the immediate vicinity from the consumer and are used for their own needs, but at the same time it is an additional part of the grid, that is, the consumer is not disconnected from the main power supply network. As the sources of electricity renewable energy (solar panels, wind generators), heat pumps, steam boilers, gas turbine power plants, micro-turbine power plants, etc. can be used.

This topic is relevant nowadays and presents a great interest in science, that is why we decided to make a general review of it to show the main advantages of using this energy.

The development of this type of energy is observed in many countries. For example, in the United States, about 12 million small distributed power plants with a total capacity of over 200 GW are used, of which about 170 GW are used as spare power sources for power supply in emergency or accident cases. Each year, these indicators are increasing, which will soon lead to the use of these facilities as regular sources. [1]

In the EU countries, the introduction of this distributed energy system depends on the regulatory framework and relevant policy decisions, but on average, the figures are about 10% of the total energy produced. For example, in Denmark, distributed generation accounts for more than 45% of electricity generation, or in France, the energy industry is mainly based on nuclear energy. In Denmark, nuclear energy has never been considered as an option for the long-term development of the energy sector due to certain risks and possible environmental consequences.

In Russia, in contrast to foreign countries, centralized power supply systems will prevail in the near future along with the growth of large power plants. At the same time, the geographical features of our country provide an excellent opportunity for the development and application of distributed generation. Distributed energy opens up completely new prospects for improving energy efficiency and creating the best energy balance. There are currently more than 50,000 small distributed power plants in Russia, and the number is still growing. In remote and isolated areas, all energy is focused on distributed power generation. [2]

If we analyze the ratio of the cost of electricity generated by distributed generation in Russia and in developed countries, we see that it is mainly determined by the depth of market penetration and its scale and level of state support. These factors are mainly characteristic of most developed countries. However, their insufficiently active manifestation in Russia constrains the implementation of plans for the development of distributed electricity.

The development of distributed energy can increase the level of competition in the electricity market. Under ideal model conditions, the "active consumer" is able to become an equal market actor, participating not only in the consumption and redistribution of electric energy, but also in the regulation of frequency. The emergence of new technologies expands consumer choice and reduces the market power of large power producers. Large generating companies may have to pay attention to their customers and review pricing strategies.

Small distributed energy in Russia should occupy its niche. The implementation of its principles can, on the one hand, provide a solution to the problems of rising prices for the production and transmission of electricity, increasing the cost of connecting to electric networks, the absence of the latter in certain areas, and on the other, improve the reliability of the energy system. All these issues require comprehensive research, including the analysis of economic and technical opportunities for the implementation of distributed energy in Russia. [3]

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FEATURES OF SYNTHESIS OF VIRTUAL LABORATORY SETUP FOR STUDENTS OF TECHNICAL SPECIALTIES

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The effectiveness of specialist training largely depends on the quality of education, which includes: lectures, demonstration experiments and laboratory workshops using multimedia teaching aids. Achieving high quality education is impossible without the use of educational equipment and bench equipment. In this process, it is important to use quality laboratory equipment. This type of training materials is intended to demonstrate and explain the principles of interaction of components between themselves.

Many universities, in particular NSTU, develop their own software products for use as laboratory setups. The use of such virtual laboratories has proven its effectiveness and the need for further scaling. In this regard, it was decided to create a virtual laboratory bench to study the features of the formation and analysis of computer network traffic, since this topic has not yet been fully covered by the university.

It was planned to include elements of forming, sending, tracing, receiving and processing information packets in the setup being developed. Thus, there was a need to combine functionality in our application from several categories of programs that work with traffic:

- network analyzers (sniffers),
- tools for creating packages,
- network utilities that process information data.

So, it turns out a universal integrated solution, on the basis of which laboratory work of various levels of complexity can be built.

The application is written in the C programming language, like most utilities working with network technologies. This will provide reliability, speed of execution, full control over resources, as well as ample opportunities for scaling.

In the development process, we used RAW sockets - this is a software interface, a type of Berkeley sockets, which allows you to collect TCP / IP packets, controlling each bit of the header and sending non-standard packets to the network, as well as "listening" to the communication channel for the appearance of packets specified in them type. [1]

The graphic is implemented using Qt, a cross-platform software development framework.

The program code is written in accordance with the client-server network interaction model. The client application can create a package according to the specified parameters and transmit it over the network. In turn, the server application can receive, process and analyze traffic with the specified parameters, as well as send responses to client applications to the network.

One of the main tasks in the implementation of this project was the development of a UI (user interface) application. Thus, it is necessary to create a convenient and functional set of system control elements inside the software product so that its use does not cause discomfort.

Taking into account the fact that technical students for the most part are accustomed to using measuring equipment (oscilloscopes, spectrum analyzers, etc.), it was decided to build a UI similar to the interfaces of these devices in their hardware design.

We list the features that must be taken into account in the implementation:

1. Colors. Since the user tends to ignore elements of another area while working with one workspace, they should be separated by a color scheme. You also need to use shades that are conducive to long-term work and do not contribute to an increased level of tension in the organs of vision. In the literature on this subject, the authors do not recommend the use of bright colors and colorful combinations of shades. [2]

2. Clarity. For an interface to effectively help people achieve their goals, it must have the following characteristics. Firstly, it must be recognizable, and its purpose is to be obvious for the user. Secondly, people need to understand that they interact with through the interface. Finally, the process of interacting with the interface should be predictable. [3]

3. Simplicity. Each interface screen should be based on one meaningful action for the user. Such an interface is easier to learn and use, and also easier to complement and expand (if necessary).

4. The visual hierarchy. The visual hierarchy sets the sequence and smoothly directs the user's gaze from one interface element to another. With a weak visual hierarchy, the interface looks overloaded and incomprehensible - the gaze jumps around the screen and it is always in suspense.

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FEATURES OF THE DESIGN STAGES OF GAS TURBINE ENGINE COMBUSTION CHAMBER

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Introduction, requirements for the combustion chamber of gas turbine engines

Currently, gas turbine engines are widely used not only in transport, but also in industry. It is obvious that in the future gas turbine engines (GTE) will play a major role in generating electricity and will be widely used as compressor drives for pumping gas. The combustion chamber (CC) of a gas turbine engine is one of its main elements and to a large extent determines the environmental characteristics and engine performance. It is designed to supply heat to the working fluid by converting the chemical energy of fuel into heat. Currently, it must satisfy the following ten requirements [1]:

1) Quick and reliable start-up, stable operation of the compressor in various operating conditions. In terrestrial conditions, ignition must be provided in the temperature range from minus 40 ° to plus 60 ° C. It must be ensured that the fuel is ignited in a high-altitude aerodrome - up to an altitude of 4.5 km. Ignition altitude for civil aircraft - 9 km;

2) High fuel combustion ratio:

$$\eta = \frac{Q_I}{Q_{II}}$$

where: Q_I – the amount of heat released in the working volume of the chamber during fuel combustion per unit time and spent on heating the working fluid;

Q_{II} – the total (theoretical) amount of heat that could be released per unit of time. In modern combustion chambers in the calculated mode $\eta = 0{,}98 \dots 0{,}995$;

3) Small relative hydraulic losses of the total pressure in the chamber

$$\sigma_{\text{г}}^{*} = \frac{p_{\text{к}}^{*} - p_{\text{г}}^{*}}{p_{\text{к}}^{*}}$$

where: $p_{\text{к}}^{*}$ and $p_{\text{г}}^{*}$ – are the total air pressures at the CC inlet and gas at the gas outlet. In combustion chambers of aircraft gas turbine engines, usually $\sigma_{\text{г}}^{*} = 3 \dots 5\%$

The considered value takes into account friction losses and turbulent losses (percussion in a diffuser, mixing of flows, etc.). It is measured with "cold" purges of the combustion chamber. Under combustion conditions, losses increase due to the expansion of the gas when heat is supplied to it, the corresponding redistribution and increase in the flow velocity;

4) High heat stress of the working volume

$$H = \frac{Q_I}{V_{\text{ж}} \cdot p_{\text{к}}^{*}}$$

where $V_{\text{ж}}$ is the internal volume of the flame tube.

For aviation gas turbine engines, $H = 4000 \dots 5000 \text{кДж}/(\text{м}^3 \cdot \text{ч} \cdot \text{Па})$. Achieving high heat intensity allows to reduce the size and weight of the combustion chamber;

5) Providing a given temperature distribution diagram in the outlet section of the chamber with minimal non-uniformity of this temperature in the circumferential direction (with a large degree of unevenness, the nozzle apparatus may burn out).

$$\delta = \frac{\text{T}_{max}^{*} - \text{T}_{min}^{*}}{\text{T}_{\text{ср}}^{*}}$$

when T_{max}^{*} ; T_{min}^{*} ; $\text{T}_{\text{ср}}^{*}$ – maximum, minimum, average gas temperature behind of the CC. For

aviation gas turbine engines $\delta = 15 \ldots 20\%$ and more;

6) Long service life, convenience and safety of operation of combustion chambers; (minimum 4000 hours before repair, 20,000 hours in total - this is about 2 years);

7) The absence of carbon formation on the walls of the combustion chamber, smoke, toxicity of substances in the combustion products. The level of emissions of smoke (SN (Smoke number)), unburned fuel and gaseous pollutants - nitrogen oxides (NOx), carbon oxides (CO), unburned hydrocarbons (HC) - must comply with ICAO (International Civil Aviation Organization) and the Aviation Rules;

8) Simplicity of design and manufacturability;

9) Easy maintenance and operation;

10) Under various operating conditions, the combustion chamber should work without flame failure in the full range of variation of the coefficient of excess air α.

Combustion in a CC of a gas turbine engine usually occurs in difficult conditions of a three-dimensional turbulent inhomogeneous flow, heat transfer, and combustion processes, the modeling of which is a difficult task. Therefore, the creation of combustion chambers requires large time and material costs, going mainly to experimental development. Indeed, according to many researchers, in such complex products as gas turbine engines, the main amount of time in the general process of its creation is spent on fine-tuning.

Due to the tightening of requirements both in terms of the amount of work and the time of their implementation, traditional design methods and refinements are already becoming insufficient, therefore, in recent years, various methods of computer-aided design have become widely used.

The appearance of the combustion chamber

The appearance of the CC is selected, as a rule, on the basis of the existing prototype, taking into account the traditions and experience of the enterprise, its technological and production base, and the timing of creation. For the prototype, a previously designed CC with known characteristics can be selected that most closely meets the requirements. It should be noted that the creation of a compressor station with the necessary characteristics that reliably works for a given resource requires a significant amount of experimental development work both at the plants and in the engine system. It also makes us, when designing new compressor stations, strive to maximize the use of experience in the creation and refinement of previous designs.

The initial data for the design of the CC:

- general requirements for the engine and its components;
- special requirements for the CC;
- results of the thermodynamic calculation of the engine in the conditional cycle of takeoff and landing operations in accordance with the ICAO standard;
- characteristics of the air flow at the inlet to the CC;
- maximum available pressure and fuel temperature at the inlet to the compressor station;
- extreme “fuel / air” ratios in the mode of throttle response and gas discharge;
- requirements for the amount of air sampling from the CC;
- requirements for the quantity, location and flow sections of air, oil and venting lines, if they pass through the compressor station.

To determine the main dimensions of the spacecraft, a design calculation is carried out, which is based on the basic principles of the theory of the working process and the practical experience gained in creating the spacecraft of a gas turbine engine.

Design features of CC using one-dimensional modeling of processes

With the aim of automated tuning of the combustion chambers of gas turbine engines, obtaining and analyzing the characteristics of the processes occurring in them, at the Department of Jet Engines and Power Plants of the Kazan National Research Technical University named after A.N. Tupolev has developed a program Camera ("Камера") [2]. According to the data obtained as a result of calculations in the Camera ("Камера") program, preliminary conclusions can be drawn about the operation of the combustion chamber and a decision can be made on how to refine it.

The program allows you to analyze the emission characteristics of the combustion chamber (NO_x and CO), the influence of air distribution along the path of the flame tube on the combustion characteristics, the influence of input parameters such as braking temperature, total pressure, speed at the compressor inlet, fuel and air consumption. It is convenient to analyze the operation of the combustion chamber by examining the dependences that the program constructs "Камера" (emission NO_x, CO, the coefficient of completeness of combustion η depending on the coefficient of excess air α, etc.). The dependences are constructed at different temperatures $T_к^*$ and pressure $p_к^*$ at the inlet of the compressor.

Before plotting, $T_к^*$ and $p_к^*$, are set, the geometry of the combustion chamber is set, air and fuel consumption, type and properties of fuel, number of nozzles, diameter of swirls, etc. are set. The most important factor affecting the processes in the chamber is the number and location of the air supply belts, as well as the distribution of the supplied air over the belts.

The program also displays graphs of the completeness of combustion, temperature, coefficient of excess air and other parameters that vary along the path of the flame tube. As an example in fig. 1 presents the appearance of the chamber and graphs of changes in gas temperature, completeness of combustion, and local values of the composition of the mixture along the CC path at take-off mode at $H = 0$ km, $= 0$.

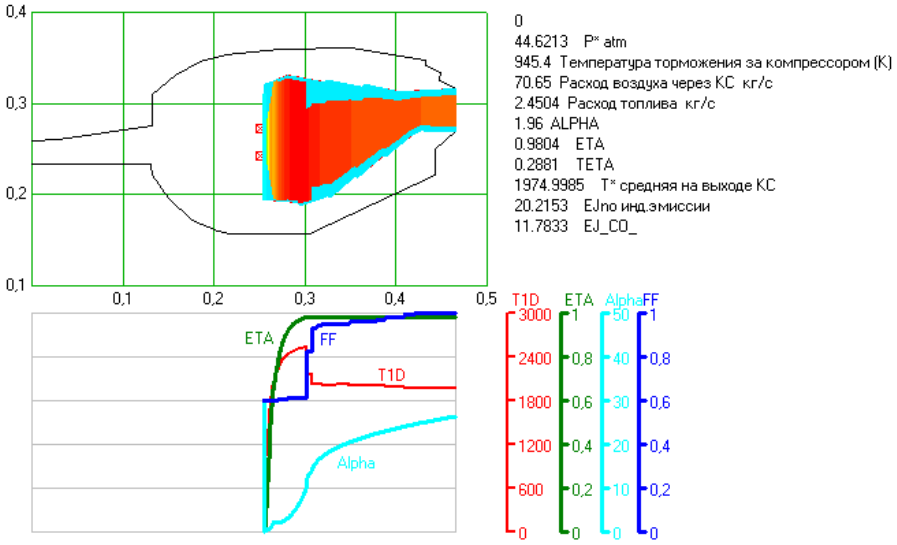

Fig. 1. The combustion process and parameter changes along the length of the CC. The initial data of the considered calculation option: $p_к^* = 44{,}6\ atm$; $T_к^* = 945{,}4K$; $\alpha = 1{,}96$; fuel consumption $G_т = 2{,}4504\ kg/s$; temperature at the exit of CC $T_г^* = 1975K$

Three-dimensional modeling based on a one-dimensional model

After there was a one-dimensional calculation of the processes in the combustion chamber, we can begin to create a three-dimensional model of the studied combustion chamber for its subsequent strength and gas-dynamic analysis. The contour of the heat pipe obtained in the program "Камера" with distributed openings for supplying secondary air serves as the initial data for the 3D model in CAD COMPASS V16. Using this program or any other CAD (computer aided design) system, the basic dimensions and appearance of the 3D geometric segment of the ring CC are created.

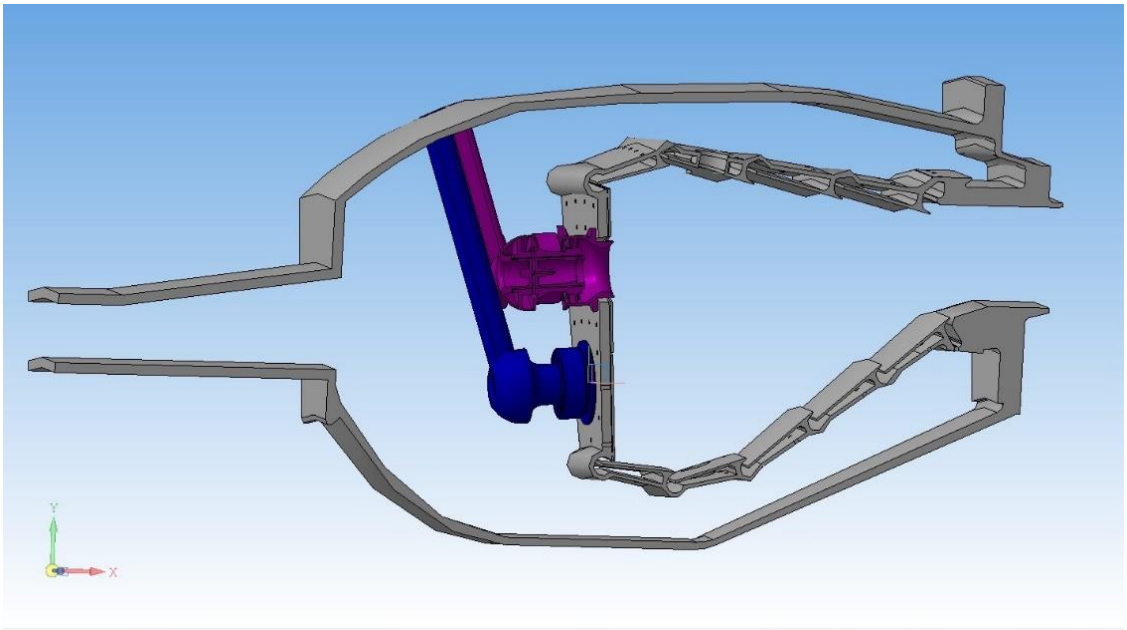

Fig. 2. General view of the CC in the context of the segment (the angle of the sector is 15^0).

In fig. 2 shows a segment of an annular CC. Typically, the limitation of the segment on the side surfaces is chosen for reasons of multiplicity in the number of front-end devices CC. In [3], it was shown that the sector size multiple of two front-end devices provides an acceptable level of calculation error when switching from a full-size ring model to a simplified sector one. The resulting segment is prepared for gas-dynamic analysis taking into account the combustion processes in the ANSYS Fluent package version R19.2 Academic. To do this, based on the obtained model, a finite element computational grid is created. For the calculation of gas dynamics and combustion in the segment of the annular CC, boundary conditions are set: fuel consumption - kerosene (mass flow rate) and temperature; flow rate and air temperature.

For the calculation in a three-dimensional setting, various combinations of turbulence and combustion models are used. In our case, a combination of models has proven itself well: k-e RNG turbulence; Combustion is a model of laminar micro-flames for an unmixed mixture (flamelet), where the Jet – A chemical mechanism (17 components of the mixture and 28 chemical reactions) was used as a set of chemical reactions for the oxidation of kerosene [3].

Calculation and analysis of a combustion chamber in a three-dimensional setting is a complex and time-consuming process that takes a lot of time. The need to analyze several design options significantly complicates this work. Therefore, it is important to reduce the number of structures to be calculated by introducing a calculation based on a one-dimensional combustion model at the initial stage of designing a compressor, and then clarifying the design features of the compressor using a numerical method.

Comparison of the three-dimensional and one-dimensional calculations by the main parameters distributed along the length of the flame tube of the CC shows a similar character of the obtained dependences and insignificant differences between them.

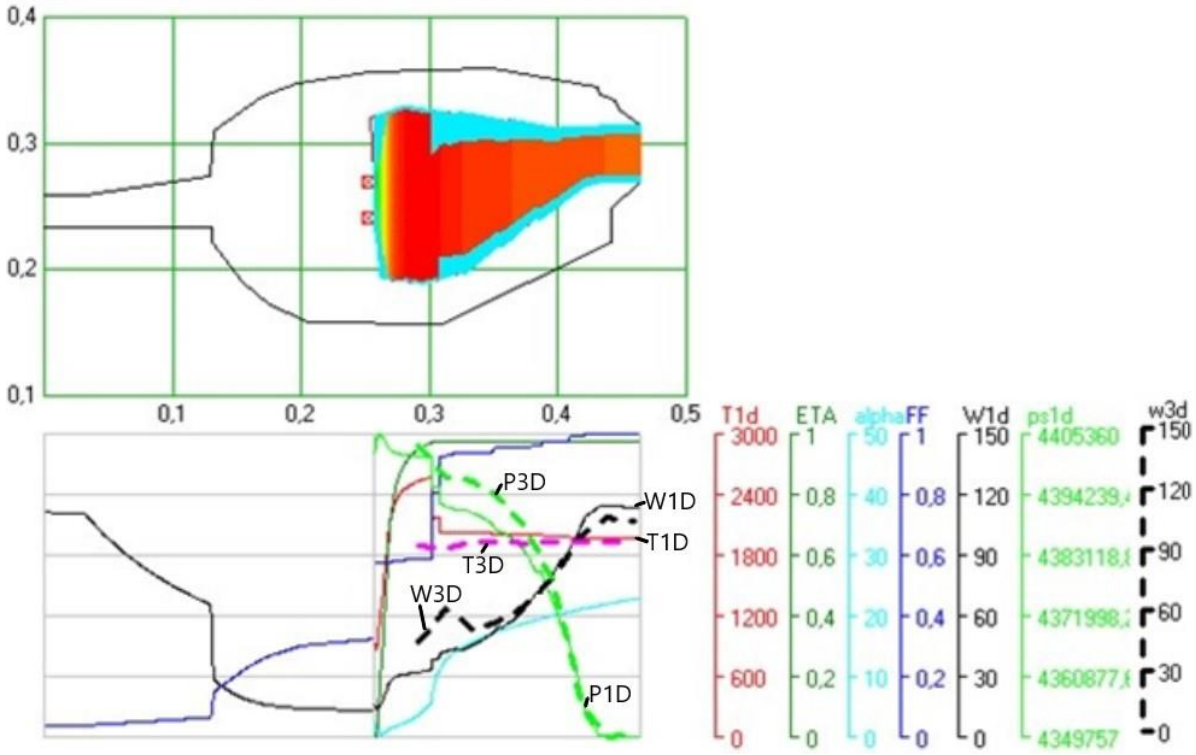

Fig. 3. Comparison of three-dimensional and one-dimensional calculations by the main parameters distributed along the length of the flame tube CC.

where: T1D; P1D; W1D are the temperature, pressure, speed of one-dimensional calculation along the length of the flame tube of the compressor; T3D; P3D; W3D are the temperature, pressure, speed of three-dimensional calculation along the length of the flame tube of the compressor.

The calculation results showed that the discrepancy between three-dimensional and one-dimensional calculations for the mass-average temperature at the outlet of the CC was no more than 5%.

Conclusion

The paper presents the basic requirements for CC, which often contradict each other and to achieve them it is necessary to fine-tune the combustion chamber. Work on refining the combustion chamber experimentally is time-consuming and material resources, therefore, three-dimensional numerical calculation methods are often used to evaluate the effect of design parameters on the operation of the compressor station. In order to reduce the options for numerical calculation in a three-dimensional formulation, it is proposed to use a program for one-dimensional calculation and analysis of CC at the initial design stage.

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УДК 004.422.81

DEVELOPMENT AND INVESTIGATION OF NUMERICAL MODELS, ALGORITHMS AND PARALLEL PROGRAMS IN THE PROBLEMS OF DETECTION AND RESTORATION OF UNDERGROUND CAVERNOUS ZONES

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In connection with the violation of the Comprehensive Test Ban Treaty on September 24, 1996 of some countries named as nuclear powers, monitoring of the consequences of underground explosions, as a result of which cavernous inclusions are formed, is actual. In addition, in the world there are many geoecological problems associated with technogenic intervention. For example, underground cavities due to the extraction of underground minerals which can cause earthquakes. Detecting them quickly will help to avoid many problems.

The detection of finding underground objects is part of the inverse problem of geophysics. As it is known, inverse problems are difficult to solve and require certain methods. This task is related to the type of incorrect mathematical problems, because it is rather unstable and has a large number of solutions. The solution to the inverse problem of geophysics today in a full form does not exist. However, many methods of solving of this problem in a private form have been developed. The aim of the research is the localization of underground cavernous inclusions using seismic methods.

Most often implemented algorithms of detection and restoration of underground objects are built into specialized platforms that have a proprietary licence, and are adapted to specific methods of exploration geophysics. For example, the software company "Schlumberger" Petrel, a package of programs ZOND domestic development, etc.

First of all, it is necessary to review the existing models of the environment with caverns and adapt them to a specific experiment.

The next step is the selection of an algorithm for detecting and restoring of cavernous inclusion. It is supposed to adapt the seismic event localization algorithm. Suppose that the moment of reflection of the wave emitted by the source from the object in the environment can be taken as a seismic event. In this case, the algorithm for localizing seismic events can be applied to this task by the difference in the S-wave and P-wave arrival on one receiver and from the ratio of the difference between the P-wave arrival times on two neighboring receivers. In both approaches, the required quantities are the coordinates of the object. The propagation velocities of elastic waves are assumed to be known, and the time of entry of these waves to the receivers is determined from the seismograms. This task relates to the type of inverse problems on the problem of comparison of theoretical and observed data, because there are many parameters, but the observations contain errors. Therefore, in both cases, it is advisable to reduce the task of the coordinates finding of an object to the least squares method. To find the minimum of the functional in this case, the Gauss-Newton method and its modifications [2], the singular decomposition, the Kacmage method, etc. are used.

The MATLAB application package was selected as the development environment. In the numerical experiment, a two-dimensional, homogeneous, isotropic model of the environment was used with elastic wave velocities: Vs = 1.4 km/s and Vp = 2.0 km/s and one point object at different distances from the receivers.

For both approaches (for the difference in the arrival of S- and P-waves on one receiver and on the difference in the arrival of P-waves for two neighboring receivers) at known velocities of elastic waves, the same accuracy was shown by both the Gauss-Newton method and the Levenberg-Marquardt method.

After selecting and adapting of existing models and algorithms for the task, it is necessary to test them on real data. Further this algorithm must be parallelized on the computer system used. It is supposed to use OpenMP, MPI and CUDA parallelization technology. It is necessary to compare the effectiveness of the parallelization technologies used on operating computing equipment.

The expected results of the research is a developed parallel algorithm of detection and restoration of underground cavernous zones for a specific model of the environment for seismic exploration method.

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УДК 331.453

DANGEROUS AND HARMFUL INDUSTRIAL FACTORS OF THE FOUNDRY OF «SIBLITMASH» ON THE EXAMPLE OF SAND MIXER’S AND CUPOLA MELTER’S WORKING PLACES

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Abstract: In this article, we will consider current problems linked with releasing of harmful and dangerous industrial factors of the foundry at «Siblitmash», and its effect on cupola melter’s and sand mixer’s specialty; ecological state; equipment used in workshops; implementation of production and instrumental control.

«Siblitmash» is the only plant in Russia specializing in the field of foundry engineering. Today, the foundry specializes in the production of gray cast iron SCH20-SCH35, conveyor casting (from 300 grams to 50 kg), shaped-body castings (from 50 kg to 3 tons), base casting (from 3 tons to 15 tons) [1].

Harmful and dangerous industrial factors have been identified during the research of a technological operation at the workplace of a 3rd-category sand mixer. The sand mixer is engaged in the preparation of the molding sand at a mixture preparation complex for automatic molding lines, the preparation of the molding sand and core mixture on the runners to separate the molds.

According to the results of a special assessment of working conditions for the following factors of the working environment and the labor process which involves: aerosols of predominantly fibrogenic action (3.4), noise (3.1), microclimate parameters (2), severity of the labor process (3.2), the final class of working conditions was established as 3.4 - harmful 4-th degree [2].

The main danger at the workplace of the sand mixer, molder is dust of various compositions (sawdust, dry sand, binders). Dust removal and gas cleaning plants are used to maintain the level of acceptable working conditions on the territory of the workshop.

Tests of industrial emissions on the territory of «Siblitmash» showed that the gas volume flow in the gas duct is 4.745/4.905 m^3/s with a gas duct diameter of 0.28 m and an area of 0.062 m^2. According to the results of the analysis, the concentration of harmful substances is 0.3188 /0.0295 g/m^3, the emission value is 1.5127/0.01447 g/s. The gas cleaning efficiency is 90.43%.

The plant's sanitary-industrial laboratory carries out measurements within the framework of production and instrumental control. The study of the air in the working area is performed by using an automatic tester OP-221, a fur aspirator AM-5, a combined device TKA-PKM. Selection conditions are general exhaust ventilation.

According to the measurement results, the average monthly concentration is:

- on the body section (knockout grate, molding machines) silicon-containing dust - 5.8 mg/m^3 with maximum permissible concentration - 2.0 mg/m^3; carbon monoxide - 15 mg/m^3 with maximum permissible concentration - 20 mg/m^3;

- on the base site (sandblast) SC dust - 5.0 mg/m^3 with MPC - 2.0 mg/m^3; carbon monoxide - 15 mg/m^3 with MPC - 20 mg/m^3;

- on the land preparation site (preparation of the composition of the land, cleaning of burnt land) wood dust - 15.6 mg/m^3 with MPC - 6.0 mg/m^3; SC dust - 9.8 mg/m^3 with MPC - 2.0 mg/m^3; carbon monoxide - 20 mg/m^3 with MPC - 20 mg/m^3;

The next subject to determine is harmful and hazardous industrial factors released during the technological operation at the workplace of the 4th category cupola melter. According to the results of a special assessment of working conditions for the following factors of the working environment and the labor process which involves chemical (3.2), aerosols of predominantly fibrogenic action (3.3), noise (3.1), microclimate parameters (3.1), severity of the labor process (3.2), the final class of working conditions was established as 3.3 - harmful 3rd degree [3].

The furnace poses the greatest danger at the workplace of the cupola melter, as he works directly with hot metal (when cast iron is melted t = 1150°C, when steel is melted t = 1450°C). The cupola does not have its own dust and gas cleaning system, ventilation pipes go outside to the territory of the plant.

The plant is upgrading equipment, so in 2015 a new electric arc furnace DPPTU - 6 I 1 was installed with its own gas purification system. The capacity of the furnace is 50 tons/day. In 2018, an additional aspiration system was installed (Figure 1) from the electric arc furnace DPPTU – 6 I 1 as part of the technical re-equipment of a hazardous production facility, i.e. the foundry of «Sibltmash».

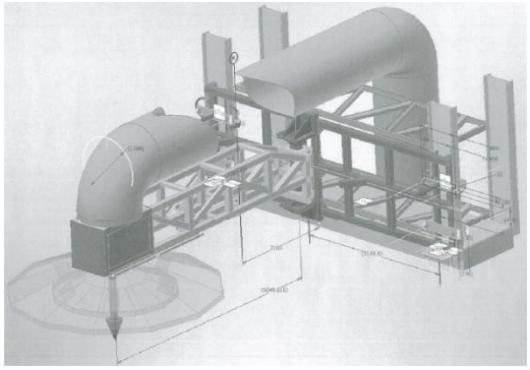

Figure 1. The metal structure of the vent installed above the electric arc furnace DPPTU - 6 I 1

In accordance with the requirements of paragraph 226 of the Federal Law "Safety Rules for the Preparation, Transportation, and the Use of Melts of Ferrous and Non-Ferrous Metals and Alloys Based on Them", the electric arc furnace is equipped with an aspiration system consisting of an vent device (umbrella), air ducts, valves, and fan V – Ts 4 - 70 -16 with a capacity of 58,000 m^3/h and the existing dust collector. In accordance with the requirements of paragraph 98, a special heat-reflecting film is glued onto the glass of the window of the control panel of the arc furnace to increase the heat-reflecting ability. The remote control window is equipped with a removable metal mesh for protection against mechanical damage.

In accordance with the requirements of paragraph 236 of the Federal Law on Federal Requirements, it is necessary to conduct an annual instrumental check of the efficiency of aspiration systems.

Thus, harmful and dangerous factors (noise, microclimate parameters, dust, emissions of harmful substances, temperature) have been identified during the research; measures for replacing old equipment with new ones and modernization have been proposed. Due to this, a reduction in harmful factors and a reduction in labor costs are achieved. The use of modern personal protective equipment allows us to achieve improvements in working conditions by 10-15%. The latest masks and headphones are purchased for workers, designed by 3M company to be used in conditions of a significant level of industrial noise and pollution.

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УДК 620.97

THE USE OF ELECTRIC VEHICLES AS THE STORAGE OF ELECTRICAL ENERGY

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In the current conditions of the electric power industry the issue of electric power accumulation systems is quite acute. These systems are needed in order to reduce the load on power plants during peak loads, i.e., storage units should take over a part of consumers and supply them with electricity.

Electric vehicles containing batteries in their design can help in this regard. Vehicle owners can use both public and private charging stations, allowing owners to be mobile enough to choose their route.

Figure 1. Example of including an electric vehicle as an energy storage device in the distribution network.

Essentially, electric vehicles can be used as an energy storage device at night, when there is a significant load

subsidence and excess energy from the network needs to be stored somewhere. An electric vehicle can also store energy from generators during production downtime, in order to give away some of the stored energy if it is overloaded. For example, this may be useful in the oil and gas industry, as some gas piston generators are needed to provide electricity to the oil and gas field in normal operation. But when the drilling process begins, power consumption starts to change dramatically, the generators are unable to cope with this changing power, and they have an emergency shutdown. That's why now they keep the so-called "hot reserve" at such facilities, i.e. some more generators are idling all the time. With the use of storage devices, including in the form of electric cars, these backup generators may not be needed, so you can achieve significant savings. [1]

An important trend in the development of electric transport is the possibility of electric vehicles returning electricity to the grid. This concept is called "virtual power plant" or more often V2G (Vehicle to grid). One of the key events in this area is the agreement signed between Nissan and the international power grid company Enel in Paris in 2015 at the UN Climate Change Conference. As part of this agreement, a project was announced in France to implement a technical feasibility study for private vehicles to bring their energy back into the grid. Already in 2016, Enel launched a similar project in the UK and a year later in Italy. It is also important that such projects can be economically justified. A good example of this is the transport sector in Denmark, which, according to a study by Nissan and Enel, generates revenues of around 1300 € a year. The quality of the electricity returned to the grid is satisfactory, but the main advantage is that, if the system is properly organized, the peak hours of electricity from electric vehicles' batteries will help to reduce the negative impact on the network caused by excessive loads. Among the potential risks of this technology is the possibility of voltage instability in the connected network if the batteries are discharged too quickly into the network. This problem can be eliminated by using a special controller. Australian researchers also propose to charge the battery of an electric vehicle with energy from a wind turbine for the subsequent return of generated energy to the network, to avoid reducing the quality of electricity when the wind energy is fed directly into the network.

This technology has already been tested in Germany in Hagen. Here, Nissan Leaf electric vehicles are able not only to consume energy from the grid, but also to supply it when needed. In Germany, for example, they are trying to integrate electric vehicles as a regulatory reserve for the grid.

New and innovative solutions are needed to stabilize power grids in order to satisfy the universal desire to move towards decentralized energy production from renewable sources. The increasing use of renewable energy is leading to fluctuations in the network, which must be balanced with primary regulation to prevent impending blackouts. Electric vehicles such as Nissan Leaf, with integrated bidirectional charging technology, can play an important role in this.

Conclusion: The return of electricity from electric vehicles is also useful from the perspective of network organizations, as it contributes to the normalization of the voltage, the maintenance of frequency stability, and from the perspective of electric vehicle owners, as it can be economically advantageous. Technical implementation will require separate elaboration and development of uniform requirements and standards.

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2. Mobile power stations on the way - with the use of electric car Nissan Leaf to stabilize the German electricity grid. Electronic resource. Access mode: https://www.mobilityhouse.com/int_en/magazine/press-releases/v2g-hagen-electric-car-stabilise-electricity-grid.html/

УДК 519.63, 004.942, 519.876.5

PREDICTING DURABILITY CHARACTERISTICS OF AIRCRAFT DESIGN PARTS

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This work demonstrates computational capabilities of the FEniCS finite element modeling environment [1] during some test simulations of durability characteristics of helicopter blades under mechanical load during rotation. Obtained results are compared with the ones computed under similar operation conditions using commercial software commonly used in aircraft industry of Kazan.

Nowadays virtual simulations are widely spread and their role in industry has been rapidly growing. The most popular commercial CAD systems are the follows: COMSOL Multiphysics, SIMULIA Abaqus FEA, Nastran, ANSYS and domestic LOGOS. Although the high level of performance and lots of built-in physical models the cost of these packages may reach 1 million rubles. This is a major drawback making difficult to transfer these professional tools to use in small research companies. Professional-level open-source finite element modeling software (like the FEniCS) can be wise solution.

Modeling of various cases of structural mechanics shows that in addition to the flexibility of the mathematical formulation of the engineering problem FEniCS provides results comparable with commercial analogues. This circumstance makes it a competitive solution for updating and substitution of conventional CAD software typically used in enterprises segment is supposed to have significant effect on making cheaper the process of prototyping and numerical analysis maintaining the same level of functionality. For companies commercial effect to switch their code base to the FEniCS platform is directly proportional to total amount of unique installations of this software. Advantage is minimum costs to train engineering-technical staff to use the FEniCS, because it is equipped with theoretical base and well-illustrated tutorials to solve for typical engineering problems.

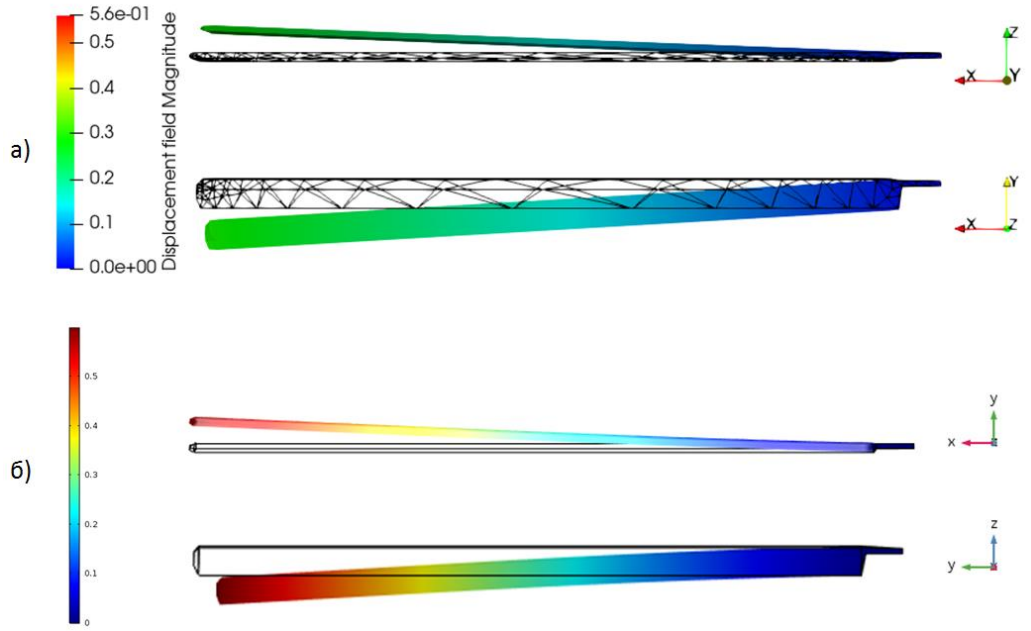

Fig. 1

Gravitational and centrifugal-forced deformations of simplified geometry of the Mi-8 helicopter blade, presented on Fig. 1, under constant mechanical load have been calculated in FEniCS as well as Mises stress. Results have been verified via side-by-side comparison solutions produced in COMSOL Multiphysics under similar initial and boundary conditions. It's shown that FEniCS is not worse than commercial ones within the range of abilities, and its level of customization is not constrained, in contrary to typical "black-boxes" used in commercial solutions with closed code. It makes the FEniCS a relevant tool to substitute existing simulation platforms to be paid which are used in Kazan's aircraft enterprises.

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УДК 621.762

INVESTIGATION OF THE Ni_5Al_3 PHASE IN NiAl AND Ni_3Al INTERMETALLIC COMPOUNDS OBTAINED BY SPARK PLASMA SINTERING (SPS) AND PLASMA SPRAYING

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Abstract: A number of new experiments have been conducted to study the Ni_5Al_3 phase in intermetallic compounds obtained by spark plasma sintering and plasma spraying methods. As a result, optical, electron, and x-ray microscopy data have been obtained, the analysis of which supplements the data on the formation mechanism and the region of existence of the Ni_5Al_3 phase.

Key words: nickel aluminides, Ni_5Al_3, heat treatment, SPS, plasma spraying

Nickel aluminides Ni_3Al and NiAl are of scientific and practical interest due to their high corrosion resistance, wear resistance, high strength characteristics at elevated temperatures. At present, the preparation of the Ni-Al intermetallic compounds is an urgent topic, which has been the subject of many studies. However, the field of the production of intermetallic compounds using SPS, as well as the production of dense coatings of nickel aluminides using plasma spraying technology, are still poorly studied. Since SPS and plasma spraying technologies provide high cooling rates, the residence time of the material in a high-temperature state is drastically reduced. Due to this, the initial fine-grained structure is preserved, which contributes to the growth of the complex of mechanical properties. However, these methods do not prevent the occurrence of an undesirable Ni_5Al_3 phase which has a hardness of 8500 MPa and is more brittle than NiAl-based alloys. This leads to the fact that the heat resistant intermetallic compounds of the Ni – Al system can become brittle and crack [1].

The martensitic structure (NiAl) is formed by heating to temperatures above 1133 ° C and the following rapid cooling. Subsequent heating to temperatures below 700 ° C facilitates the conversion of NiAl → Ni_5Al_3. The question of the appearance of the Ni_5Al_3 phase is rather widely considered in various reliable sources, but in different sources the temperatures of the onset of the martensitic transformation (Ms) have large discrepancies of the order of 120 K. These discrepancies, presumably, arise primarily due to differences in measurement methods, production methods and the uncertainty of alloy composition.

The aim of the study is to elucidate the mechanism of formation and the region of existence of the Ni_5Al_3 phase in intermetallics of the Ni-Al system obtained by SPS and plasma spraying, as well as to develop recommendations for obtaining Ni-Al intermetallics by SPS and plasma spraying.

Powder of the ПН85Ю15 brand was used as a starting material for the manufacture of samples. The chemical composition of the powder is 70 to 72 at. % Ni, the rest is Al. The particles have a size of 40 to 100 microns.

Sintering of the powder mixture was carried out in graphite form at the SPS10-4 Advanced Technology spark plasma sintering unit. Sintering was carried out according to the following mode: the sintering temperature was 1100 ° C, the pressing pressure was 40 MPa, the medium was argon, the exposure time was 10 minutes. The heating rate was 500 ° C / min; the optimal regime of spark plasma sintering was determined from [2].

The plasma spraying technology with a distributed ring input of powder and gas-dynamic focusing was used for coating by the method of air-plasma spraying. The air-plasma spraying of the ПН85Ю15 powder was performed using the ПНК-50 plasmatron. Pipes made of low-carbon steel (0,2 % C) were used as a substrate. Before coating, the surface of the pipes was sandblasted; after plasma spraying, stress-coated samples were annealed at 300 ° C for 5 hours to remove internal stresses.

The coatings were sprayed in the following mode: arc current 200 A, voltage 223 V, shielding gas – a mixture of air and propane-butane, transporting, focusing, and plasma-forming gases – air. The obtained samples were heated in an oven from 300 to 800 ° C, with an interval of 100 ° C. The exposure of samples in the furnace was 1 hour. Air cooling followed after that.

The behavior of the Ni_5Al_3 phase was monitored during heating for every 100 ° C using microscopy methods. As a result, images were obtained by optical microscopy methods, scanning electron microscopy, transmission electron microscopy, X-ray phase analysis. An analysis of the obtained data allows us to elucidate the formation mechanism and the region of existence of the Ni_5Al_3 phase in the intermetallic compounds of the Ni-Al system obtained by SPS and plasma spraying.

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УДК 621.382.032.27

EXPERIMENTAL DETERMINATION OF THE VOLTA POTENTIAL DIFFERENCE OF THE Cu AND Al WORK FUNCTION ENERGY HARVESTER PLATES

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Today, electrostatic energy harvesters are one of the most promising devices for ensuring the autonomous work of various wireless sensor devices and networks based on them [1, 2].

In such devices, batteries are most often used as the primary power source, which requires periodic replacement and recharging.

The use of Volta potential difference between two different materials as the primary power source may eliminate the need for batteries and related problems. Taking into account the wide

scatter of published data on the material work function [3] and, as a consequence of the Volta potential difference, the task of experimental determination of the Volta potential difference of the most used materials for electrostatic energy harvesters (cooper and aluminum) becomes urgent.

To determine the value of the Volta potential difference of Cu and Al in the electric circuit with series connection of elements (Fig. 1), consisting of a resistor R and a variable capacitor C, an additional voltage source V_0 was included. One of the variable capacitor plates was made of copper and the other of aluminum. In this case, the voltage across the resistor is defined as

$$V_R = V_C - V_{Cu/Al} \pm V_0,$$

where "+" – corresponds to the case when the keys S_1 and S_2 are in positions a_1 and b_1 (direct polarity of V_0), and "-" – corresponds to the case when the keys S_1 and S_2 are in positions a_2 and b_2 (reverse polarity of V_0), respectively. $V_{Cu/Al}$ – Volta potential difference. Thus, the value of V_0 at which a minimum of V_R will be observed is the Volta potential difference of the materials of the capacitor plates.

In the experiment, a variable capacitor with 150 mm × 150 mm aluminium and copper electrode plates was used. The capacitance value C in a stationary state was 165.7 pF, and the resistance value R was 4.82 MΩ.

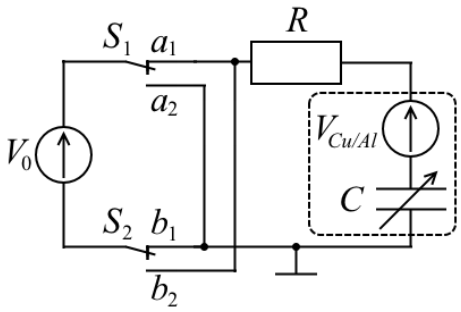

Fig. 1. Energy harvester electrical circuit with serial connection of the elements

Fig. 2 shows the dependences of the peak-to-peak voltage amplitude across the resistor R on the value and polarity of the additional voltage source V_0, determined by experimental data. These dependences show that the minimum signal amplitude is achieved with direct polarity of V_0 = 0.374 V (Fig. 2, squares). And as it was mentioned earlier, this value also corresponds to the value of the Volta potential difference of $V_{Cu/Al}$. It was also found that in this case there is a sharp an 180^0 phase change of the V_R signal. With a reverse polarity of V_0, the peak-to-peak voltage amplitude across R monotonously increases over the entire range of V_0 (Fig. 2, triangles). Also, the presence of a signal on the resistor R in the absence of V_0 indicates the possibility of the energy harvester working only with the Volta potential difference as a primary power source.

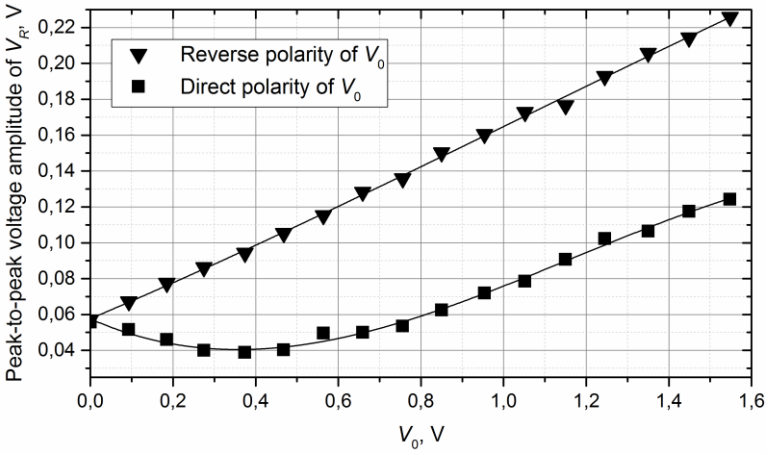

Fig. 2. The dependence of the peak-to-peak voltage amplitude across the resistor R on the value and polarity of the additional voltage source V_0

Thus, the experimentally established value of the Volta potential difference between copper and aluminum is 0.374 V. The possibility of using the Volta potential difference as a primary power source for work function energy harvester is also shown.

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УДК 621

DANGEROUS LOADED DETECTION IDENTIFICATION EQUIPMENT IN A MINE OF MINING

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Abstract. The issues of constructing equipment for predicting the dynamic manifestations of rock pressure by the method of electromagnetic radiation are discussed. The results of the field tests are shown, the oscillograms recorded at different sections of the mine are shown. It is shown that in the studied areas of the mine S.M. Kirov dangerous are dynamic manifestations in the form of shooting, and in the depths of the development there is no growth of cracks that can manifest themselves in the form of a rock shock.

Coalfields, mines, ore rock burst hazard, natural stress state, rock mass, EME, device of registration radiation emission.

Introduction

One of the promising and poorly studied non-contact methods for predicting the dynamic manifestations of rock pressure is the electromagnetic radiation method. The essence of the method is that when the rock is destroyed, electromagnetic radiation emission is observed, according to the characteristics of which we can talk about the nature of the discontinuity in the rock mass. For the first time, the employees of Tomsk Polytechnic University observed the emission of radiation in the 60s and early 70s under the supervision of Professor A.A. Vorobyov . The method of electromagnetic radiation involved the leading scientific institutions of the country, such as the Institute of Physics of the Earth. O.Yu. Schmidt RAS, The Institute for Integrated Subsoil Development of the Russian Academy of Sciences, Ioffe Institute of Physics and Technology RAS [3], Mining Institute SB RAS [2]. For this method, electromagnetic radiation recorders were developed, but this equipment does not allow carrying out a frequency analysis, since it only operates on the integral component of the signal [3], but one of the key parameters in predicting the dynamic manifestations of rock pressure is signal spectrum. So it was shown [1] that, when the signal spectrum approaches the 500 kHz, the signal for the marble breed, an avalanche-like collapse

occurs. The Mining Institute of the SB RAS together with Novosibirsk State Technical University have developed the registration and diagnostic of complex REMI-4S. The complex consists of a portable recorder and software, shown in Figure 2. The recorder is equipped with non-volatile memory for recording and storage of recorded signals, as well as a graphic indicator that allows you to observe the measurement results in real time. The information stored by the registrar is analyzed and visualized in detail using software. The block diagram of the device is shown in Figure 1.

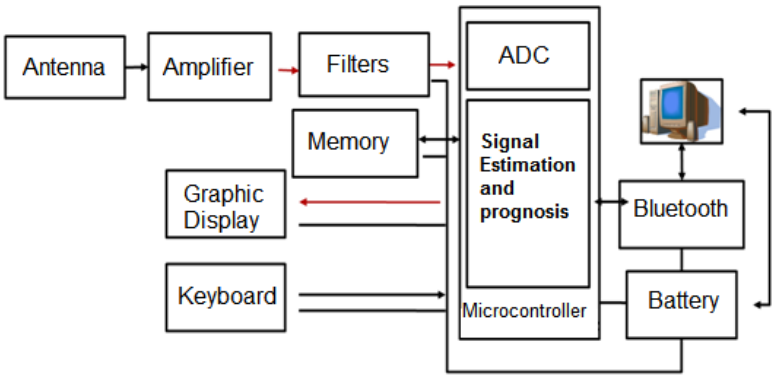


Figure 1 – Block diagram REMI-4S

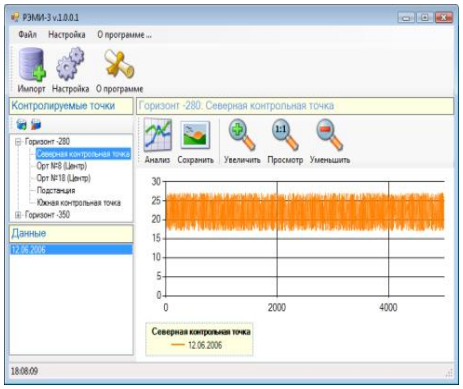


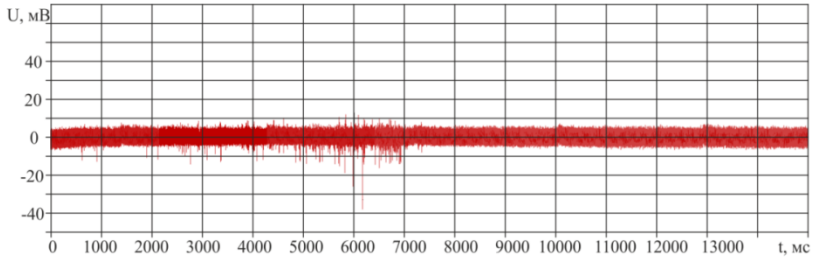
Figure 2 – Appearance of the registrar and software of electromagnetic radiation REMI-4S

Technical characteristics:

- Antenna sensitivity, signal /noise 40 dB — 6mV/m
  Antenna output voltage corresponding electric field strength 6 mV/m — 10uV
- Antenna operating frequency range — 10 kHz ÷ 250kHz
- Resolution ADC — 12
- Interval of averaging of indications on the indicator — 1/4 s
- Non-volatile memory capacity — 32 Gb
- Type of computer interface — Bluetooth
- Continuous registration time — 36 hours
- Weight with batteries — 300 g
- Client operating system — Windows
  Type of supported databases — Microsoft SQL Server, Microsoft Access

The mine of S. M. Kirov, JSC SUEK-KUZBASS, located in city Leninsk-Kuznetsk, Kemerovo region, was chosen as the place of research. The methane mine category is a super category. The work on identifying hazardous areas was carried out in productive strata: the Boldyrevsky stratum — power is 1.8–2.4 m, the bedding angle is from 0 to 10°; Polenovsky stratum - power is 1.4-1.8m, the bedding angle is from 0 to 12°. The absolute gas content of the mine is 181.7m3/min. The mine has two lava coal mining, four tunneling face. Studies were conducted in

the lava 25-101, tunneling slab CMPH 25-03, capital workings, ventilation furnace 25-97 in the zone of geological disturbance and the influence of lava 25-101. The results of measurements with the REMI-4S device with integration over an interval of 1 ms were recorded, and the signal component at an interval of 15 seconds was recorded in memory. Oscillograms at different sections of the mine are shown in Figures 3-5. The measurement results are shown in table 1.



Figures 3 – The results of measurements of the level of EMR on a PC72

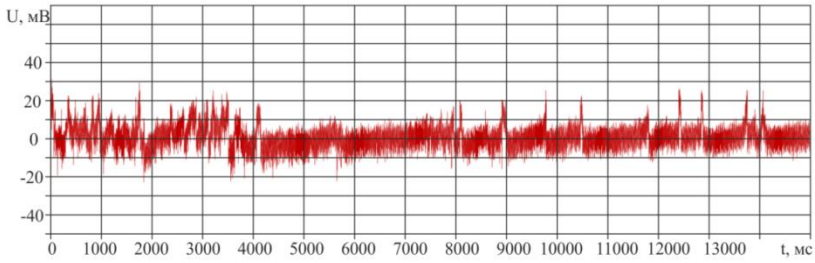


Figure 4 – Measurements near the lava 50 meters from the KS

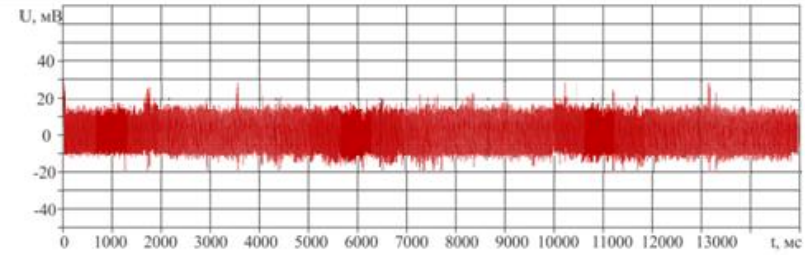


Figure 5. The results of measurements of the level of electromagnetic radiation at TSPSH2503

From the oscillograms recorded by the REMI-4S device, it can be seen that in those places where there is an increased crack formation and failure, the period of single pulses increases from 5 ms to 100 or more. In places where there is abundant peeling, the signal amplitude increases from 5 mV to 20 mV, immediately near the source. In the process of profiling mining with REMI-4S devices, pickets were selected at an interval of 50 meters. A plot was found where an excess of the background component by more than 10 times was observed. During the measurements, there was a dynamic manifestation of rock pressure in the form of shooting, after which the values of the instruments approached the background values.

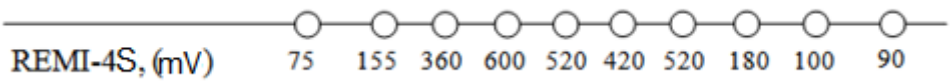


Figure 6 – Profiling of a mine working on a lava pairing

Table 1 – Measurement results with the REMI-4S device

Region	**REMI-4S**
Substation, LSI pairing 2503 TSPSH	0-150 50-300 0-150
Crash 24 FPO 2503	50-160 20-150 20-180
PC20 VS lava	15-400 40-350 40-150
PC52	70-180 10-120 50-140
Lava Pairing 25101	200-500 230-300 330-400
Lava 50 meters from KS	350-600 400-750 360-630
KS pairing	30-70 40-80 40-80
TSPSH 2503	30-60 60-90 80-100

Conclusions

1. New equipment has been developed for recording electromagnetic radiation emission using non-volatile memory and a graphic screen.

2. Field studies of the mine site were carried out using REMI-4S equipment. It is shown that mechanical stresses are manifested in the form of peeling and shooting.

3. In places with a possible manifestation of rock pressure, the background component is exceeded by more than 10 times.

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УДК 621

DESIGN OF PORTABLE CARDIOGRAPH

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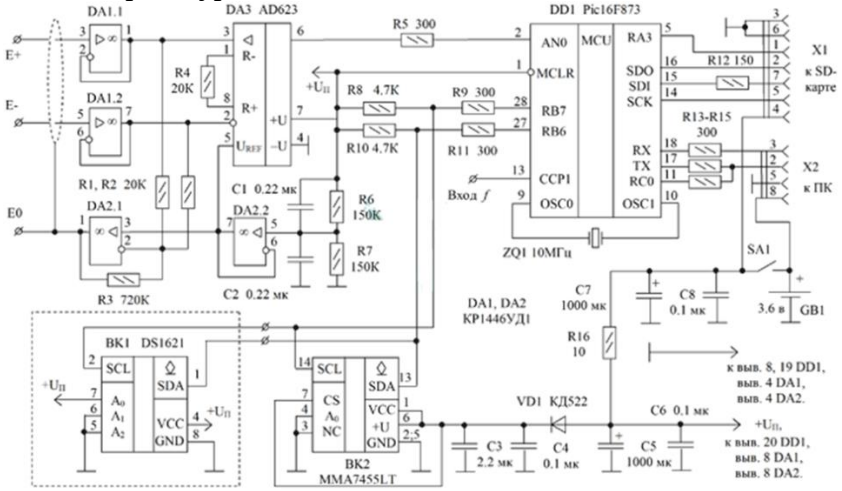
Information of World Health Organization (WHO) states that cardiovascular diseases are one of the main reasons of world mortality in developed countries. The level of mortality in Russian Federation falls since 2003, but it is still very high: there are 653,9 death cases because of cardiovascular diseases per 100 thousands in 2014 [1]. This is the reason why prevention and timely diagnosis of these diseases is very important. One of the most effective diagnosis methods is the electrocardiography (ECG) – medical examination that allows recording the electrical heart activity. The result of electrocardiography is electrocardiogram, which is a graphical representation of the potential difference arising during the activity of the heart.

Despite the fact that the ECG is the simplest and the most informative diagnosis method, it is available in medical facilities only and must be carried out by a doctor. Home-using electrocardiographs exist, but even they are too expensive for ordinary users. But it is indispensable for detecting latent and rare arrhythmias, as well as for monitoring the condition of patients who underwent heart surgery. Therefore the purpose of my research is designing the portable electrocardiograph, which is cheaper, lighter and easier to use than the existing analogues.

At the beginning of this research I looked at several existing circuits of electrocardiographs and, based on the results, I chose a prototype device:



Further on I changed the component base of the circuit in favor of surface mounted devices (SMD). Application of these components allows reducing the cost of the device and its manufacture. SMD has some limitations, for example, a vulnerability to hard vibration. However this limitation can be neglected in this research, because there are no too powerful, vibratory components in my circuit. In addition, I replaced the microcontroller PIC16F873, which has been used in a prototype device, with STM32L052K8T6, because it is cheaper and more powerful.

The research I conducted demonstrates that it is possible to improve the existing medical technologies and make them accessible for everyday home use. By changing the component base I have achieved cost reduction by 6,66% when I replace the electrodes and by 39,86% without this changing. Furthermore, the device has ability to record survey results to a memory card, that allows developing this project to a electrocardiograph with a cardiomonitor function. Of course this implies using a battery of sufficient capacity. I also plan to add a Bluetooth data transfer function in the future. It will be made to send data to the smartphone and next send to a doctor or wrap data using the application like Qardio

App for iPhone. All of this gives this project a new perspective.

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УДК 621.3.073.9

ESTIMATION OF SYNCHRONOUS GENERATOR PARAMETERS WITH COMBINED EXCITATION

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A generator in a closed gondola at high altitude must not demand frequent maintenance. Hybrid designs of a synchronous generator provide the possibility of regulating the electric machine through a low-current control channel and get rid of frequent maintenance of the brush contact. Permanent magnets excite the main magnetic flux in machines with combined excitation. The excitation winding can provide an additional flow or control the magnetic shunt. The presence of permanent magnets makes it possible to use less powerful excitation windings in comparison to purely electromagnetic excitation.

The synchronous machine with combined excitation is used as a basic variant in the design of the 90 kVA generator, in which the electromagnetic combination of the second kind is performed, that is, united not only the three-phase winding but also the magnetic core to the magnetoelectric and inductor generator.

When the excitation coil is de-energized, the flux from the magnets of the left rotor package, entering the stator, can go in two directions: through the greater magnetic resistance of the air gap to the passive poles of its package, or, through the ferromagnetic case to the right stator package, to the south active pole of the rotor. To overcome the second path from the magnet located on the left packet, a significantly smaller MMF is required, since it is "assisted" by a magnet located on the right rotor packet and having a corresponding flow. Therefore, in the absence of saturation of the steel sections of the axial magnetic core, the fluxes passing through the passive poles are close to zero.

To investigate the parameters of a synchronous generator with combined excitation, a magnetic substitution circuit was used, hereinafter MS. It is known that in the design of electrical machines, the MC makes it possible to formulate the problems of calculating the electromagnetic field already at the early stages of making technical decisions and to adjust the dimensions of the individual parts of the generator in order to obtain optimal electromechanical characteristics. Having analyzed the structural features generator a magnetic replacement was held. The circuit we developed for the calculation is shown in Fig. 1.

The calculation of the circuit occurs with zero excitation flux. To find the nonlinear magnetic resistance of the yokes at the operating point, the magnetic fluxes in the circuit were calculated. For this, the method of graphical constructions on the plane was used. The total characteristic of the rotor and stator at the point of intersection with the output characteristic of the MDS (Fig. 2) will yield the required magnetic flux, which makes it possible to calculate the magnetic resistances by the yarn.

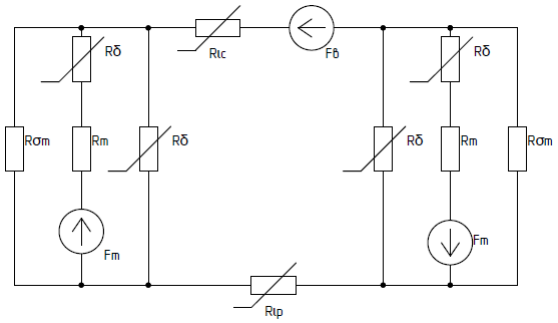

Fig. 1 – Magnetic circuit replacement of the generator: Fm – is magnetomotive force of the magnet; Fв – is magnetomotive force of the excitation winding; Rm – is the intrinsic resistance of the magnet; Rσm – is magnetic scattering resistance; Rδ – is magnetic resistance of air gap and tooth zone within one pole division; Rıc – is the magnetic resistance of the stator housing; Rıp – is the magnetic resistance of the shaft and ferro of the magnetic sleeve of the rotor.

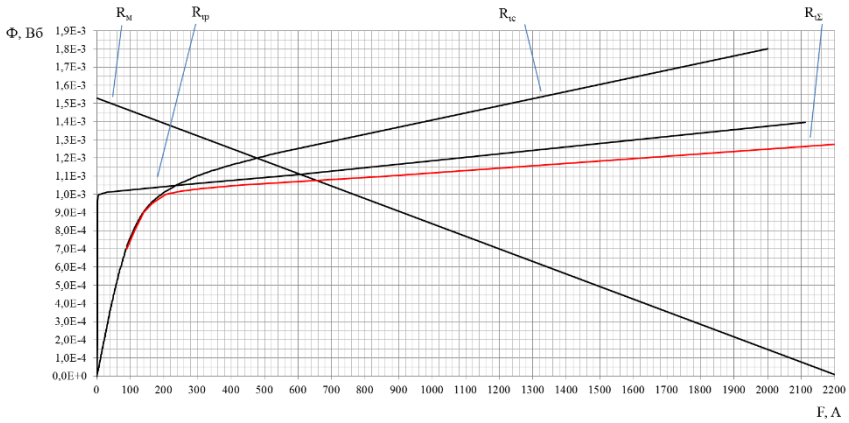

Fig. 2 – Dependence of the flow on MMF in yokes.

Having calculated the circuit for various excitation fluxes, we determine the working flux of the generator by formula

$$\Phi_p = \frac{\Phi_\delta - \Phi_м}{p} \cdot 2,$$

where Φ_δ – is the flux in the magnetic gap, Φ_m – *is* the flux of the magnet, p – is the number of pole pairs.

As a result, the regulating characteristic of a synchronous generator with combined excitation was obtained (Fig. 3).

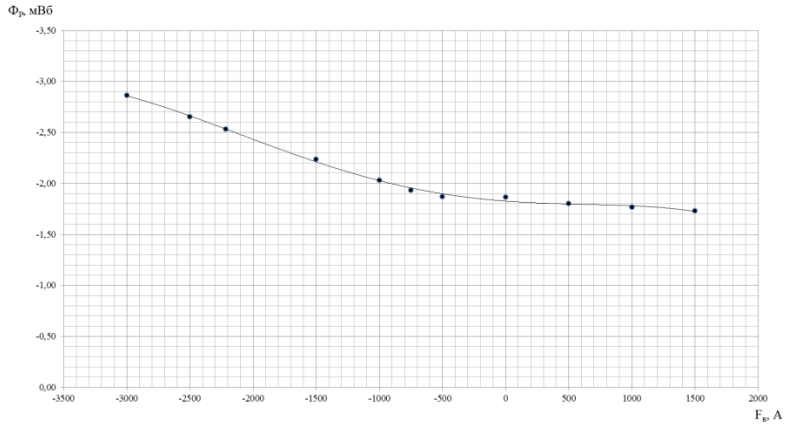

Fig. 3 – Dependence of the working flux on the value of the MMF of the excitation coil.

Analyzing the obtained characteristic, it can be concluded that the adjustment characteristic has a nonlinear nature. The characteristic can be conditionally divided into two linear sections. The change in the excitation flux of a magnet directed along with the flow has a significant effect on the working flow. When the direction of the magnetic flux is reversed, the change in the working flux is slightly pronounced due to the flux of magnets. From here it follows that to feed the excitation coil, it is expedient to use a voltage of one polarity. This solution significantly simplifies the control system of such a generator.

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УДК 608.2

LAYOUT OF POWER CABINETS OF THE INDUSTRIAL ENTERPRISE POWER SUPPLY SYSTEM

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The article considers the layout algorithm of the power cabinet of an industrial enterprise. To minimize the cost of designing and manufacturing power cabinets, an algorithm for determining the optimal layout and wiring of electrical circuits of power panels is presented.

Keywords: composition, layout, algorithm, power cabinet, power supply.

The layout of the power cabinets of the power supply system of an industrial enterprise means to combine the elements of electrical equipment in one cabinet, unit or distribution point. Modern production of switchboard equipment has stringent requirements on weight and overall parameters of power cabinets, which are associated with providing convenient maintenance and equipment movement, aesthetic qualities [1, 2].

It is necessary to formulate engineering requirements to solve this problem:

• The requirements of electromagnetic, thermal, mechanical compatibility, reliability must be implemented;

• A predetermined fill factor of structural units must be provided;

• The volume of structural units should be limited.

The task of the layout in general can be expressed as follows: it is required to divide the set of composable elements E into α disjoint subsets Es, which represent an elementary set of structural nodes.

The most acceptable criterion is the criterion of minimizing the number of connections between structural nodes, because it gives a reduction in the mass of products, minimizes mutual flooding, increases reliability, simplifies the design. Based on the sequential algorithms [3, 4], an algorithm with matrix chains T is developed. In addition to the matrix T, a list of forbidden elements that cannot be in the same subcircuit is also given. Figure 1 shows the layout algorithm of the power cabinet.

1. In the matrix $\boldsymbol{T}$, select the row $\boldsymbol{e_i}$.

2. Build the string s_0^i.

3. Determine the increments of $\Delta K_j^i, \boldsymbol{j} = \overline{1, p}$ into pieces of 1÷p (or $\boldsymbol{l}$ in the first step).

4. Choose $\Delta K_{j*}^i = \min_j \Delta K_j^i$.

5. Modify the row s_{j*} of the matrix S by bitwise disjunction with the row s_0^i.

6. If the number of elements in piece G_j is equal to the given one, then piece G_j is formed. Otherwise, we take the next element and repeat it first.

Fig. 1. The layout algorithm of the power cabinet.

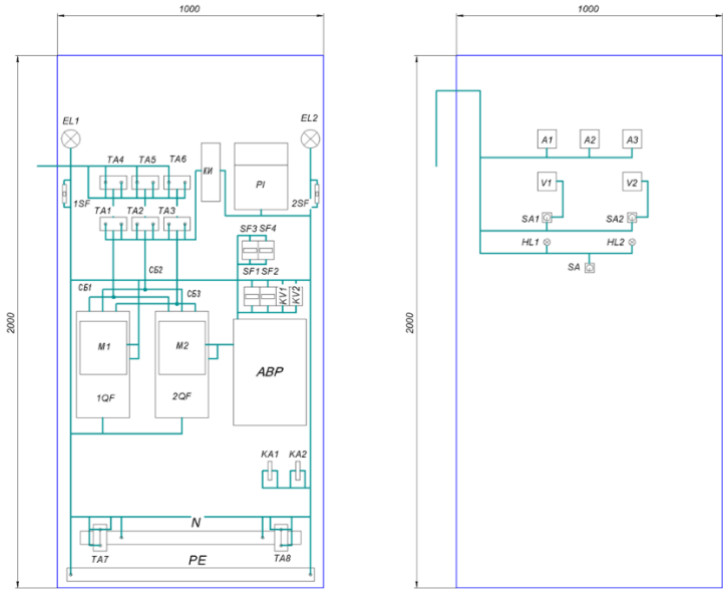

Fig. 2. The layout of the power cabinet

Figure 2 shows the layout of the electrical components of the power cabinet using the developed algorithm. As a result of using this method, the length of the wires decreased by 4615 mm. Thus, an optimization algorithm for the layout of the power cabinet has been developed, a feature of which is the criterion of minimum electrical connections.

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УДК 621

ANALYSIS AND SELECTION OF METHODS OF WEAR RESISTANCE TETS OF SEALING COVERINGS IN GTE

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The analysis of modern developments of sealing coatings used in gas turbine engines, their properties, and also their existing methods for wear resistance is carried out. Based on the analysis, a selection of the test method was made and the terms of reference and a draft of a laboratory setup for testing model samples of sealing coatings were developed.

The use of sealing coatings in parts of the turbine and compressor for a gas turbine engine (GTE) can significantly increase the efficiency and thermal power of the engine depending on the pressure on the peripheral clearances and on the combs of the labyrinth seals between the stages throughout the environment, minimizing the wear of rotor blades. The main requirements for a sealing coating in a gas turbine engine are sufficient strength, high antifriction and heat-shielding properties, low resistance to "weathering" of the working surface, flexibility when cutting blades, labyrinth, erosion resistance [1]. Since the size of the radiation clearances and labyrinth seals between the rotor and stator elements affect its efficiency and economy, the value of this factor during assembly of the unit must be such that it excludes the possibility of the rotor and stator during operation and the possibility of destruction of the rotor part of the seals, which move failure of the entire unit. Taking into account the fact that it is optimal that there is less durable material on the surface of the stator part than on the rotor.

However, fixing on the surface of static seals made from sintered metal, sintered inserts or honeycomb elements is a laborious technological operation that does not allow minimizing these risks. Currently, three main areas have been identified in the creation of materials for gas-turbine engine seals: sintered (inserts), sprayed (gas-thermal coatings) and honeycomb structures (unfilled and filled).

The enterprises of the machine-building industry have developed various compositions and technologies for sealing coatings. Thus, a series of easily developed aluminum-based materials for compressor radial seals, as well as a plasma technology for their application from a charge onto liquid glass, were developed at OJSC Kazan Motor-Building Production Association.

However, the requirements for triggered coatings are constantly increasing and therefore even materials such as ANB (aluminum boron nitride) do not fully meet the new requirements. It has been established from the experience of spraying compositions of sealing materials that a silicate binder (~ 850 - 890 ° C), and then metal components, are initially melted in the plasma jet. The use of these composite materials on a silicate binder does not allow for the long-term performance of the sealing coatings in the gas turbine engine at temperatures above 850 - 870 ° C.

When developing fifth-generation modern gas turbine engines operating at elevated temperatures (up to 1000 ° C), honeycomb fused seals are usually used to seal clearances and protect parts. The radial honeycomb seals currently used in turbines do not sufficiently prevent gas overflow, which reduces the efficiency of the equipment. To seal the clearances and protect parts operating at high temperatures (up to 1200 - 1400 ° C), ceramic heat-shielding materials are used. Coatings of clad or intermetallic alloys based on nickel aluminide alloyed with refractory metals with boron nitride and polyester are considered promising.

In recent years, much work has been done to study the influence of alloying elements, mechanical properties, oxidation and corrosion in the coating. The results showed that Ni_3Al can serve as an excellent matrix for a high temperature self-lubricating composite due to its heat resistance, good corrosion resistance and corrosion resistance.

Carrying out control operations, as well as testing coatings on finished products is an incredibly important operation, which subsequently allows you to find out how effective this or that technology is.

The choice of the methodology for testing wear coatings is determined by the purpose of the study, during which the fracture process is studied to identify general patterns of wear of coatings, the effect of technological parameters of coating deposition, the composition and properties of powders on wear resistance, the influence of the structure and properties of coatings on wear resistance under specified external exposure conditions is evaluated.

The degree of wear in any system will typically depend on a number of system factors, such as the applied load, the characteristics of the testing machine, sliding speed, sliding distance, test conditions (temperature and humidity) and material properties. The value of any wear test method is in predicting the relative ranking of material combinations. This laboratory test method, which is standard, (according to US ASTM G99) allows you to determine the wear of materials under sliding conditions using a pin-on-disk device. Materials are tested in friction pairs under nominally non-abrasive conditions.

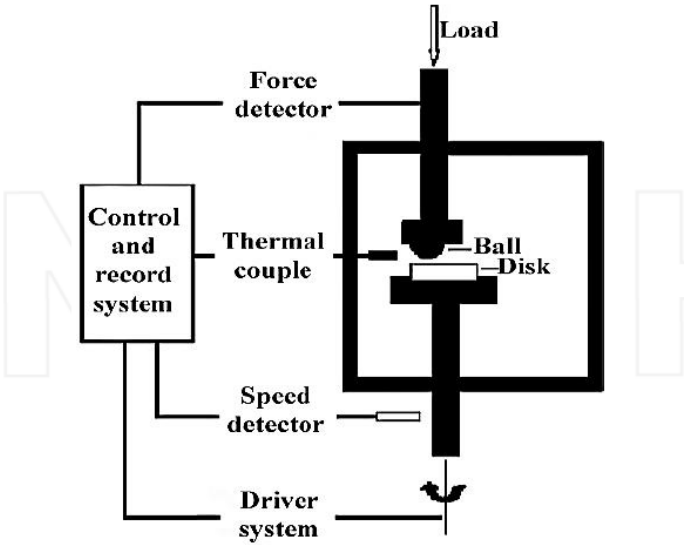

Figure 1 - Diagram of wear test method "pin on the disk" at elevated temperatures

Test parameters

1. Load - force values in Newtons at the point of contact.
2. Speed - the relative speed of sliding between the contacting surfaces in meters per second.
3. Distance - accumulated sliding distance in meters.
4. Temperature - the temperature of one or both samples in places close to the contact point.

5. Medium - medium (laboratory air, relative humidity, lubrication, etc.) that surrounds and affects the point of contact and wear as a whole.

The determination of volumetric wear W for a “pin” having a rounded tip is carried out according to the formula 1:

Wp = $\pi d^4 64r$, (1)

where d is the diameter of the wear track, r is the radius of the tip of the "pin".

The definition of volumetric wear W for the disk is calculated by the formula 3:

Wd = $\pi R d^3 r$, (3)

where R is the distance from the axis of rotation of the sample disk to the point of contact, d is the width of the wear track, r is the radius of the tip of the "pin". With slight wear of the "pin".

Also, the friction coefficient is an important test parameter. Its definitions for a specific pair of samples can also be determined using the pin-on-disk method.

Thus, the parameters controlled during testing by this method to determine the wear characteristics are:

1. The diameter of the sample disk
2. Disk rotation speed
3. Test temperature
4. The diameter of the circle of the wear track (that is, the double distance from the axis of the disk to the point of contact)
5. The load
6. Test time
7. The diameter of the sample pin

The results of tests performed by this method can be:

1. The coefficient of friction
2. Volumetric wear
3. Mass wear
4. The nature of wear or tear
5. Wear rate

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INVESTIGATION OF LIQUID-PHASE OXIDATION OF PHYNOL ORGANIC POLLUTANT IN THE PRESENCE OF FE-CONTAINING CATALYSTS BASED ON SIBUNIT CARBON MATERIAL

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Abstract

When performing this work, solid iron-containing catalysts based on the carbon material Sibunit were synthesized. For the preparation of the catalysts six Sibunit modeles were used, differing in pore volume and moisture capacity. The amount of iron in all the catalysts was equal to 2%. The catalysts were tested in the reaction of peroxide oxidation of phenol at ambient temperature. It was found that a catalyst based on the Sibunit-2 model was found to be the most effective (active). In the presence of this catalyst the degree of conversion of phenol exceeded 80%.

Key words

Pollutant; Phenol; Peroxide oxidation; Ferrum ; Sibunit

Introduction

Phenols are one of the most common pollutants entering surface water from plant effluents. Discharge of phenolic waters into reservoirs and watercourses sharply worsens their general sanitary condition, affecting living organisms not only by its toxicity, but also by a significant change in the regime of biogenic elements and dissolved gases (oxygen, carbon dioxide). The process of self-purification of reservoirs from phenol is relatively slow. The processes of oxidation by hydrogen peroxide are often used for the treatment of wastewater from various organic pollutants. It is proposed to use transition metal systems (Ru, Pt, Pd, Fe, Cu, Mn) deposited on oxide, carbon or zeolite carriers as catalysts. It should be noted that the using of base metals is more promising, while the using of noble metals (Ru, Pt, Pd) can significantly increase the cost of the catalyst. On the other hand, carbon materials are highly resistant to the effects of the reaction medium, and are often more active than other carriers due to the high adsorption capacity of carbon materials. Thus, in this work, solid catalysts based on iron deposited on the carbon material Sibunit were used to conduct research on the processing of the pollutant phenol.

The aim of the work was to prepare the catalysts of 2%Fe/Sib using six grades of carbon carrier, test the catalysts in the conversion of phenol in peroxide oxidation in an aqueous medium and identify the optimal composition of catalysts.

Experimental

Chemicals

During the deep catalytic oxidation of phenol the following substances were used without pretreatment: C_6H_5OH purity 99.5 % (GP Ufareaktiv, Ufa); argon (GOST 10157-73); air mixture of 20% oxygen and 80 % nitrogen (GOST 5583-78 and 9293-74); water purified at the Milli-Q plant (Millipore, France); H2SO4 (OS.CH., Reagent); HNO_3 (OS.C., Reachim); $Fe(NO_3)_3 \cdot 9H_2O$ (H. C., Reachim); TiCl4 (OS.CH, ZAO Crystal); NaOH (98 %, PA-ACS, Panreac, Spain); CH_3COONH_4 (oc.H., Reachim); H_2O_2 (OS.C., Reachim); C_2H_5OH (H. C., Reachim); CH_3ON (for J. T. BAKER HPLC).

The synthesis of the catalysts

For the preparation of carbon catalysts, 6 grades of Sibunite differing in physical and chemical parameters (specific surface area, moisture capacity, ash content, pore volume, etc.) were used. Carbon materials were washed by boiling, crushed, filtered out a fraction of 250-500 microns for further work. Iron was applied by impregnation by moisture capacity from a solution of Fe $(NO_3)_3$, calcined in the air stream for 4 hours at 200˚C and a flow rate of 150 ml/min.

Table 1

Physico–chemical characteristics of samples of "Sibunit"

Figure	Sibunit-1	Sibunit-2	Sibunit -3	Sibunit -4	Sibunit -5	Sibunit -6
Total pore volume, cm^3/ g	0,67	0,58	0,46	0,52	0,42	0,50
Moisture capacity, ml/g	0,616	0,497	0,431	0,406	0,341	0,492
Ash content, %	0,18	0,20	0,14	0,26	0,15	0,10

Testing of catalysts

Catalysts in phenol peroxide oxidation at atmospheric pressure and room temperature in a glass reactor were tested. The initial reaction solution was kept for an hour in the argon stream with constant stirring to adsorb phenol on the catalyst surface and phenol concentrations were measured before and after adsorption. Hydrogen peroxide was added to the initial mixture to initiate the oxidation reaction. At the beginning of the reaction, pH=3; $[H_2O_2]$=0.14 M; [P h H]=0.01 M. Throughout the reaction, the concentration of hydrogen peroxide in the reactor was kept constant. Samples from the reactor to determine the phenol content by HPLC (MiLiChrome a-02 device) and the hydrogen peroxide concentration by spectrophotometric method (uvicon-923 spectrophotometer) were taken.

Results and discussion

According to the results of HPLC analysis, kinetic dependences of the phenol transformation reaction time for all six catalysts are constructed. The conversion of phenol proceeded at a high rate for the first 15 minutes of the reaction, after which there was a noticeable slowdown in the process associated with the poisoning of the catalyst by the decomposition products of the substrate (Fig. 1).

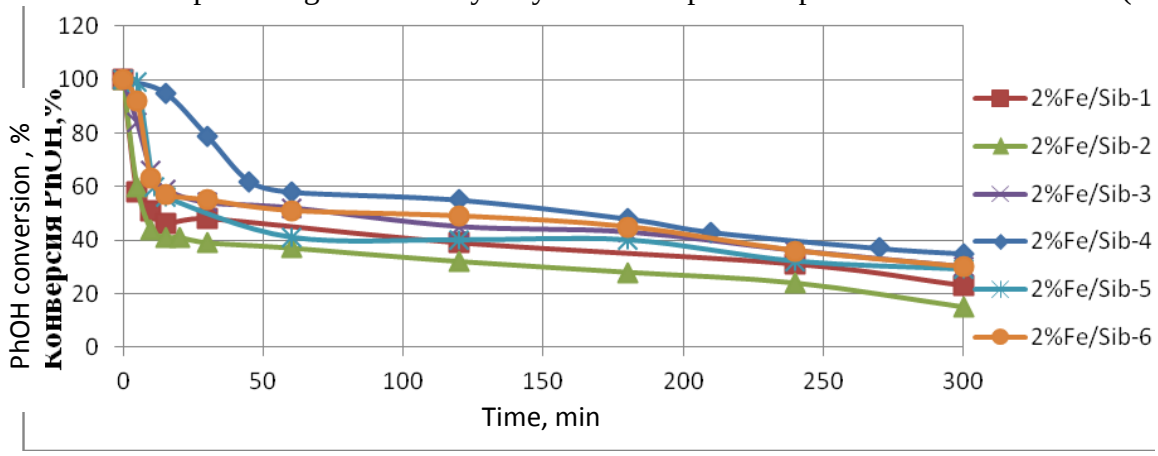

Fig. 1 - Kinetic curves of consumption of phenol, depending on the reaction time

The PhOH conversion was calculated by the formula (1):

$$x = \frac{C_0 - C_t}{C_0} \cdot 100\% , \qquad (1)$$

Phenol conversion data is given in table 2. In general, the depth of transformation of the substrate reached 63-80%. The largest amount of phenol conversion was recorded in the presence of the catalyst 2%Fe/Sib-2. In the presence of all catalysts, the first observed order of the phenol reaction was found. To evaluate the efficiency of the catalyst, the TOF (turnover frequency – "number of revolutions") parameter was used, which was calculated by the formula:

$$TOF = \frac{r_{max}}{n_{Fe}}, \qquad (2)$$

The calculation results are given in table 2. TOF increases in a row: 2%Fe/Sib-4 > 2%Fe/Sib-6 > 2%Fe/Sib-3 > 2%Fe/Sib-5 > 2%Fe/Sib-1> 2%Fe/Sib-2. The highest value of TOF equal to 0.083 min^{-1} in the studied reaction was demonstrated by the catalyst 2%Fe/Sub-2.

Table 2

The data of the testing of catalysts

	x, %	r_{max}, mmol/min	TOF, min^{-1}
2%Fe/Sib-1	70,1	0,271	0,076
2%Fe/Sib-2	80,7	0,371	0,083
2%Fe/Sib-3	69,6	0,281	0,063
2%Fe/Sib-4	63,5	0,129	0,014
2%Fe/Sib-5	70,9	0,320	0,072
2%Fe/Sib-6	70,0	0,274	0,061

Summary

In this work, solid iron-containing catalysts based on the carbon material Sibunit were synthesized. Six grades of Sibunite, differing in pore volume and moisture capacity, were used for the preparation of catalysts. The amount of iron in all catalysts was the same and it was 2%. The catalysts were tested in the phenol peroxide oxidation reaction at room temperature. It was found that the most effective (active) catalyst was based on Sibunit-2. In the presence of a catalyst based on it, the degree of conversion of phenol exceeded 80%.

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OPTICAL SCHEME OF LASER BEAM INTENSITY REDISTRIBUTION

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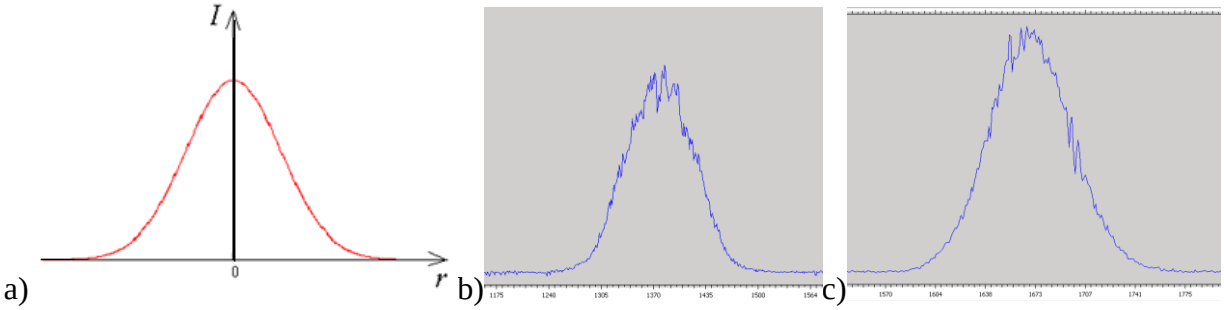
A method of correcting the Gaussian distribution with the help of the simplest two-component optical circuit to obtain an evenly distributed laser beam is described.

Nowadays, lasers are used to solve a wide range of problems in our lives, and for each of them we need a laser with individual parameters of light flux. It is known that the distribution of laser beam intensity is not uniform, but close to the Gaussian Distribution (Fig. 1), which is

described by the formula of the same name (1), which can reduce the efficiency in some areas of industry: holography, interferometry, marking, engraving, welding, hardening[1].



a) b) c)

Fig. 1. a)Gaussian distribution, b) Gas Laser Gauss distribution c) Diode Laser Gauss distribution.

$$I(r) = I_{max} e^{-2\frac{r^2}{\omega_0^2}}, \quad (1)$$

where: *I* - radiation intensity, *Imax* - maximum radiation intensity, *r* - distance from the beam center.

This is due to the fact that the quality of the material processing decreases because the laser beam does not evenly process the entire surface area on which it falls, or the processing time increases because the laser needs more time to process the surface.

Therefore, if necessary, the intensity profile should be corrected. For this task, a short telescopic system is desirable so as not to increase the size of the laser, so we are best suited to the Galileo system (Fig. 2), which consists of two components: positive and negative, where the back focus of the positive component coincides with the front focus of the negative component.

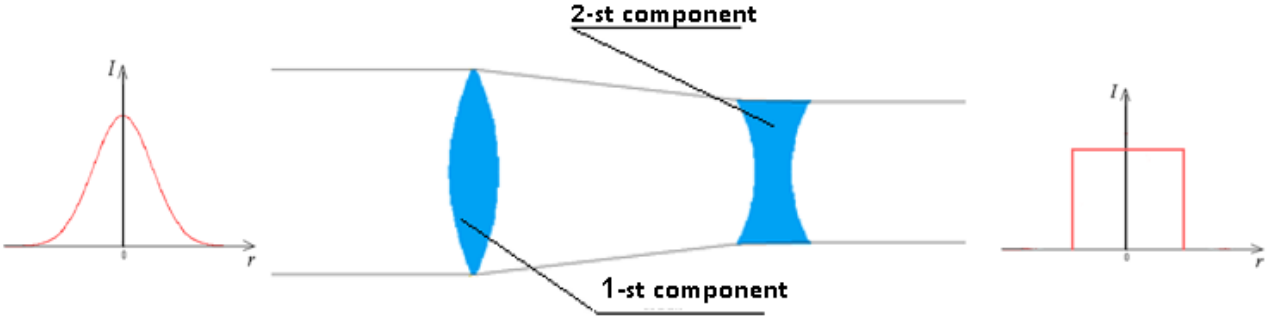


Fig.2. Galileo's telescopic system

In the chosen system, the positive lens introduces spherical aberration and redistributes the intensity of the laser flux, and the second component eliminates the created aberrations and returns homocentricity to the light beam, with the laser intensity becoming more uniform. The components will be single lens components to minimize light loss and prevent lens heating.

We'll find the design parameters: 3 positive and 3 negative meniscuses, with different degrees of surface curvature, by selecting radii using the OPAL program[2]. Taking into account the close distance between the components, their diameter will be considered the same.

The choice fell on the meniscus for a reason, theoretically they should give the maximum spherical aberrations (Fig. 3.).

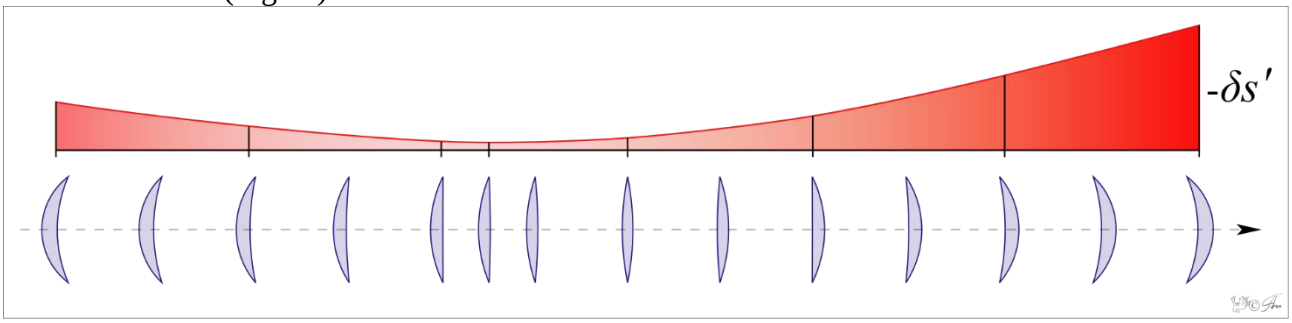


Fig.3. Dependence of spherical aberration on the type of lens.

Let's write down results of calculation of parameters of lenses in the table 1:

Table 1

Type of lens	r_1, mm	r_2,mm	f', mm	Thickness on the axis, mm
Positive meniscus 1	-6,9458	-6	48	0,4
Positive meniscus 2	-9,9697	-8	48	0,4
Positive meniscus 3	-13,4383	-10	48	0,4
Negative meniscus 1	7.6568	6	-40	0,4
Negative meniscus 2	11.0185	8	-40	0,4
Negative meniscus 3	15.0207	10	-40	0,4

The results of aberrations showed that we can use 4 lens combinations for the system under design:

1. Positive meniscus 2+ Negative meniscus 2
2. Positive meniscus 2+ Negative meniscus 3
3. Positive meniscus 3+ Negative meniscus 3
4. Positive meniscus 3+ Negative meniscus 2

Aberration and enlargement of the optical system of the mentioned lens combinations in Table 2:

Table 2

Couple №	$\delta S'$	Γ(magnification)
1	39’ 35”	1,191
2	44’ 01”	1,186
3	24’ 09”	1,192
4	19’ 15”	1.196

Other variants of the offered components are not considered, because of small aberrations of 2 components of the system.

The point diagram of the beam with uniform intensity on the first surface of the positive meniscus looks as follows:

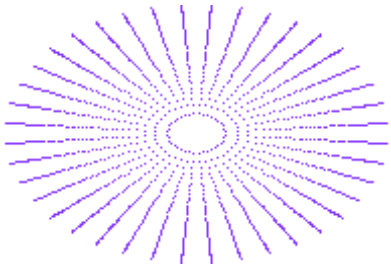


Fig.4. Spot diagram of the laser beam (OPAL)

Point diagrams show that the combinations of components coped with their main task - the redistribution of the laser beam. In them we can see that because of the spherical aberration created by the 1st component, the rays from the saturated beam center tend to be closer to the edge than the uniformity is achieved.

Conclusion. The report considers the variants of the laser beam redistribution system "πShaper" and their aberration. Also, in comparison with the work [3], in this paper we have

achieved greater aberrations and better values of redistribution, due to the use of meniscuses, which was shown by the diagram of the dependence of the lens shape and spherical aberration (Fig. 3).

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TWO-STAGE LOW VOLTAGE RAIL-TO-RAIL CMOS OPERATIONAL AMPLIFIER

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This paper presents a two-stage, low voltage CMOS operational amplifier with rail-to-rail input and output ranges. This operational amplifier is a pre-amplifier block of the low-power analog-to-digital converter for IoT thermal sensing.

Thermal sensing is one of the most commonly desired features in IoT devices to monitor either environmental or system/chip conditions. An accurate temperature sensor usually requires carefully calibrated, high-accuracy ADCs, which prevents their use in ultra-low-power sensor nodes. An operational amplifier is the main analog building block for both the systems on discrete elements and systems on silicon. CMOS technology provides an opportunity to add new functional advantages (low voltage supply, rail to rail input/output), to improve operational amplifier accuracy and power/speed ratio.

The main aim of the work under discussion is to design precision Rail-to-Rail CMOS low voltage operational amplifier. The series of problems need to be resolving while developing the device: provide constant g_m at input stage [1] and the frequency compensation [2].

The small-signal bandwidth of an OpAmp with Miller compensation, C_M, and input stage trans conductance g_m is GBW = g_m / C_M. This parameter is limited by the high frequency poles originating from the parasitic capacitors of the output devices, folded cascode stage input resistance, etc. The process variations of C_M can be as high as 10%. The variation of g_m should be in the same range or less to keep the bandwidth spread within approximately the same limits.

To achieve constant g_m, two switches and two current mirrors have been used to alter the effective tail of regime currents when the input common mode voltage V_{CM} exceeds the limits of proper operation of the PMOS differential pair or the NMOS differential respectively. These switches are easily implemented using a transistor with its gate tied to a fixed bias voltage.

The compensation tasks can be separated into three groups:

- overall OpAmp compensation, with the goal of achieving a smooth -20 dB/dec slope of the open-loop gain up to twice the unity-gain frequency;
- compensation of internal feedback loops;

- prevention of conditional instability.

Frequency compensation achieved by using of standard the Miller compensation technique with some features. The proposed compensation strategy, fundamentally introduced a high frequency current leaky path has been introduced in the traditional compensation network.

The results are given for static and dynamic performance. Simulation results confirm that the proposed scheme allows achieving required performance. In the future, on the basis of the schemes, the device topology will be developed

The simulation was performed by using Virtuoso IC 6.

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