Казанский национальный исследовательский технический университет им. А.Н. Туполева

АНГЛИЙСКИЙ ЯЗЫК В СФЕРЕ ПРОФЕССИОНАЛЬНОЙ КОММУНИКАЦИИ

VI Всероссийская молодежная научная конференция
Казань 26 ноября 2020 г.

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СЕКЦИЯ 1

ПРАВОВЫЕ, ЭКОНОМИЧЕСКИЕ И СОЦИАЛЬНЫЕ ПРОБЛЕМЫ НА СОВРЕМЕННОМ ЭТАПЕ РАЗВИТИЯ ОБЩЕСТВА

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PROBLEMS IN THE SPHERE OF LIGHT AVIATION IN RUSSIA ON THE EXAMPLE OF THE REPUBLIC OF SAKHA (YAKUTIA)

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The Republic of Sakha (Yakutia) is the largest federative unit of the Russian Federation in terms of area which is 3 million square kilometers and has a population of about 1 million people. The difficult terrain, the presence of mountain ranges (Verkhoyansky, Chersky), the almost complete absence of a network of roads and railways, makes aviation practically the only year-round mode of transport. However, the low passenger traffic, which is due to the low population density of Yakutia, makes air transportation in the region economically problematic. This requires a special approach to organizing air transportation in the region, as well as special aviation equipment.

The purpose of this study is to analyze the current situation in the sphere of light aviation in Russia (using the example of Yakutia) and to find ways to solve them. To achieve this goal, the following tasks were set: 1) to study how this problem was solved in the USSR; 2) to analyze the sphere of modern domestic aircraft design, suitable for work in the sphere of small aviation.

The relevance of the study is confirmed by the importance of providing year-round transport links throughout Russia, including the undeveloped territories of the Far North [1].

In the course of the work, the following methods of analysis, generalization and systematization were used.

Light aircraft sphere of the Republic of Sakha (Yakutia) was chosen as the object of the study.

In the second half of the 20th century, the Soviet State created a year-round air service system. Each regional center had its own airfield with at least an unpaved runway and was connected with the capital of the republic, Yakutsk, by flights on aircraft such as Li-2, Il-14, Yak-40, An-24 [2]. Almost at every such airfield there was a fleet of small aircraft, connecting the regional center with remote settlements for 50-200, and sometimes even more, kilometers [3]. There were up to several dozen of such airfields in each region, and their total number in the republic was up to 350 [4].

In the Soviet period, the cost of an air ticket from the regional center to any settlement with an airfield was 5-7-9 rubles (depending on the distance) and was acceptable for any resident of the republic [5, 6]. The population is accustomed to the simplicity and affordability of air service by light aircraft.

One of the most suitable aircraft for these conditions is the An-2, which the famous Soviet designer Oleg Konstantinovich Antonov called "his favorite child". Although the aircraft fleet of his design included such wonderful aircraft types as An-24, An-26, An-8, An-10, An-12, An-124 and the largest aircraft in the world - "Mriya"! Indeed, the An-2 aircraft turned out to be very successful. This aircraft is unpretentious in operation, easy in maintenance and piloting, with a minimum wheeled landing gear specific load on the ground, with a minimum take-off run and landing run of 200-250 m, is able to take off and land on almost any ground, even from a river pebble spit due to the large clearance of the propeller.

An important problem for the aviation services of the population and the economy of the territories of the Russian Far North at the present time is the almost complete absence of a domestic aircraft fleet - light aircrafts.

According to the results of a survey conducted among the population of the republic, it turned out that such marketing concepts, adopted in modern large aviation, such as the comfort of seats, the design of the passenger cabin, etc. are far from the top ten requirements for passengers. As it turned out, the very existence of such a cheap service is mostly important for passengers.

The An-2 aircraft, launched into production in 1949, is outdated both in terms of calendar service life and in all other parameters. The license for its production was transferred in the 60s of the last century to the Polish People's Republic.

The B-91/115 aviation gasoline required for the An-2 engine is not produced in Russia. For the An-2 fleet still in operation, motor gasoline with octane number 100, is imported in small volumes from abroad, the cost of which is approximately 3 times the cost of jet fuel.

Thus, based on the analysis of the above arguments, we can conclude that the An-2 needs a replacement with another aircraft type with similar characteristics.

For the comprehensive provision of the constitutional rights of the citizens of Russia living in the republic, there is no other option except for the restoration of the Soviet air service system, as outlined above.

One of the most probable ways of solving the problem described in the article is the "Baikal" aircraft project. The planned start of serial production is scheduled for 2022. The aircraft was designed in Novosibirsk, its serial production is planned in Ulan-Ude.

The projected flight performance data of the Baikal aircraft are not inferior to the flight performance data of the An-2 aircraft [7], and in some parameters are much better - the cruising speed and non-stop flight range are almost 2 times higher than that of the An-2.

The fuselage and tail assembly of the aircraft are made of composite materials - it is lighter than the metal An-2, the specific landing gear pressure on the ground does not exceed the analogous parameters of the An-2, which means that this aircraft can be operated on the same airfields as the An-2.

In the initial project, the passenger capacity of the Baikal aircraft is 17 people. Polar Airlines, which carries out air transportation in Yakutia, signed a memorandum of intent to purchase 20 aircraft of this type. In the latter version, the capacity is 9 people, which corresponds to the ICAO restrictions for an aircraft with one engine [8]. The designers are forced to reduce the number of passengers due to the prospective of sale of the Baikal aircraft abroad. The version of the Baikal aircraft with 17 passenger seats is more preferable and 2 times more cost effective. Therefore, for operation on the domestic market, it is also possible to deviate from the ICAO requirements, as it was done earlier for the An-2 aircraft.

Thus, the commissioning of the Baikal aircraft will allow to solve the existing problem in the sphere of small aviation of the Republic of Sakha (Yakutia). Passengers in need of cheap transport in the Far North will be satisfied with any version of the layout of the passenger compartment of this aircraft. The quicker it goes into production - the better.

References:

1. Соболев Л.Б. Большая миссия малой Авиации // Экономический анализ: теория и практика. – №3, 2016. – 4-16с. [Электронный ресурс]: Режим доступа - URL: https://cyberleninka.ru/article/n/bolshaya-missiya-maloy-aviatsii/viewer\

2. Негенбля И. Е. Малая гавань неба Якутии: очерк истории Маганского авиапредприятия : посвящается 55-летию базового аэропорта Маган. / Якутск: «Якутский край». - 2007 г. – 215с.

3. Негенбля И.Е. История инженерно-авиационной службы воздушного транспорта Якутии. / Якутск: «Сахаполиграфиздат», 2004. – 24с.

4. Негенбля И.Е. История воздушного транспорта Якутии. Т. 2: (1945-1965 гг.). / Якутск : Якутия, 2017. - 279с.

5. Васильев М.Е. Воздушные гавани Якутии. Якутск: ОАО Медиа-холдинг «Якутия», 2010. – 180с.

6. Васильев М.Е. Кровеносная система авиации Якутии: события и люди. – Якутск: Медиа-холдинг «Якутия», 2012. – 157с.

7. Проект «Байкал». Современная замена для Ан-2. [Электронный ресурс]: Режим доступа - URL: https://topwar.ru/176046-proekt-bajkal-sovremennaja-zamena-dlja-an-2.html/

8. ИКАО. [Электронный ресурс]: Режим доступа - URL: https://www.icao.int/about-icao/Pages/RU/

УДК 372.8

THE PROBLEM OF ENVIRONMENTAL EDUCATION IN THE MODERN WORLD

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The modern world is the world of man's undivided rule. A world in which nature is a secondary hero that you can ignore. At the moment, the development of mankind is equated with the destruction of the natural environment. After all, intense anthropogenic impact leads to natural imbalance, man-made environmental disasters. Over its centuries-old history, mankind has become too accustomed to living without developed ecological thinking, without ecological ethics and without conscious, environmentally oriented activity. It should be realized that only in the close friendship between man and nature can the further existence of mankind be seen.

Environmental education is the formation of a person's ability and desire to act in accordance with the laws of ecology [1]. This concept should become key in the field of education. Until now, education has helped to tailor the environment to the needs of the individual. But now it must train a person to take care of her. Fostering a careful, attentive attitude to nature should become the goal of modern society.

The content of work on the formation of the ecological culture of students includes the activities of teachers, parents and children themselves [2]. This activity is aimed at mastering the system of knowledge about the interaction of nature and society. It should also develop ecological value orientations, norms and rules of behavior in relation to the natural environment. Activities aimed at acquiring the skills and abilities of studying and protecting nature. The current situation is such that the older generation, which was deprived of the opportunity to sufficiently master the basics of environmental knowledge, cannot properly influence the environmental education of students. Thus, the mission of environmental education should be accepted by all cells of society in which the student is spinning.

The main goal of ecological education is the formation of ecological culture, that is, the totality of ecologically developed consciousness, emotional and sensory activity of the spheres of the personality. It consists in the continuous process of educating and teaching people about environmental standards. As a result of this education, a person has an emotionally positive attitude to the world around him, consciously and responsibly refers to his health and the health of the environment. He complies with moral and ethical standards of behavior [3].

The objectives of environmental education are:

1. The need to interact with nature, strive to learn its laws and phenomena;
2. Specialized attitudes and motives of activity, which will be aimed at understanding the universal significance of nature;
3. Conviction of the need to preserve the world around, to ensure both their own and public health;
4. The need to actively participate in activities for the study and protection of nature, to promote environmental knowledge.

Environmental education is an important and relevant aspect for modern society. It implements a number of important functions:

1. Educational function. This function is to help students understand nature as the habitat of humans and all living things. Students must understand the law of harmonious human existence in the world. Assimilate the idea that knowledge about the world around you must be used to preserve it. Prevention of irreversible destruction of nature should be the goal of humanity.
2. Developing function. Thanks to him, students comprehend environmental phenomena, learn to discover and formulate the laws of natural phenomena. The function helps to draw correct

conclusions about the state of nature. After its development, the possibility of mutually beneficial cooperation between man and the environment increases.

3. Educational function. It is expressed in the formation of a moral and aesthetic attitude to nature. Students develop a sense of admiration for nature. In this regard, they will want to leave the pristine beauty of the surrounding natural world. In the future, this will be expressed in active environmental protection.

4. Organizational function. Forms awareness of the need to protect the surrounding world. The student understands that without human help, nature cannot cope with the pollution that humanity carries.

5. Predictive function. Helps to make predictions about the impact of human activities on the environment. Forms an understanding of what these or those interventions in the environment lead to [4]. Leads to an understanding of which activities will be beneficial in protecting nature, and which will not.

The implementation of environmental education should start at an early age. From the age when the ecological worldview and ecological culture are formed most strongly.

To foster a respectful attitude towards nature in students, it is necessary to approach this issue in a comprehensive manner. But at the same time, students should not be forced to do this business. Violent participation in activities only encourages dislike. And in the future, the student simply does not want to do the work that he associates with coercion. It would be more correct to find an approach to each of the students. In this process, it is important to share conversations, games, music, visual arts, literature and research activities. The more versatile the approach, the more likely students will have an interest in nature, and they will learn to respect it. Educational work should be carried out in the classroom and during walks [5]. Theoretical and practical knowledge should be provided in the most visible form.

Educational institutions are just one small unit from which students can receive environmental education. And there are many such cells. With the right organization of training in the future, we will be able to maintain a good relationship with the natural environment.

References:

1. Попов А.М. Актуальные проблемы экологического образования и воспитания // Вестник Омского университета, - 2007, - №1, - С. 141-146

2. Рубанова Е.В. Проблемы современного экологического образования // Известия Томского политехнического университета. Инжиниринг георесурсов, - 2009, - С. 75-81

3. Актуальность экологического воспитания [Электронный ресурс] // Автор24 URL: https://spravochnick.ru/pedagogika/aktualnost_ekologicheskogo_vospitaniya/ (дата обращения 07.11.2020)

4. Самарина О.И. Актуальные проблемы экологического образования и воспитания школьников (методические рекомендации) [Электронный ресурс] // Образовательная социальная сеть URL: https://nsportal.ru/nachalnaya-shkola/raznoe/2016/01/28/aktualnye-problemy-ekologicheskogo-obrazovaniya-i-vospitaniya (дата обращения 07.11.2020)

5. Галущак В. Как воспитать в детях бережное отношение к природе [Электронный ресурс] // activityedu URL: https://activityedu.ru/Blogs/edu/kak-vospitat-v-detyah-berezhnoe-otnoshenie-k-prirode-op19/ (дата обращения 07.11.2020)

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LEGAL PROBLEMS AT THE PRESENT STAGE OF DEVELOPMENT OF RUSSIAN SOCIETY

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Main social problems:

1) Demographic situation (falling birth rate, increasing mortality);

2) The health of the nation (the growth of youth infertility, the growth of congenital chronic diseases);

3) The quality of life of the population (the use of harmful components in products, food, household appliances, furniture, etc.);

4) Low level of culture of the population (primitivization due to smartphones, tablets, the Internet);

5) Socio-economic inequality and poverty (division of citizens into rich and poor, the presence of a significant number of the population below the poverty line);

6) Territorial imbalances in the socio-economic development of regions (the presence or absence of minerals, industrial centers, infrastructure in the regions).

Main economic problems:

1) Dependence on commodity industries;

2) Insufficient GDP growth;

3) Low percentage of medium and small businesses (the basis of business in Russia is made up of large concerns and state companies).

In my report I would like to dwell in more detail on the problems of the legal modern Russian society.

After the signing of the Agreement on the Independence of the States that are part of the Soviet Union, in 1993 Russia adopted a Constitution that puts the norms of international law above state norms. Before the amendments were made to the main law of the country, this norm contradicted the laws adopted by the legislative power of Russia.

Article 79 of the Constitution of the Russian Federation (as amended) states: "Decisions of interstate bodies adopted on the basis of the provisions of international treaties of the Russian Federation in their interpretation, contrary to the Constitution of the Russian Federation, are not subject to execution in the Russian Federation"

In accordance with the amendments in the Russian Federation, it is necessary to change the legislative base, i.e. apply new laws in which priority will be given to the norms of Russian law.

The solution of this problem will be to bring Russian legislation in line with international standards, but taking into account the current legislation of Russia.

The second problem is the abundance of laws adopted both at the federal and regional levels, which often overlap, and in some cases even contradict each other.

An example would be Article 23 of the Constitution of the Russian Federation, which reads:

1. "Everyone has the right to inviolability of private life, personal and family secrets, protection of his honor and good name."

2. “Everyone has the right to privacy of correspondence, telephone conversations, postal, telegraph and other messages. Limitation of this right is allowed only on the basis of a court decision. "

On July 7, 2016, the President of Russia signed a package of anti-terrorist amendments to Russian laws.

Personal conversations of Russians are stored in special databases of mobile operators. When using additional encryption of electronic messages, Internet companies must provide the FSB with keys to decode these messages. Concealing such information costs 1 million rubles.

To solve this problem is necessary to update the laws, to abolish duplicate laws, and to eliminate contradictions.

The third problem is the lack of coordination between the legislative and executive branches of government. An example is the failure to comply with Presidential Decrees at the regional level.

May Decrees - the name of a series of 11 decrees signed by V.V. Putin on May 7, 2012, on the day of inauguration of the President of the Russian Federation, and containing 218 instructions to the Government of the Russian Federation for implementation during 2012-2020. They set out targets for salaries of state employees, the attractiveness of Russia for business and other areas. Some of the indicators set in the May decrees were not fulfilled. On May 7, 2018, a new Putin decree was issued, setting new targets. In 2020, Putin's decree, issued amid the coronavirus pandemic, adjusted some of the targets and extended the timeline for reaching them.

The solutions of this problem are: the development of discipline, the replacement of officials and regional leaders, the replacement of the cabinet of ministers at the federal level, the attraction of young politicians to the leadership of the regions.

The fourth problem is the reassessment of Russian values under the influence of Western influence (tolerance, destruction of Christian values, discrediting and distortion of the previous historical stages of the state and historical events).

The solution of this problem is the possibility of independent development of Russia, focused on its own values, but also using the positive aspects of the development of other countries.

Conclusion

Thus, the theoretical material on legal, social and economic problems at the present stage of development of Russian society was analyzed and generalized.

As a result, it was revealed that for the stable existence of Russian society it is necessary:

1. To improve the legal, social, economic tasks of the state.
2. Develop the rule of law.
3. Develop civil society.
4. Observe the rights and freedoms of citizens.

References:

1. The Constitution of the Russian Federation (adopted by popular vote on 12.12.1993 with amendments approved during the all-Russian vote on 01.07.2020);
2. https://revolution.allbest.ru/sociology/00640025_0.html - дата обращения (12.11.2020);
3. https://ru.wikipedia.org/wiki/Заглавная_страница - дата обращения (11.11.2020);
4. https://revolution.allbest.ru/law/00414093_0.html - дата обращения (12.11.2020);
5. https://studwood.ru/928346/pravo/grazhdanskoe_obschestvo_ponyatie_osnovnye_etapy_razvitiya_printsipy_funktsionirovaniya - дата обращения (13.11.2020).

УДК 37.013

PROBLEMS ASSOCIATED WITH TEACHING FOREIGN LANGUAGES IN RUSSIA AND POSSIBLE WAYS TO SOLVE THEM

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In modern society, the process of globalization and international integration is taking place more and more actively. With the help of the World Wide Web, people now are able to communicate without looking back at the distance separating them. And since the technical side of the issue has been successfully resolved, then the problem of understanding each other by people speaking different languages comes to the fore. Now it is quite a typical thing when several

countries are working together on some grandiose project. Therefore, the study of foreign languages every year becomes an increasingly urgent need for any specialist of any profile and level.

Watching movies and TV shows, listening to music, online games, books, tourism, sports - it becomes much easier to get involved in these and many other activities, knowing several languages, and at least one recognized as the language of international communication. World languages or the languages of international communication are the most common languages used by representatives of different peoples outside the territories inhabited by people for whom these languages were originally native. The functions of these languages are not limited to life within the nation and cover international spheres - diplomacy, world trade, tourism, global communication systems.

Currently, there are eight world languages, knowledge of each of which greatly expands employment opportunities. These include: English, Chinese, Spanish, Russian, French, Arabic, Portuguese and German. But learning languages isn't easy, and not everyone has the capacity or willpower to do it.

According to VTsIOM (Russian Public Opinion Research Center) data for September 30, 2020, the majority of Russians are convinced of the need to learn foreign languages (63%), especially residents of Moscow and St. Petersburg (75%), respondents 60+ (71%), women (69%) and those with higher education (66%) [3] (see Table 1).

Table 1.

the need to learn foreign languages	All respondents	Incomplete secondary education	Secondary education (school or vocational school)	Secondary specialized education (technical school)	Incomplete higher (at least 3 years of university), higher education
Nowadays, it is necessary to study foreign languages, you cannot do without it	63%	54%	63%	61%	66%
Nowadays, learning languages is useful, but you can do without it	31%	24%	31%	34%	30%
Nowadays, you can do without learning foreign languages	5%	17%	5%	5%	4%
Difficult to answer	1%	5%	1%	0%	0%

For clarity, let us compare the reasons for learning the language among the respondents with the data of 2015 (see Table 2).

Table 2.

the reasons for learning the language among the respondents	Year 2015	Year 2020
Communication with foreigners ("to conduct a dialogue with foreigners", "It is easier to communicate with foreign friends")	28%	36%
Traveling abroad (communication, independence from the guide, the ability to communicate while traveling)	16%	34%
Job (employment, career growth, higher salary, higher chances of getting a good job)	22%	33%
Self-development / broadening of horizons ("to be more erudite", "useful for general development", trains memory)	11%	21%

Read literature in the original, instructions for the technique, watch films	4%	16%
Obtaining information in a foreign language ("unlimited access to information in a foreign language")	0%	5%
Today it is necessary ("a necessary skill in the modern world", foreign languages are used everywhere)	2%	5%
In studies ("to enter the university", "I needed to study", "training, since the language will help to master the profession faster")	3%	5%
Study and work abroad ("the opportunity to study abroad", "the prospect of working abroad")	1%	4%
You understand more ("understanding of the environment", "you understand everything")	0%	3%
Facilitates work with a PC ("more fluency in the computer", "programs for the computer")	2%	3%
Working with Internet resources ("It's hard to work on the Internet without a foreign language", "It's easier to use the Internet")	1%	2%
Move to live abroad ("the possibility of emigration", "it is easier to live in a foreign country", "freely move to another country")	1%	2%
More possibilities ("great advantages", "wider possibilities", "opens up new possibilities")	1%	2%
None	1%	1%
Do not know	25%	11%

We see that the main motives are communication with foreigners, travel abroad, work and self-development. It is also worth noting that over the past 5 years, people have begun to understand more clearly why they are learning languages, and therefore this issue is less difficult for them.

But despite the fact that 63% of the respondents consider knowledge of a foreign language necessary, 74% of the respondents do not plan to study it in the nearest year.

We will try to analyze the reasons for such results. VI Uvarov in his article "Actual problems of teaching a foreign language in a non-linguistic university" identifies three sides of this problem: teachers, students and educational environment [1].

The problem of the lack of professionals in the field of teaching foreign languages in Russia is quite urgent. In universities the workload of the teaching staff is often exorbitant, and their professionalism is measured only by their own knowledge of the subject, but not by their ability to teach and find a common language with the audience.

The students themselves also often simply do not see the point in studying the subject. They do not understand the possible connection of their future specialty with foreign languages. Many are simply afraid and cannot cross the "language barrier"; they immediately give up. Finally, an important reason is that learning new languages is a lengthy process and for many people an individual form of learning is much more convenient, but not everyone has the material means for this.

And finally, the education system itself often belittles the importance of learning languages, as a result, for non-linguistic universities, the curriculum provides only 1-2 academic hours per week, and the rest is assigned to self- study. Another problem is that tutorials are not of sufficient quality or are outdated.

In recent years, the situation has begun to improve a little, but it is still far from ideal. To solve this problem, it is necessary to influence all three sides of the problem at once: create an environment of real communication, establish a connection between teaching foreign languages and life, and actively use foreign languages in natural situations: discuss classical foreign literature,

modern books, and films. It will be a good help to create foreign languages clubs and open lectures with native speakers, where people of various interests and professions can hold their meetings. It is necessary to introduce such a practice from primary school, in parallel with the study of the native language. Knowledge of a foreign language should become a habitual practice for all children, not the privilege for the elite. For more advanced proficiency, it is expedient to involve native speakers in the teaching process and in the working-out of theoretical materials. Foreign languages as means of communication between representatives of different peoples and cultures should be studied in indissoluble unity with the world and culture of the peoples speaking these languages [2].

Summing up, we can draw the following conclusion: the role of foreign languages in the formation of personality should not be belittled. If all these problems are taken into account, young specialists will become interested in this issue and the level and quality of language proficiency will increase many times over. The university graduates will receive a huge advantage in employment, and will be able to more quickly adopt foreign experience and share their own, which will give a huge leap in science and art at the world level.

References:

1. Uvarov V.I. Actual problems of teaching a foreign language in a non-linguistic university and their possible solutions // Vestnik RGGU. Series “Psychology. Pedagogy. Education". 2018. No. 3 (13). P. 145-156.

2. Saitimova T.N. The role of intercultural communication in the process of teaching foreign languages at the modern stage // Concept. - 2014. - Special issue No. 08. - URL: http://e-koncept.ru/2014/14603.htm. / Date of access 14/11/2020

3. VTsIOM poll "Foreign language: a promising investment?" // URL: https://wciom.ru/index.php?id=236&uid=9924 / Date of access 14/11/2020

УДК 81-25

ENGLISH LANGUAGE AS A SYSTEM OF INTERPRETATION IN THE CONTEXT OF BRITISH CULTURE

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Each of us often wondered why a person who owns the grammatical norms of the language has a large vocabulary, sometimes expresses his thoughts and feelings in a foreign language erroneously or inadequately. In our survey we tried to consider the reasons of mistakes and occurrence in the use of the English language in the context of British culture.

We focused on the fact that the language should be studied in indissoluble unity with the worldview and culture of the people speaking this language. Besides, communicating with the representatives of the foreign language culture we encountered with the concrete topics which should not be touched upon in conversations.

In our opinion, errors and inaccuracies in use arise due to insufficient knowledge of the culture of the country of the target language, and, consequently, the context behind grammatical constructions, key words, phrases reflecting the norms of etiquette and behavior. Therefore, oddly enough, but a person who is fluent in English may seem ill-mannered.

In order to understand the peculiarities of the English language, you definitely need to familiarize yourself with the culture and national characteristics of the country, which are extremely important for those who study this language. Since the language, like any creative process, reflects in itself the intellectual and creative state of the national culture.

It is necessary to trace the changes that have occurred in English society over a long history, and how they were reflected in the language.

First of all, it should be emphasized that Britain is a state with a rich, centuries-old history and a rich cultural heritage. Once there was an empire that ruled about a quarter of the planet's population, occupied about a quarter of its land mass and dominated almost all of its oceans.

The memory of the past power at sea and on land is an important component of the British national identity. Pride in its past, in its traditions, loyalty to these traditions and the past, is the most important feature of the English nation. In all fairness, it's worth noting that recent polls show that 44% of Britons are proud of their colonial past.

In confirmation, we can cite the words of Bill Bryson, who writes: «The British are ingenious race. Their contribution to the world's comfort and knowledge is way beyond what, measured proportionately. Trade and Industry made a study of national inventiveness and concluded that in the modern era Britain had produced 55 per cent of all the world's significant inventions, against 22 per cent for America and 6 per cent for Japan» [1].

Awareness of the fact that the British have given the world a lot keeps them proud, high self-esteem and a sense of a rightly done duty - this is the basis of British conservatism. We are special - we were able to do what no other people could do in the 15th - 16th centuries. England's loyalty to its traditions, respect for the past and former achievements and victories are not just a national feature, but also a means to defend the national identity of their country at all costs.

This issue is especially relevant in the period of globalization, when social and cultural changes of the modern era are the driving force behind the processes of national self-identification. The question of cultural identity for the British first arose in the 50s of the 20th century, when mass immigration to Britain from its former colonies began.

This question continues to remain acute to this day, since the flow of migrants reached a record level over the past decade, perhaps this is what prompted Britain's desire to leave the European Union, while preserving its identity and culture.

In proposing her plan for Brexit, Theresa May, former British Prime Minister, has repeatedly stated that they are voting for a bright future, for a great, strong and confident nation respected throughout the world. «It was a vote to restore, as we see it, our parliamentary democracy, national self-determination, and to become even more global and internationalist in action and spirit. A Global Britain means being one of the best places in the world for science and innovation» [3].

This circumstance is reflected in the speech behavior of the British, who strive to preserve the norms of speech etiquette and expression, demonstrating the originality and uniqueness of this nation.

Every culture has topics that should be avoided in conversation. Remember that when meeting new people, such as coworkers, it may be inappropriate to speak English about things that are fluent in your native language.

Therefore, during small talk, you should not resort to rude jokes to defuse the situation, it is also better to avoid highly specialized topics, conversations about politics, religion, death, illness, age and appearance, otherwise you risk offending or embarrassing the interlocutor, or seem gloomy.

From personal experience we know that the British are patient with poor pronunciation, grammatical errors in speech, but they cannot stand mistakes associated with ignorance of culture and etiquette. For example, an Englishman should never be asked: «Do you earn very much money?» A person who asks such a question commits a linguoculturological mistake, that is, he is mistaken twice. The first mistake is purely grammatical, associated with the incorrect use of the verb. It is more correct to ask: «Do you make a lot of money?» The second mistake is cultural, since it is not customary in England to ask direct questions about earnings. Therefore, to speak English correctly, you need to know not only words and grammar, but also the culture.

The British steadfastly, patiently and even with a sense of humor relate to the events that are not always favorable to them. One of the clearest examples of English patience is the English queue, which can be observed during peak hours at bus stations. They, as a rule, wait for their turn without fuss, making no attempts to get in the queue or disturb its order.

In his travel book «The Road to Little Dribbling» Bill Bryson gives a wonderful example of how the British drive their cars through narrow streets, showing patience and tact with each other. «All the roads were narrow and full of blind corners and tight spots. At every village and hamlet lines of parked cars meant that roads were not wide enough for two cars to pass, so everyone had to take turns letting other cars through. It was all surprisingly good-natured and agreeable because everyone was considerate and no one cheated. This was the English at their best – like the England that used to exist everywhere, in which you considered the needs of the others along with your own on the assumption that they would do likewise with you» [1].

Another important feature of the British national character is politeness. For the British, it is realized on a subconscious level, so it sometimes manifests itself in the form of an involuntary reaction. Politeness acts as a necessary component of speech etiquette, helps to establish and maintain a positive attitude of interlocutors to each other, and determines their social status.

The above examples allow us to talk about the phenomenon of English identity in modern society, which is undoubtedly important to know when communicating with representatives of another culture.

You need to have an idea of what and how, where and why we are talking. Since there will be real people talking to you, who at any moment can change the stereotype that you have carefully learned, and then, finding yourself face to face with a representative of another culture in real life, you can get confused. It follows from this that you need to at least imagine how people communicate with each other in this language.

First of all, you should know etiquette and rules of behavior, which are undoubtedly the most important elements of culture. In confirmation of the above, one can cite the statement of one Western businessman, to which Lynn Visson refers: «You can master a foreign language. You always stumble over culture» [2].

Therefore, at present, in the search for new approaches to learning a foreign language, the idea of the need to merge language teaching with the study of the native speakers' culture, and master a certain amount of knowledge about the worldview picture of another linguistic community is developing.

References:

1. Bryson B. The Road to Little Dribbling. More notes from a Small Island. – Lndn: Black Swan, 2015, p. 195, p. 205.

2. Lynn Visson Where Russians Go Wrong in Spoken English: Words and Expressions in the Context of Two Cultures. – M.: R.Valent, 2007, p. 46.

3. http://time.com/4636141/theresa-may-brexit-speech-transcript/ (date of access: 10.01.2017).

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COVID-19 PANDEMIC AND TATARSTAN: PROBLEMS AND SOLUTIONS

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The pandemic of the coronavirus Covid-19 which has swept the whole world has endangered not only the lives and health of millions of people but also the state of the world economy as a whole.

Russia and the Republic of Tatarstan were no exception. Due to the pandemic in the Republic of Tatarstan, many enterprises face the threat of closure. First of all, these are small and medium-

sized businesses in the field of trade in non-food products and public catering; in the field of leisure and entertainment; in the field of tourism and transportation "; in the hotel service.

Many employers have been forced to lay off their employees. Therefore, since the beginning of the year in Tatarstan, the number of officially registered unemployed has grown almost sevenfold (from 10 thousand to 73 thousand people). The pandemic has exposed the problem of the "gray" labor market. According to Elmira Zaripova, Minister of Labor, Employment and Social Protection of the Republic of Tatarstan, about 25 thousand people have actually lost their official jobs since March 1. Every second of those who came to register during a pandemic, either was previously employed in the “gray” labor market or did not work at all for a long time.

The locomotive of the labor market during the pandemic was construction and agriculture - these industries practically did not stop. Today there are a lot of vacancies in the republican employment services - these are offers from the construction sector. They need assemblers, fitters, bricklayers and auxiliary workers. Drivers of cars are in demand today (there are about a thousand of such vacancies with a salary of up to 35 thousand rubles. Employees are needed for public transport. In general, as we can see, there is a choice in the labor market today. In total, since March 1, about 10 thousand jobs have been employed in the republic.

In March 2020, the Government of Tatarstan formed a plan to ensure the sustainable development of the region's economy amid a worsening situation due to the spread of coronavirus infection. The Plan has four main directions:

- provision of essential goods and support to the population;
- support for sectors of the economy that are at risk;
- support for small and medium-sized businesses;
- system-wide measures.

The implementation of the Plan is entrusted to the republican ministries and departments, including the Ministry of Economy, the Ministry of Industry and Trade, the Ministry of Labor, Employment and Social Protection, as well as the Commissioner for the Rights of Entrepreneurs under the President of the Republic of Tatarstan.

During the pandemic, the Ministry of Economy of the Republic of Tatarstan launched financial support programs. More than 2 billion rubles have been allocated for their implementation. These are preferential microloans, guarantees, subsidies.

The recipients of the support were entrepreneurs from the real sector of the economy operating in the sectors of agriculture, forestry, manufacturing, construction, information and communication, as well as in other sectors of the economy.

Business entities have already received 466 microloans worth over 700 million rubles. Also, 82 entrepreneurs received various subsidies in the amount of 43 million rubles.

The Guarantee Fund of the Republic of Tatarstan helped businesses to restructure loans in the amount of 1.4 billion rubles.

Due to the pandemic, many catering establishments sold their products using delivery services. The Ministry of Economy of the Republic of Tatarstan has completed a program to subsidize 100% of the costs associated with paying for food and food delivery aggregators. This program is the only one in Russia. It was aimed at maintaining efficiency and employment in the catering segment. Such major market players as Yandex Food, Delivery Club, Ozone and Wildberries have joined the program. During the implementation of the program, 154 subsidies were issued in the amount of 28 million rubles. Thanks to the support provided to them, about 100 restaurants and cafes were able to continue their work.

In addition, the federal center supported a number of Tatarstan educational organizations: Kazan Federal University and Kazan State Technological University were included in the list of backbone organizations of the Russian economy and were able to apply for state support measures.

Currently, in the context of the second wave of the pandemic, it is necessary to continue the implementation of measures aimed at maintaining the economy of the republic in a stable state:

- formation of the budget of the Republic of Tatarstan for 2021, taking into account the need to allocate funds to support small and medium-sized businesses;

- elaboration of price containment mechanisms with retail chains, increase in purchases of products from personal subsidiary plots and additional agricultural brands.

- the allocation of funds for retraining people who have become unemployed, as well as the organization of public works;

- extension of the temporary deferral for the payment of lease payments by small and medium-sized businesses - tenants of state or municipal property;

- deferred tax payments, business inspections, preferential lending, a simplified mechanism for issuing microloans;

- “point” or individual distribution of support measures;

- explanation to the business community of measures aimed at its support;

- optimization of expenditures in government agencies: saving travel expenses and reducing internal spending, not increasing the salaries of civil servants.

References:

1.https://sovet.tatarstan.ru/events/v-tatarstane-formiruyutsya-predlozheniya-po-dopolnitelnym-meram-podderzhki-predprinimateley-v-period/

2. https://realnoevremya.ru/articles/191267-koronavirusnaya-pandemiya-prodelala-pochti-34-milliardnuyu-dyru-v-byudzhete

3. https://kazanfirst.ru/news/529859

4. http://rt-online.ru/rynok-truda-epohi-pandemii

5. https://www.interfax-russia.ru/koronavirus-v-rossii/tatarstan-sformiroval-plan-razvitiya-ekonomiki-v-usloviyah-pandemii-koronavirusa

6. https://tatarstan.ru/index.htm/news/1807433.htm

7. https://mert.tatarstan.ru/index.htm/news/1845156.htm

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ALTERNATIVE ENERGY AND SOCIETY'S ATTITUDE TO IT

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In our opinion, the problem of energy generation and storage today is one of the most acute.

In Russia, thermal power accounts for about 28% of harmful emissions, while, for instance, on cars – only 12%. The transition to renewable energy sources together with energy-in general, intensive batteries can, solve this problem. If there are wind generators or solar panels from renewable sources to choose from, the situation is with batteries is much more problematic. Today, the most advanced type of battery is a lithium titanate one. These batteries are energy-intensive and cycle-intensive, but expensive. Russian scientists volunteered to solve this problem, announcing the technology of using sodium instead of lithium in batteries. They were able to achieve a similar battery capacity, which makes the technology very promising due to the fact that sodium is cheaper than lithium due to its wider distribution. In addition, sodium is a more stable element than lithium, which has a positive effect on battery safety.

A team of domestic specialists from the National Research Technological University "MISIS", Institute of Biochemical Physics named after N.M. Emanuel RAS together with foreign colleagues from the Helmholtz in Dresden-Rossendorf (Germany), under the guidance of Professor Arkady Krasheninnikov, found a way to replace expensive lithium with the more common sodium.

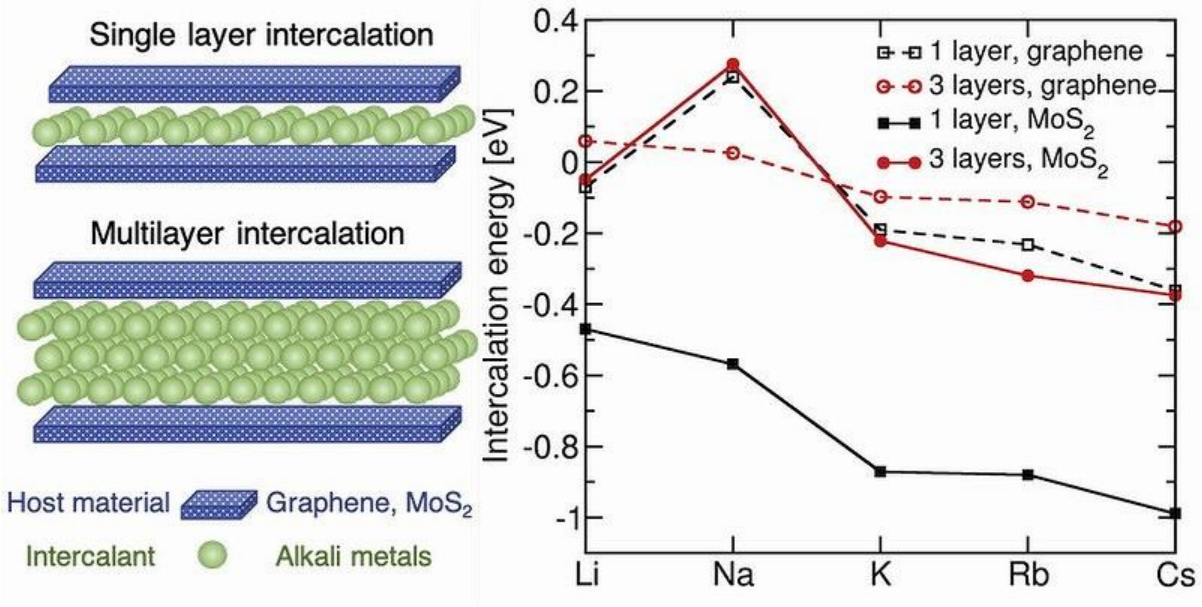
In the course of research, Russian scientists found out that in order to achieve a capacity similar to a lithium battery when using sodium, it is necessary to "stack" the atoms of the elements in a certain, multilayer way. They experimented with a three-layer structure - a layer of sodium

atoms from above and below was covered with layers of graphene, a promising material that is a two-dimensional lattice of carbon atoms.

A special way of packing sodium atoms is to arrange them in several layers, one above the other. A similar structure is achieved by transferring atoms from the metal into the space between two graphene sheets under high voltage, which simulates the process of charging a battery. It turns out a kind of "sandwich" of a layer of carbon, two layers of alkali metal (sodium) and an additional layer of carbon.

According to experts with such a structure, the capacity of the batteries, becomes similar to the capacity of standard lithium batteries - 335 mAh / g for sodium (mAh per gram of substance) versus 372 mAh / g for lithium [3].

Figure1.



Difference between single-layer and multi-layer battery structures

The advantage of sodium over lithium used in batteries was even recognized by John Goodenough, the creator of the lithium-ion battery and the winner of many prestigious awards. Since the principle of operation for lithium and sodium batteries is the same, the first mention of a sodium battery dates back to 1993, simultaneously with a lithium one, but at that time it was unprofitable. However, since lithium reserves are significantly less than sodium, it becomes increasingly expensive every year. Moreover, lithium is a very corrosive and fire hazardous chemical element, and its extraction is accompanied by environmental pollution.

Today Russian scientists are leading in the study of sodium energy sources, but they do not even give approximate forecasts about the timing of the start of production, because the technology is experiencing serious problems and needs improvement, and Russian scientists plan to start joint work with foreign colleagues from the V. Helmholtz Dresden-Rossendorf to obtain the first laboratory samples. The main problem of the new type of batteries is low current efficiency, because the lithium atom is 25% less than the sodium atom. Because of this, sodium ions move slowly and are difficult to integrate into the crystal structure of the electrodes. So far this problem seemed to be insoluble, because it is impossible to reduce the size of sodium ions, but scientists have found a way to bypass this barrier. In addition, at the present, scientists are focused on improving the designs of sodium-ion batteries, primarily on the selection of the optimal electrode design and the search for environmentally friendly materials. After the completion of this work, it will be possible to talk about the beginning of the commercialization of the new technology [2]. The main competitor of this project can be considered graphene-based batteries, which was obtained by Russian scientists back in 2004, but the leadership in this area was lost, and today Estonia is the leader in the field of graphene research.

Another problem is the attitude of people towards the alternative energy industry.

Alternative energy based on the use of renewable energy sources includes already existing energy sources that use the energy of the Sun, wind, ebb and flow, sea waves, internal heat of the planet. Solar panels, hydroelectric power plants and wind generators, their installation and maintenance are often more expensive than traditional fuel energy sources, therefore, they are of little interest to the state and private companies. Today in Russia there is no state support for the field of alternative energy, the existing hydroelectric power plants were built back in the USSR, and modern installations are the initiative of private companies. For example, several experimental wind farms have already been installed in Tatarstan, and it is planned to install a wind farm with a total area of 900 hectares and a capacity of 100 megawatts by 2024. The investment will amount to about 10 billion rubles. Despite the impressive capacity, this will amount to less than 1% of the total share of generated energy, and it is necessary to strive to increase this figure to the level of developed countries. And there is already some positive trend here – in 2016, alternative energy accounted for 30% of the whole generated energy, and in 2019 – already 46%.

As for Russia, the share of alternative energy in the total fuel and energy balance of the country does not exceed 0.2%, which is no more than 180 MW. At the same time, the share in electricity generation is even less – only 0.04%. The reason for this is a very low return on investment, because for Russia the issue of pollution and lack of resources is not so acute. It is also impossible not to take into account the fact that the production of power equipment for alternative energy is mainly located outside the Russian Federation. Thus, it is an expensive import, with all the ensuing consequences.

In this regard, scientists predict the depletion of non-renewable energy sources by the 50s of this century, which is why it is extremely important to draw public attention to the problem of environmental pollution and saving non-renewable natural resources, otherwise in a few decades it could turn into a disaster for humanity. Long-term trends of world economic and energy development make it possible to expect during the period till 2050 formation of a new energy civilization [1]. Then, not ideological, but environmental problems will come to the fore; it will not be relations between nations that will dominate, but relations between humanity and nature.

References:

1. Bushuyev V.V., Mastepanov A.M., Pervukhin V.V., Shafranik Yu.K. Euroasian Energy Civilization. Regarding «Future Energy» – Moscow, Energy Publishing Centre, 2017 – P. 11. URL: http://www.energystrategy.ru/editions/docs/EEC_EN.pdf (page 11, date of access: 11/19/2020).

2. Kulova T.L., Skundin A.M. From lithium-ion to sodium-ion batteries // Electrochemical energetics. 2016. No. 3. URL: https://cyberleninka.ru/article/n/ot-litiy-ionnyh-k-natriy-ionnym-akkumulyatoram (date of access: 11/19/2020).

3. URL: https://www.cnews.ru/news/top/2020-07-14_rossiyane_pridumali_deshevye (date accessed: 11/19/2020).

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USING GAMIFICATION IN TEACHING

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High-quality training of future specialists in various fields is of great importance at the present time. It is essential to create favorable conditions for the educational process, so that a set of tasks of a scientific and methodological nature could be determined. The formation of students' interest in the material of the educational program is an urgent task for every teacher. Therefore,

learning activities should be organized in such a way as to generate and maintain interest in learning. That is, the student must be motivated. Motivation is a psycho physiological process that controls human behavior, sets its direction, organization, activity and stability [1].

One of the ways to solve the problem of motivation can be gamification. Gamification is the use of game elements and mechanics to solve non-game problems. The Oxford Dictionary defines gamification as: "The application of typical game elements (e.g. points, competition elements, rules of the game) in other areas of activity usually used to make the activity more interesting" [2].

Gamification in education has a number of special features. They are known as the three main principles of gamification in education, which should be relied upon when introducing it into the educational process.

The first is quick feedback. When a person is busy performing complex and voluminous work, he may not see the results of his activities for a long time, which may lead to a drop in the level of motivation. Gamification of the process allows us to provide a person with quick feedback. For example, for a correctly completed homework assignment, a student receives a certain number of points, which are necessary to receive a certain reward. Also, the system of levels can help the student to most accurately assess the scale of the work done and the quality of its implementation. The latter is necessary not only for the student, but also for the teacher, who, using this information, can identify the strengths and weaknesses of the student.

The next principle is a phased immersion in the environment. The gradual complication of tasks, including games, makes it possible to systematically study educational material, which increases the quality of its assimilation. In addition, breaking the program into stages allows the student to get rid of the thought about the prospect of a long and boring study of the discipline.

One more principle of gamification is the creation of a legend or the plot of the game. Unlike the previous two, this principle is not always implemented in games. Nevertheless, the correct implementation of an interesting plot allows the student to be even more interested in the game and,

as the result his attention will be completely focused on participation in the game, that is, on the study of the subject.

Elements of gamification in education have been used for a very long time. For example, in school, students receive grades for their work in the classroom and homework, and the curriculum is designed so that it gradually becomes more complex as the course lasts. However, the gamification approach is not fully implemented in many educational institutions. One of the examples is Quest to Learn (Q2L), a public school located in New York City that opened in 2009. The educational institution offered the first set of sixth graders a gamified curriculum, in which the study of school material is carried out by motivating students to participate in the game. For example, in the school's unified math and science curriculum called How Things Work, in one of the course games, students help an old scientist navigate the human body. Thus, students study human anatomy, participating in an interesting game.

If we generalize the influence of gamification on educational activities, then we can conclude that the introduction of game mechanics into the educational process increases the involvement of students in the study of the material. Research has shown that students are more likely to spend time playing learning-based games when a reward system is used. Badges and points awarded to students have a huge stimulating effect. With an increase in involvement, the quality of assimilation of the educational material also increases, as it becomes easier for students to interact with the curriculum through practice than simply reading or listening to a lecture. Gamification can be used to stimulate interest indifferent subjects, especially those which are not easy to learn, for example, mathematics.

Most gamification systems allow for instant feedback, such as leaderboards and dashboards, which students can use to see where they are among their peers. This information can push the student to re-check the quiz or assignment to get a higher place, and creates motivation for further participation in the lesson. Games also help students to overcome the social barrier that prevents them from establishing active interaction between members of the group training on the same program. This is especially effective if the curriculum implements team competitions that require students to work together to solve a specific problem.

In addition to the above-mentioned positive qualities of introducing gamification into the educational process, when developing a game around a foreign language learning program, additional positive results can be achieved. The game allows us to develop four main types of speech activities: speaking, listening, reading and writing. Moreover, this happens not through the implementation of boring and monotonous exercises from the textbook, but through the active and interested participation of students in the game proposed by the teacher. It is interest that is one of the most important incentives for learning a foreign language It is also very important that the game

helps to overcome the language barrier and promotes emotional relaxation, which is extremely necessary for mastering the speaking skill.

In the field of foreign language learning, gamification is quite popular, especially among online services that teach English. For example, the Funbrain service contains many different interactive games aimed at comprehensive language learning.

As an example, let us consider a game called “Word Confusion”. A sentence is displayed with one word missing. Of the two answer options, the student must choose a word that matches the meaning. This game teaches a person to correctly use words that are often confused in English: “there” and “their”, “accept” and “except”, “advise” and “advice”.

The next game - "The Plural Girls", helps the student to remember how plural nouns are written in English. There are 2 different modes to choose from. In the first, the player needs to choose the correct word from the two proposed options. In the second, the player is asked to write the answer himself. Also "The Plural Girls" has 2 levels of difficulty: the first is for people with English proficiency of Elementary-Intermediate, and the second is for Upper-Intermediate and higher.

“Stay Afloat” is for learning and repeating words. The player is given a word in which only a few letters are open. The player must choose the letter he wants to try to open. Each letter can be selected only once. If the selected character is contained in a word, then it is displayed in it. Otherwise, the player's boat is partially submerged in the water. The game continues until all the letters in the word are revealed, or the boat sinks. If you have to guess when opening the first few characters, then when you open the remaining ones, a large vocabulary will significantly increase the chances of winning.

“Grammar Gorillas” helps to learn parts of speech in English. The player is given a sentence where he must choose the proposed part of speech. If the task is completed correctly, then the gorilla on the game screen receives a banana. Otherwise, the gorilla is hungry. The game offers two levels of difficulty: for beginners and advanced learners.

Also is the game “Rooting Out Word” is worth mentioning. It is about word formation. The player receives several words formed from the same root. It is necessary to answer what this root means. There are several answers to choose from. For the correct answer, the player receives several points. So, if in the future a student encounters an unfamiliar word, but with a familiar root, he will be able to guess its meaning without a dictionary [3].

As the examples show, gamification can not only help a student to develop his speech skills, but also gives him useful skills for learning a foreign language.

Undoubtedly, gamification in education has a number of positive features. But like any approach to learning, gamification has a number of disadvantages, which stand out most clearly when this approach is incorrectly implemented. Critics of gamified learning suggest that fast paced and immediate feedback reduces student concentration during a class. Students may feel that they will receive immediate feedback throughout their education. Not receiving it, they can be disappointed in their work, which can have a very negative impact on further learning, and also completely discourage the desire for self- study.

A well-organized game is highly addictive for learners. As a result, some participants can play too much, start participating in the process for the sake of awards and increasing their place in the standings, forgetting about the main goal of the game – to study the material taught.

The next disadvantage is the cost of training using the gamification method. Pricing may vary depending on the type of system the institution uses. This includes the costs of hardware, software, and instructor training.

Also, when choosing a game, it is not always clear how the results of the game will relate to the course grading system. While most games have a built-in way to track progress, it is important to find a way to translate student progress into real-world goals. In addition, it is not always easy to find a good match between games on the market and traditional educational materials, which can take a long time to implement gamification.

One way or another, gamification is a promising and complex area that continues to develop and be applied in various fields, including education. Unfortunately, at the moment, this approach is mainly implemented in secondary educational institutions, since there is a popular point of view that such a powerful tool as gamification will not be effective in professional training because adults are no longer as interested in games as school students. Nevertheless, the 2019 Insight ONE survey of the gaming industry in Russia showed that the average age of a player is 30 and 68% of all players are over 18 years old, which indicates a great interest of adults in games. Therefore, gamification has great prospects in professional training and education, including teaching foreign languages. It is necessary to study and develop this approach, to make attempts to implement gamified learning in higher educational institutions. It is very important to teach the principles of gamification implementation to teachers in order to avoid incorrect implementation of game mechanics in the educational process.

References:

1. Motivation. [Electronic resource] // URL: https://ru.wikipedia.org/wiki/ (date accessed: 20.11.2020).

2. Gamification. [Electronic resource] // URL: https://www.oxfordlearnersdictionaries.com/definition/english/gamification (date accessed: 20.11.2020).

3. The 10 best online game sites for learning English. [Electronic resource] // URL: https://englex.ru/learning-english-through-games/ (date accessed: 20.011.2020).

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THE ROLE OF NEOLOGISMS AND PLURALISTIC LINGUISTICS IN RUSSIAN CULTURE AND SOCIETY

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As we know, any event and phenomenon taking place in the world significantly affects the development of society, including culture and language. Currently, there are comprehensive changes in the world community. Increasing migration processes and globalization lead to the trend when languages begin to mix as well as cultures in general. Language is closely related to absolutely all areas of our life, including the social and cultural aspects. It forms the national picture of each country, but, under the influence of foreign culture, it can undergo significant changes. This applies not only to individual units of Russian language, but also to entire layers of culture, such as art, science, economics, politics, etc. But does pluralistic linguistics influence the Russian language and does Russian culture and society reject it?

The language often changes under the influence of external factors such as the political situation or ideology. For example, in the post-revolutionary years in Russia, a new so-called telegraph style emerged, based on abbreviations, and in France the monarchical vocabulary was

opposed to the republican one. A new language policy was required, namely a language reform [1] - a change in the graphics of the language, lexicology, grammar, vocabulary and many other sections of the language [2], which meant that a large amount of literature, maps, documents, and so on had to be rewritten in a new language with a new grammatical form of speech and uniformity of the writing style.

The obvious fact is that any language develops according to the natural laws of logic. Contemporary Russian culture is a legacy of Peter's reforms. Since the 17th century, so-called neologisms have actively invaded the Russian language – the words or phrases that have recently appeared in the Russian language, as well as newly acquired meanings of words due to the influence of many foreign languages. Throughout its development, the Russian language has always been, in one way or another, associated with the assimilation of Western European cultures and values. During periods of the most active social, political and cultural life of the country, the influx of new words especially increases. In our country, extremely favorable conditions have developed for enriching vocabulary, and we are still witnessing an active influx of neologisms into the Russian language. The culture of the Russian people is quite plastic, as well as the consciousness of the Russian people is rapidly developing and transforming under the influence of modern trends.

But the language itself is quite hostile to any innovations and often keeps certain ideas that are no longer relevant in modern life. For example, words retain the memory of how they functioned in earlier eras. Over time, the language acquires new words and lexical units, which cannot be said about grammar. It changes much more slowly under the influence of time and is more embedded in the language. For example, in the English language grammar has transformed over time as follows: when we want to say something without indicating the gender of a person (due to the realities of modern times, when tolerance issues are very sensitive) we can say: “Do you know them? » (Do you know this person?) So we don't mention the gender of the person. In Russian we will not be able to say “Кто пришла?” In this case, coordination plays an important role, because the pronoun "Who" in Russian is masculine. Perhaps we can observe some kind of inequality here, but for the Russian language and its culture to transform in the same way as, for example, English, we will need more than a century [3].

It is believed that the Russian language is tuned in such a way as to reject pluralistic vocabulary by any means. Let us take an example. The Russian words “терпимость” and “толерантность” are very close in meaning, but still have different meanings. The first word is natively Russian, while the second is borrowed from Western European culture. By the word“терпимость”, which has no analogue in English, we mean a deliberate decision not to commit any persecution of those, whose way of thinking or acting does not coincide with our own or causes someone's disapproval, implies lack of any dislike for a person who is not like other people in his way of life. The word “толерантность” (tolerance) is borrowed from English and means the recognition and respect for a large number of opportunities and characteristics, each of which has the same rights and at least has a place to be. This term does not mean complete agreement with other people in everything. Tolerance means striving for the concept of the difference in views on a particular subject and respect for these views in order to establish mutual understanding between ethnic groups, agreement between different cultures and religions. In the modern world, this term is often used for manipulation, under the pretext of tolerance, human rights are violated, but in this case, one should defend one's rights exclusively by constitutional methods. At first glance, it may seem that the concepts are similar, but they are fundamentally different. When such a borrowings take place, words that at the initial stage had absolutely the same meaning begin to diverge in meanings under the influence of different cultures, views and ethnic stereotypes.

Thus, as a result of the analysis, we can conclude that now the Russian language is a collection of internal and external factors, a unique work of culture and one of the richest Slavic languages. The Russian language has indeed been influenced by many languages, but pluralisms are already an integral part of culture and society. They enrich the Russian language with new terms, concepts, and meanings. If a word or phrase that is not natively Russian concerns any significant sphere of human activity, then it automatically begins to be used and, over time, is actively applied

not only in one range, where it was first introduced into use. The interaction of Russian and foreign languages is often the subject of heated discussions and scientific linguistic researches, the attention of which is directed to the study of pluralistic linguistics in the structure of the Russian language. Language exists not only in dictionaries and grammars, it manifests itself to a greater extent in speech, and therefore language is all of us.

References:

1. M.A. Arutyunova Language policy and the status of the Russian language in the USSR and the states of the post-Soviet space // Bulletin of Moscow University. Series 25. International relations and world politics. 2012. No. 1. URL: https://cyberleninka.ru/article/n/yazykovaya-politika-i-status-russkogo-yazyka-v-sssr-i-gosudarstvah-postsovetskogo-prostranstva (date accessed: 20.11.2020).

2. D.S. Sudnichenko. Language and politics: aspects of interaction / D.S. Sudnichenko // Coll. scientific. articles student., master. aspir. Issue 11, Volume 2 / Four Quarters Publishing House; under total. ed. V.G. Shadurskogo - Minsk: FMO BSU, 2014 - pp. 37-39

3. O.V. Goncharova Sociophonetic direction in foreign linguistics // Philological sciences. Questions of theory and practice. Tambov: Diploma, 2018 №7. Part 1.S. 119-122.

СЕКЦИЯ 2

ИННОВАЦИИ В НАУКЕ И СОВРЕМЕННОЕ ОБЩЕСТВО

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EGTS AS AN EXAMPLE OF ENVIRONMENTAL ENGINEERING

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Men is both creature and moulder of his environment, which gives him physical sustenance and affords him the opportunity for intellectual, moral, social and spiritual growth. In the long and tortuous evolution of the human race on this planet a stage has been reached when, through the rapid acceleration of science and technology, man has acquired the power to transform his environment in countless ways and on an unprecedented scale [2]. But this way leads to a rapid increase in the quantitative and qualitative impact of man on nature. Undoubtedly, at the initial stage the interaction between man and ambiance was quite friendly, but after the scientific and technological advance, it has already become hostile. If a progress is boon to society, it is a real disaster for environment. Even now the world community is concerned about such global issues like:

- Pollution of The world's Oceans, reservoirs and firm ground;
- The emission of toxic substances and exhausted gases into the atmosphere;
- The impact of production activities on the planet's thermal background and background of radioactivity and so on.

By the way, most modern industries are built on the idea of “infinite and overabundant” natural resources. But this injurious behavior is petering-out "natural reserves". Therefore, nowadays there is an intensive rethinking of the necessity of such a consumer attitude to the environment. Concern about the current environmental situation is one of the most powerful motivators for creating new inventions.

It is not surprising that transport is the main source of contamination of the atmosphere. Unlike many other modes of transport, aviation not just covers a great distance, but also affects air quality locally, regionally, and globally.

So, in 1972, at the United Nations conference on the environment in Stockholm, the position of the International civil aviation organization (ICAO) was stated as follows: "In performing its role, ICAO is aware of the harmful environmental impact that may be associated with the operation of aircraft, as well as its responsibilities and the responsibility of ICAO member States to achieve maximum compatibility between safe and systematic development of civil aviation and the quality of the human environment" . And that was the beginning of the new approach to the development of new aircrafts with care for the ecology. And the time when the new requisitions appeared. [2]

For example, over the past few decades, significant progress has been made in reducing emissions due to the increased environmental friendliness of aviation fuels (partial replacement of kerosene with liquefied natural gas or biofuels) and technical improvements in aircraft engines (increasing their traction efficiency, implying a reduction in fuel consumption).[3]

Some engineers also said that decreasing taxiing time can cut the amount of poison emissions into the atmosphere as less fuel is used. And that was the impulse for a new excellent idea.

And here we have Electrical Green Taxiing System – a new concept that allows airplane to taxi and pushback without requiring the use of aircraft engines. It is designed to reduce fuel volumes used by aircraft and decrease greenhouse gas emission during ground operations. The EGTS system allows aircraft to push back from the gate without a tug tractor and taxi without the use of the main engines till takeoff operations.

The Pilot Interface Unit enables the pilot to switch on the EGTS and select the desired taxi speed (forward) or push back speed (backwards). The EGTS controller receives and converts the pilot's directives into orders to power the electronics.

Some technical facts about the system:

- The system weighs 300 kilograms
- It is permanently installed on the aircraft and has been architected such that there would be very few and minor changes to the aircraft in a retrofit basis
- EGTS is established in Airbus 320 and Boeing 737
- With EGTS aircraft can accelerate to 37 km/h
- Two electrical motors with motor rating 50kW are powered by APU generators (Auxiliary Power Unit),which consume 6 times less fuel than main engines
- The system cuts fuel consumption by up to 4% per flight cycle net of any weight penalty. For example a short- or medium-range aircraft that spends 2,5 hours on taxiways each day could save 600 kilograms of fuel.
- Engineers also promise indirect benefits by reducing wear and tear on engines and breaks and lessening the risk of damage to engine turbines from foreign objects and airport surfaces [1]

What are the main bright sides of the system? First of all, EGTS can provide a decisive economic advantage based on lower fuel consumption and the abandonment of the tug tractor. Secondly, cutting the amount of vehicles and the number of workers on the runway will speed up airport's work as a whole. And finally, the usage of the EGTS can also reduce emissions and noised in the terminal environment.

So, we easily "kill two birds with one stone": care about the environment and save fuel

To sum up it must be said that nowadays the progress is marching in step with the anxiety about ecology. The incorporation of these spheres can lead to astonishing and unthinkable results, like EGTS. We are absolutely confident that the system has great prospects and it should be definitely introduced to all airlines all around the world.

References:

1. D. Baudier, M. Bellet et al. Electric Green Taxiing System: Revolutionizing Aviation from the Bottom-up // Safran Magazine. –2011, December –No.11. – pp. 10-11. – ISSN 1960-7164.

2. Declaration of the United Nation Conference on the Human Environment – Stockholm, 1972. – p.4

3. EGTS [Electronic resource]: the free encyclopedia. – access mode: https://en.wikipedia.org/wiki/EGTS, free entry

УДК 001.895

THE ROLE OF PROGRAMMING IN THE MODERN WORLD

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Abstract. The article provides an overview of information technology development research.
Key words: Information technology, programming, computer literacy.

At the moment, digital technologies are closely related to the life of every person. Achievements in engineering and software development are used in almost all spheres of human activity. Smartphones, computers, cars, to name a few, are engineered and programmed. Engineering enables to improve devices at the physical level, reducing the size and increasing the quality and performance of many radio-electronic microelements, while programming helps to use the resulting computational power in the right direction. Electronic devices consist of microelements - processors, which are based on basic programs that perform certain tasks.

To consider this subject, it is necessary to gain insight into the key concepts:

- Information technology (IT) is a process that uses a set of means and methods for collecting, processing and transmitting data (primary information) to obtain information of a new quality about the state of an object, process or phenomenon.
- Computer literacy is a minimum set of computing skills and knowledge to use computer technology efficiently; understanding the computer science fundamentals and the importance of information technology in society.
- Information society is a society that is engaged in the production, storage, processing and sale of information.
- Informatization of society is an organized socio-economic, scientific and technical process of creating optimal conditions to meet information needs and realize the rights of citizens, state authorities, local governments, organizations, and public associations through the formation and implementation of information resources.

Every day the need for digital technologies is increasing, therefore, there is a great need to increase the volume and quality of digital technologies produced. Quality and quantity is one of the main parameters of a country's development. The prevalence of programming in a country plays the main role.

For the development of information technology, the following parameters are required: high computer literacy of the population and excellent programming skills.

Computer literacy of the population. For the IT development, it is necessary for people to be able and know how to use these technologies. To take a closer look at this subject, we have surveyed 100 people in order to examine the quality of computer literacy among the population of different ages. The results are shown in Table 1.

Table 1

	High level of computer skills	Intermediate level of computer skills	Low level of computer skills	Lack of computer skills
Ages 10-18	11	6	3	0
Ages 18- 35	7	5	6	2
Ages 35-50	3	6	7	4
Ages 50+	0	3	10	7

Summing up the survey results, it is worth noting a sharp decline in computer literacy with increasing age. The decline can be explained by the fact that computer technologies have appeared relatively recently. But even among the younger generation, the percentage of computer literacy is low for the Information Age.

It is necessary to find the root of this problem. Most likely, the lack of interest in computers is due to the fact that children are not fostered their interest in computing since childhood. Schools usually either have no computer science classes included to their curricula, or allocate just few hours to the subject (about 1 hour a week, starting from grade 8). It is in the school that they should show many solutions that simplify the search, storage, structuring and use of useful information. Changing the curriculum to increase the number of hours for computer science.

Programming. The stage of information technologies development is impossible without programming. There are several types of software development models. In this article, we will consider the waterfall lifecycle model. This model provides for the sequential execution of software development stages. In other words, transition to the next stage of production is carried out only after the accomplishment of the current stage. In this model, the following main stages are discriminated:

1. System and software requirements: captured in a product requirements document

2. Analysis: resulting in models, schema, and business rules
3. Design: resulting in the software architecture
4. Coding: the development, proving, and integration of software
5. Testing: the systematic discovery and debugging of defects
6. Operations: the installation, migration, support, and maintenance of complete systems

This process requires a large team of developers and a lot of time. Programmers work together towards a common goal - software creating. A program is a large set of classes responsible for basic tasks, which in turn consist of a larger set of methods that perform certain logical, mathematical, graphic and other processes.

In conclusion, we would like to mention the growing interest in information technologies not only among the younger generation, but also the older one. With the growing popularity of programming and engineering, society is making great strides in the development of IT and manufacturing facilities. It improves the quality of life and helps humanity to develop.

References:

1. Scientific & Academic Publishing [Electronic resource]. – Access mode: http://article.sapub.org/10.5923.s.scit.201301.08.html , free – (16.11.2020).

2. E-library Wikipedia [Electronic resource]. – Access mode: https://en.wikipedia.org , free – (16.11.2020).

3. Project Manager [Electronic resource]. – Access mode: https://www.projectmanager.com/waterfall-methodology , free – (16.11.2020).

УДК 629.113

THE USE OF AUTOPILOTS IN DOMESTIC AND FOREIGN AUTOMATIVE INDUSTRY

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An autopilot is a device or software and hardware complex that allows a vehicle to move without human interference, or reduces human participation in driving to a minimum. Cars equipped with an autopilot system are able to move independently thanks to special software and sensors. Soft (software) controls all systems of the car: a steering wheel, a gearbox, a gas and a brake. Sensors located on the body read information about the environment and send the appropriate signals to the central computer, which, in turn, processes this information and makes a decision.

Autopilots are classified by the system of autonomy. This division into levels was proposed by the American Society of Automotive Engineers (SAE International). It was published in 2014 and is currently international. According to SAE, the autopilot has 6 levels:

1) Autopilot 0 - “No automation”. In fact, there is no autopilot; the control is completely at the disposal of the driver. Warning signals and automatic emergency braking are not considered automation, but are included in zero autonomy.

2) Autopilot 1 - “No legs”. Automation not only warns the driver about danger, but also interferes in the control in order to correct the movement. This is done due to adaptive cruise control, which monitors the distance to the vehicle in front and, if necessary, changes the movement, parking sensors (parking radar is an auxiliary system of proximity sensors installed on cars to facilitate maneuvering when parking.), lane departure warning systems (in case of driver fatigue, when vigilance is lost, it helps to avoid accidents).

3) Autopilot 2 - “No hands”. In this case, it is possible to fully control the car by the autopilot, which can be responsible for such maneuvers as acceleration, braking, and steering.

4) Autopilot 3 - “Without eyes”. At times, the autopilot takes full responsibility for the movement of the vehicle. In addition to radars, lidars and sensors, artificial intelligence will be used.

5) Autopilot 4 - “No attention”. The autopilot takes full control of the vehicle, and it is assumed that a person may not follow the situation on the road. However, in more difficult situations (in the city, or in traffic jams), human participation is necessary.

6) Autopilot 5 - “Without driver”. There is no human participation at all. The system has full autonomy and is responsible for the management of all components [2].

The goal of engineers is complete autonomy, when a person does not need to step on the pedals and take control, even in difficult road situations.

Foreign manufacturers are actively bringing to the market unmanned trucks with the obligatory function of switching to driver’s control, who, if necessary, can intervene in the process of car movement. The Swedish company Scania has already unveiled an innovative concept last year – a fully autonomous Scania AXL without a cab, designed for using in mines and large indoor construction sites. The use of such a model allows streamlining the process of transportation of goods; the model is economical and reduces the adverse impact on the environment. The traditional driver's cab is replaced by a special intelligent front module, which integrates various control systems (cameras, radars, lidars and GPS receivers). As a result, the truck performs autonomous operations in mines, receiving tasks from a digital logistics system.

The Russian manufacturers are trying to keep up with market trends and are developing their own trucks. But unlike foreign analogues, the range of use of domestic cargo unmanned vehicles is many times greater. This is due to the peculiarities of road and weather conditions [1].

The leading domestic manufacturer among unmanned cargo vehicles is KAMAZ.

"KAMAZ is developing an unmanned truck without a cab", - said the head of the project "Reengineering of the automotive industry and the creation of a promising KAMAZ family" Hans Peter Moser. "We are approaching the creation of a new generation of trucks with electronic architecture, which is prepared for the operation of autonomous driving technology," he said, noting that the new truck will be driven without driver participation. According to him, in Russia, the possibility of monetizing autonomous transport still exists only in closed territories, and not on public roads, while in Europe, drone trucks are already being tested. Moser explained that trucks move from Germany to Italy every day as part of a convoy, and the driver only performs his usual functions in the first car. "The second truck is without a driver, it just sits behind the wheel and does nothing," Moser said.

Earlier, KAMAZ announced its participation in projects related to the development of unmanned vehicles. The company presented a prototype of an unmanned passenger electric bus and announced plans to jointly develop unmanned harvesters at Rostselmash. At the moment "KAMAZ PTC" has prototypes of unmanned vehicles.

KAMAZ has received a patent for an electric unmanned truck without a driver's cab.

KAMAZ-3373, called the "Shuttle", is an autonomous battery electric vehicle with an onboard platform. The company's new development is a two-axle chassis with a symmetrical platform located in the center of the chassis, where both axles are pivotable to maximize the ability to maneuver in small areas. The car is equipped with duplicated front and rear lighting equipment and, as a result, the ability to directionally equal movement both forward and backward. While driving in one direction, the corresponding headlights and opposite rear lights are illuminated. When changing the movement of the car in the opposite direction, the lighting is changed according to the direction of the movement.

The side cladding panels have ventilation grilles, which are designed for air intake when cooling the traction batteries and the electric motor. The traction batteries are located at the bottom of the chassis, which provides a low center of gravity.

On the front and back of the car, there are machine vision elements that provide the car in autonomous mode.

Overall dimensions of the electric vehicle are as follows: length - 8000 mm, width - 2550 mm, height - 4000 mm, carrying capacity - up to 10 tons. The travel speed is electronically limited to 40 km / h. The machine is equipped with a permanent magnet synchronous motor with vector control, which gives a constant speed under various loads.

This is the company's sixth unmanned vehicle and the first one without a cab. The first sample of the "Shuttle" has already been created, debugging work is underway.

The creation of a cabless truck will avoid unnecessary costs and make the car more symmetrical, as any engineering idea strives for simplicity and perfection. The shuttle can be safely called a world premiere. From a geometric point of view, it is a simple parallelepiped that has a number of advantages over conventional trucks.

Among the indisputable advantages of the "Shuttle" can be identified the ability to move both the front of the car and the rear, which avoids unnecessary manipulations when changing the trajectory. The steering formula « 1-2» (both axles are pivot) makes it possible to steer both axles simultaneously, increasing maneuverability. The car is distinguished by ideal weight distribution along the axes - 50/50.

In addition, the "Shuttle" has a unique superstructure that provides five-sided loading and unloading of cargo. This allows using any infrastructure of logistics hubs of auto enterprises.

A module for autonomous vehicle control has also been created at KAMAZ. The project was named "Avatar".

"Avatar" is a mobile module installed on the roof of a car that allows turning a car into an unmanned vehicle. To carry out autonomous control using the module, the car must be equipped with an automatic transmission, an electronic accelerator pedal, an electronic braking system and an electric power steering. All units must support remote control via the vehicle CAN bus. The development of "Avatar" in the Scientific and Technical Center "KAMAZ" started in 2018. The design and filling of the module were developed by the Automotive Innovation Service in 2019. Today the control algorithms and decision-making, software debugging, validation and testing of the autonomous control system in real conditions are being worked at. The module is being tested on a KAMAZ-43118 vehicle. "Avatar" allows making existing machines "smart", which opens up the opportunity to quickly and cost-effectively increase the fleet of unmanned vehicles [3].

Unlike its predecessor, an unmanned vehicle from “Odyssey” project, “Avatar” is additionally equipped with a duplication system for autonomous control, decision-making bodies and a fusion system consisting of various sensors, both in the frontal zone and around the car, which significantly increases safety movement in autonomous mode, and also allows to insure the main system in case of its failure or breakdown. There is also a duplication of the communication system, which allows, in the case of interference from one of the transmission channels, to switch to another one. Both the module and the software are designed in accordance with ISO 26262 (European Standard for Functional Safety).

“Avatar” is capable of building a digital road map using 3D-lidars. On this map, it can independently build a route for itself to move. The operator specifies the end point of the route, the system loads the map, builds a route and after that the car starts moving along a given trajectory. For greater reliability, an integrated navigation system is used, which allows loading additional coordinates from the satellite navigation system and turning on corrections from the inertial navigation system.

A method of driving a vehicle that excludes human intervention in driving or restricts it has its own advantages and disadvantages. Among the positive aspects are: reducing the number of accidents; reducing the cost of transporting goods; ensuring the safe transportation of goods in difficult-to-pass places and hazardous areas.

The main disadvantage is the gradual loss of skills by people that can be useful in critical or unforeseen situations.

From all of the above, the conclusion suggests itself that automatic systems are being introduced into the automotive industry and are gradually being developed in this industry. The

trend is that in the nearest future, self-driving cars will take over the market, displacing the human-driven car we are used to.

References:

1. Khalyafiev A.A., Khalyafiev R.A. Unmanned trucks // Scientific journal. 2016. No. 9 (10). URL: https://cyberleninka.ru/article/n/bespilotnye-gruzovye-avtomobili (date accessed: 11/15/2020).

2. L. Dolginova., N. Kryzhanovsky "Unmanned vehicle - five levels of autonomy" - Text: electronic // Doe: electronic library system. - URL: https://e.lanbook.com/ua/news/bespilotnye-avtomobili-. (date of access: 15.11.2020). - Access mode: for authorized users.

3. URL: https://vestikamaza.ru/posts/na-kamaze-sozdali-modul-avtonomnogo-upravleniya-avtomobilem/ (date of access: 15.11.2020)

УДК 67.02

RESEARCH ON VACUUM COOLING OF FOOD

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The relevance of the study can be noticed in several drawbacks of the work of the modern food industry. An important goal of using vacuum cooling as a replacement for some other cooling methods is the significant reduction of the time spent on transferring energy from food to the external environment, which makes it possible to increase the shelf life considerably.

Nowadays, there are several foreign corporations engaged in the production of chambers with vacuum cooling. However, these companies offer only ready-made full-size installations, without the possibility of configuration for specific goals. In addition, the high cost of the products is a clear disadvantage.

The main purpose of this research is to analyze all physical patterns of using vacuum systems in cooling and its edge over some other types of food refrigeration, to calculate the time, required for the cooling of food products using a two-stage liquid ring vacuum pump.

The main advantages of using vacuum pumps in the food industry are high speed of cooling (conventional refrigeration takes 2 – 5 times more time), decent compatibility with existing equipment, low cost (in comparison to foreign vacuum installations).

We have developed 2 options for vacuum pumps use for the specific example: decreasing the product temperature after baking.

The initial data and values are listed below:

The initial pressure Pa = 760 mmHg, the temperature of the water supplied to the pump (pump and condenser) = 150^0C, the percentage of moisture in the product is 40%, the chamber is considered sealed, without air leaks from the outside.

Q - the amount of heat that should be removed from the product to cool it, M - the mass of evaporated moisture, V - the volume of a chamber, P - the pressure in a chamber, S – the efficiency of the pump.

1. In the first case, the vacuum system consists of a two-stage liquid ring vacuum pump with a nominal capacity of 14 m^3 / min (840 m^3 / h) without a preliminary condenser. The consumption of electricity is approximately 20 kW.

All computations are based on the experimental data of the characteristics of a two-stage liquid ring vacuum pump. The calculation is carried out with an interval of several degrees.

The results of calculations:

№	V, m^3	Q, kcal	M, kg	S, m^3/min	P, mmHg	T, ^0C	$\tau_{1,}$ min	$\tau_{2,}$ min	$\tau_{sum,}$ min
1	2	1200	2	14	355	80	0,25	0,11	0,36
2	2	1200	2	14	150	60	0,43	0,12	0,55
3	2	1200	2	10	55	40	1,15	0,2	1,35
4	2	840	1,4	9	25	26	3,15	0,17	3,32
									5,58

τ_1 is the time, elapsed for pumping water vapor out of the product. τ_2 is the time, elapsed for pumping air out of the chamber. τ sum is the total time.

Totally, pumping the liquid out of a 2 m^3 chamber with a two-stage liquid ring vacuum pump (capability of 14 m^3 / min, without a preliminary condenser) with the decrease of product temperature to 40 °C and, accordingly, the pressure to 25-55 mmHg, takes the vacuum pump 2.26 minutes. Eventually, the mass of evaporated moisture is close to 6 kg.

The reduction of the product temperature to 26 °C and, accordingly, the pressure to 25 mmHg takes 5.58 minutes. By the end of the process, the total mass of evaporated moisture is 7.4 kg.

2. In the second case, the vacuum system consists of a two-stage liquid ring vacuum pump with a nominal capacity of 14 m^3 / min (840 m^3 / h) with a preliminary condenser. The water consumption of a condenser is 5 m^3 / hour.

The results of calculations:

№	V, m^3	Q, kcal	M, kg	S, m^3/min	P, mmHg	T, ^0C	$\tau_{1,}$ min	$\tau_{2,}$ min	$\tau_{sum,}$ min
1	2	1200	2	14	355	80	0	0,11	0,11
2	2	1200	2	14	150	60	0	0,12	0,12
3	2	1200	2	10	55	40	0	0,2	0,2
4	2	840	1,4	9	25	26	2.1	0,17	2,27
									2,7

Totally, pumping the liquid out of a 2 m^3 chamber with a two-stage liquid-ring vacuum pump (capacity of 14 m3 / min with a preliminary condenser) with the decrease of product temperature to 40°C and, accordingly, the pressure to 25-55 mmHg takes the vacuum pump 1 min. The total mass of evaporated moisture is close to 6 kg.

For both cases, the product temperature 26^0C and corresponding pressure value 25 mmHg have been chosen due to the fact that this is the minimum acceptable pressure of a two-stage liquid ring vacuum pump. The following decrease of the pressure causes cavitation and vacuum pump destruction.

Thus, the use of vacuum pumps in food cooling is an order of magnitude more efficient than other methods of refrigeration. According to the charts above, a two-stage liquid-ring vacuum pump considerably decreases the time required for cooling products as well as the money, intended to be spent on refrigerating systems.

References:

1. Vukalovich M.P., Thermodynamic properties of water and steam, Mashgiz, M., 1955, pp. 21-28, 34- 38.

2. Sterling Fluid Systems Group, Liquid Ring Vacuum Pumps & Compressors, 2012, pp. 12 – 15, 24 – 25.

3. FlowServe, Liquid Ring Vacuum Pumps, May 2016, pp. 6 – 7.

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INNOVATIVE APPROACHES TO AIR SPACE USAGE IN RUSSIA

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Air space usage technologies required a lot of innovation in some districts of Russia. In some regions the reason for reforming the air traffic organization was the lack of new and up-to-date equipment. In the other regions a law background did not let the airlines develop the efficiency of flights in full swing. By 2020 the State ATM Corporation knew what steps should be taken in order to increase the level of the provided service. However, the high intensity of flights in the previous year as well as in the beginning of 2020 did not allow the company to implement new technologies. That is to say that new processes and technologies will take the air traffic controllers and pilots some time to get ready to use them and that is very inconvenient in terms of high flights intensity.

As we all know 2020 is quite remarkable because of the COVID-19 outbreak. As to civil aviation industry, it suffered a crisis of an unknown extent. It caused a dramatic decrease in the total number of flights. It means that while deteriorating airlines' operation it gave the State ATM Corporation an opportunity to implement some innovative approaches into Russia's air traffic control. We are going to consider some of them.

Firstly, we will draw your attention to changes in Moscow air zone. The changes have already been established and they will come into effect in December 3, 2020 at 00:00 UTC. The new rules are designed to improve the organization of flights in prohibited and restricted areas. Moreover, new Standard Terminal Arrival and Standard Instrumental Departure routes (STAR and SID) for the biggest airports (Domodedovo, Sheremetyevo, Vnukovo, Ostafyevo, Ramenskoye) were produced to predict and resolve conflict situations between arriving and departing air traffic. Special attention was paid to parallel runways operations enabling the aircraft to take-off and land independently[1]. The primary unit of altitude / height measurement is the foot. In order to ensure the safety of flights setting the altimeter using QNH atmospheric pressure becomes obligatory for all airports in zone. It is a common rule for western countries which has been steadily spreading all over the world. And it had played a big deal in increasing the safety of flights in the world, especially in mountainous regions. Another major innovation is the same transition level in the whole zone. It is said that this measures are going to increase the ability of Moscow's air traffic controllers to provide safe service in the context of flight intensity growth in the close future [2].

However it is not a common opinion that the mentioned innovations lead to the increase in safety of flights and efficiency of airspace usage. The "Jeppesen" company – one of the world's leaders in providing navigational information after getting acquainted with coming changes claimed that they would not be successful. The reason for it is the lack of qualified staff to provide air traffic control service on new routes and in new zones. "Jeppesen" also states that the average flight time in Moscow region is going to increase because of the length of new approach and departure routes [3].

As we may see innovations in Moscow region airspace are controversial and their efficiency is under doubt of some experts whether the others are sure in it being useful in the future. However there are also innovations in Russia air traffic management which has already received comments on their efficiency which we are going to investigate.

We would like to consider the new technologies implemented in the North-East Aeronavigation branch in Magadan. Such airlines as Air Canada, Eva Airways and China Cargo Airlines were first to participate in the experiment of free-route flight in airspace controlled by this branch. It means that the pilots could choose the route on their own discretion. Almost everywhere in the world pilots have to comply with the controller's instructions about their route consisting of many geographical points which do not lie on the same line. But in Magadan's branch pilots are now allowed to fly along orthodromy and controllers may correct their routes only in cases of emergency. An orthodromy is the shortest route linking two geographical points of a globe and consequently this decision reduces fuel consumption and gas exhaust.

According to EVA Airways Corporation this technology saves about 250 kilos of fuel while China Cargo Airlines report reveals 250-300 kilos daily saving and 75 tons annualy. An approval of Chineese and Taiwanese colleagues confirms the efficiency of this approach[4] After passing the certification this approach will be able to save a considerable amount of fuel for all airlines using Magadan airspace.

To sum up we would like to draw your attention to the fact that in spite of the world-wide crisis caused by COVID-19 Russian air traffic management company does not stop implementing new approaches to airspace usage. While the airlines cannot use all their aircraft and suffer from financial problems Russian Air Traffic Management Company makes investments which bring the air traffic control in Russia to a new standard.

References:

1. Oficial'nyj sajt «Goskorporaciya po OrVD» [Electronic resource] URL: https://www.gkovd.ru/news/novosti-goskorporatsii/v-rosaviatsii-proshlo-soveshchanie-po-vnedreniyu-novoy-structury-vozdushnogo-prostranstva-moskovskoy/ (accessed 14.11.2020).
2. Oficial'nyj sajt "Rosaviatsiya" [Electronic resource] URL: https://favt.gov.ru/novosti-novosti/?id=7101 (accessed 19.11.2020).
3. Oficial'nyj sajt gazety «Izvestiya» [Electronic resource] URL: https://iz.ru/news/575144 (accessed 14.11.2020).
4. Oficial'nyj sajt «Goskorporaciya po OrVD» [Electronic resource] URL: https://www.gkovd.ru/news/novosti-goskorporatsii/k-experimentu-po-svobodnoy-marshrutizatsii-prisoedinilas-aviakompaniya-china-cargo=airlines/ (accessed 14.11.2020).

УДК 621

TESTING THE STRENGTH CHARACTERISTICS OF A NUMERICALLY CONTROLLED LATHE SPINDLE USING FINITE ELEMENT MODELING

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Annotation: *The aim of this work is to verify the strength of the spindle of the machine by the method of finite element modeling in the Ansys software environment.*

Key words: *finite element modeling, ansys, spindle.*

In a previous scientific work, a machine was designed for processing a disk-shaped part with a given range of sizes [1]. It is worth noting that the finite element method was also used in the previous work to test the strength of the lathe spindle. But in this case, the spindle design was worked out in more detail: grooves for the exit of the grinding wheel and threaded surfaces, which are stress concentrators and reduce the strength of the spindle, were added. In addition, the elements

of a three-jaw chuck were worked out in more detail (a rotary washer and some additional fastening elements were installed, the mass of the three-jaw chuck was brought into compliance with the standards).

Dimensional parameters of the spindle structural elements were obtained in the design process of this machine and are presented in the sketch (Figure 1). In this work, it is necessary to check whether the selected spindle design can withstand the required load during the specified service life (12000 hours).For this, the finite element modeling method in the Ansys software environment is used.

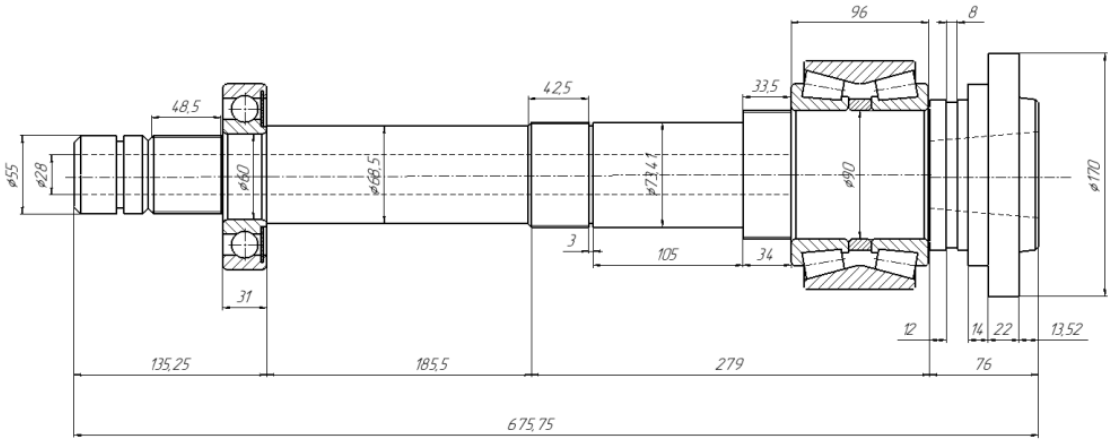

Figure 1 - Sketch of the spindle assembly

For the material “Steel 45” the value of the tensile and compressive strength is 245 MPa, the tensile and compressive strength is 570 MPa, the Young's modulus is 200000 MPa, and the fatigue endurance limit is σ-1 = 60 MPa; Poisson's ratio is 0.27 [2].

To load the spindle geometry for subsequent finite element modeling, a three-dimensional model of the spindle assembly with a three-jaw chuck and a workpiece fixed in it is to be created. The program "Compas 3D"is used for the purpose. The resulting three-dimensional model is presented in Figure 2.

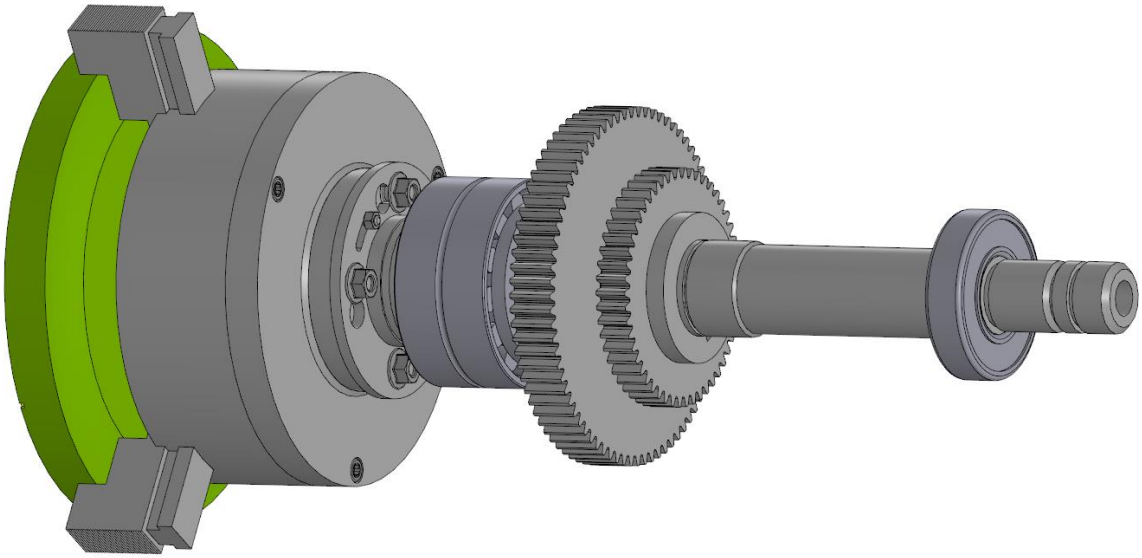

Figure 2 - Three-dimensional assembly model

Further, it is necessary to arrange all the forces acting on the spindle, as well as separately indicate the movable and fixed bearings. The resulting loading scheme of the spindle assembly, with all the forces acting on it, is presented in Figure 3.

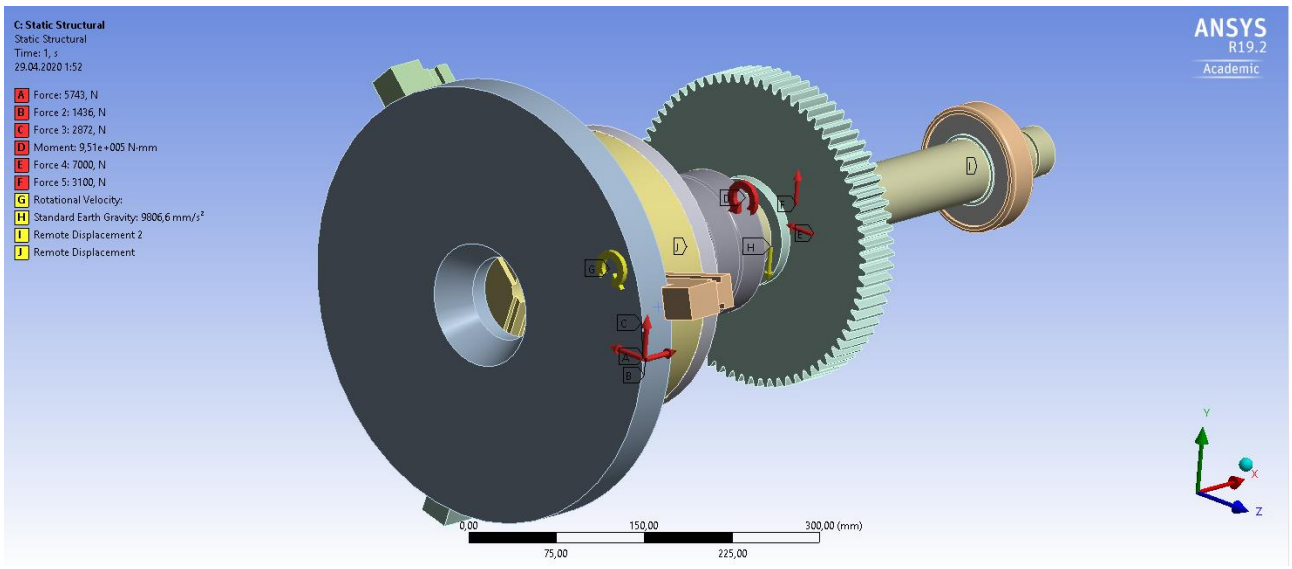

Figure 3 - Scheme of loading the spindle unit.

The results of the final elemental modeling are presented in Figure 4.

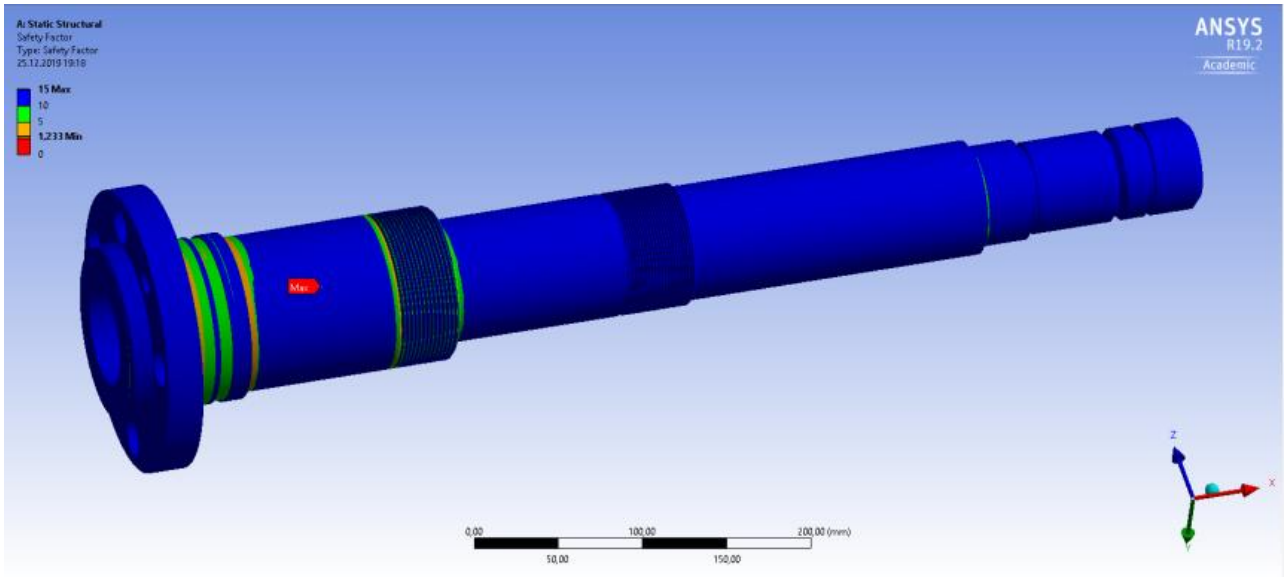

Figure 4 - Field distribution of the safety factor of fatigue strength.

In conclusion, it should be noted that the safety factor for fatigue strength is 1.233, which means that the spindle is able to withstand the required loads during its service life.

References:

1. Zacepin D.K., Razrabotka i issledovanie stanka s chislovym programmnym upravleniem dlja obrabotki diskovoj detali [Design and study of a numerically controlled machine for processing a disk part] - Novosibirsk State Technical University, 2019. 125 p.

2. LASERSAO, Moduli of elasticity of steel and Poisson's ratio, 2019 http://lasersao.ru/stali (reference date 12/08/2020)

УДК 608.4

SOFTWARE THAT SPOTS AND FIXES HANG BUGS

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It is hard to imagine our life without computers. Everything that we deal with is somehow connected with computers and therefore with the computer software. It is applied in practically all spheres of life and quality assurance is not an exception. Quality assurance is a procedure to ensure the quality of software products or services provided to the customers by developers. (Quality assurance)QA mainly focuses on improving the software development process, making it efficient and effective as per the quality standards defined for software. Quality Assurance is popularly known as QA Testing.

The goal of our research is to find an application that can reduce or completely replace the work of QA(Quality Assurance) testers.

The relevance of our work is due to the fact that similar bug fixing programs provide slightly different services, they are just gathering platform for reports and patches that developers and QR testers lay out. But we made a profound comparative analysis and found out that HangFix is a different program, its feature is independently finding bugs along with fixing them, and because of AI it becomes unique and promising.

To achieve the goal we made the following tasks:

1. We found the information about hand bugs, ways of noticing them and paths to get them fixed.

2. We made a comparative research of the following existent software: Jira; Bugzilla; Redmine.

The benefits of the HangFix software, which highlight it among the other similar programs, are the following:

- Fast speed of finding bugs due to the introduction of AI;
- The development of the program occurs independently;
- It is based on self-study with additional assistance of developers.

In the course of the work, the comparative method and the quantitative-statistical method were used.

Methodology. The theoretical and methodological basis of the research was the works on programming and applied science of such others as Marco Brocanelli, Xiaorui Wang, Ariel Eizenberg, Joseph Devietti, Gilles Pokam. The result of the research I found the ideal option, HangFix program. This application allows, unlike other programs (Jira; Bugzilla; Redmine), to find "bugs" independently, without the help of a programmer, in project. Presently developers of HangFix trying to combine their program with AI. As soon as it will be finished, the program in around 2 or 3 years could reach a level that can possibly help to remove altogether QA tester for a novice programmer developer.

References:

1. HangFix: Automatically Fixing Soware Hang Bugs for Production Cloud Systems/ Jingzhu He, Xiaohui Gu, Ting Dai, Guoliang Jin/ Text: electronic. URL: https://tingdai.github.io/files/hangfix_SOCC20.pdf (date of the application: 14.11.2020).

2. Text: electronic.URL: https://www.redmine.org (date of the application: 14.11.2020).

3. Text: electronic. URL: https://www.atlassian.com/software/jira (date of the application: 14.11.2020).

4. Text: electronic. URL: https://www.bugzilla.org (date of the application: 14.11.2020).

УДК 656.71

AUTOMATED VIRTUAL AGENT FOR TRUTH ASSESSMENTS IN REAL-TIME (AVATAR)

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The article considers the influence of information technology innovations on airport security.

The author analyzes scientific literature in the field of using information technologies in operation of aviation safety service.

As the result the conclusion has been made that there are possible problems with using machine translation of questions that are used to interview passengers and interpret the reaction (facial expressions, gestures and answers). But the effectiveness of AVATAR technology has been proven.

The tense socio-political situation forces the Airport Aviation Security Service to introduce new methods and modern technologies that can increase the passengers level security. Comprehensive security systems are being introduced to prevent acts of unlawful interference and other illegal actions aimed at destroying strategically important civil aviation facilities.

It is impossible to provide 100% safety measures for addressing terrorism. However, it is possible to increase the level of security of passengers at civil aviation facilities. Therefore, along with existing technologies and techniques that ensure aviation safety, it is necessary to constantly use alternative options to identify signs of a person preparing to commit act of unlawful interference. One promising solution of this problem is the introduction of profiling technology into the work of security services and law enforcement agencies, which has been used by Western security services for more than 30 years. Currently this technology is gradually becoming in demand in Russia and neighboring countries.

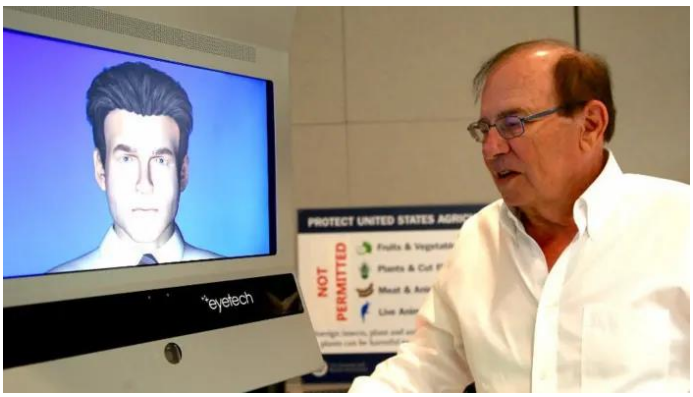
«Passenger profiling enables the Transportation Security Administration to target costly inspection effort toward passengers that have an incentive to attack» [1].

Passenger profiling technology is a part of comprehensive security systems. The purpose of this technology is to identify would-be criminals. It analyses body language of passengers, identifies those who intend to commit a terrorist act on board, in the terminal, and detects people carrying concealed weapons and explosives.

«There are both advantages and disadvantages of using profiling technology. If we talk about the disadvantages of using this technology, then Civil Rights experts argue that passenger profiling violates passengers' civil rights» [2]. «UK-based aviation security consultant Philip Baum also accepts that as a subjective security process, profiling runs the risk of being perceived as racially focused» [3].

Recently, a technical device capable of profiling at the airport has been developed.

AVATAR is equipped with proprietary algorithms to process and analyze the complex signals generated during an automated interview. Like other Artificial Intelligence systems, AVATAR can be set to process the information acquired through responses. AVATAR has been subjected to rigorous ground truth tests based on scientific studies at airports in Europe, Canada and the USA as well as the Nogales, Arizona. According to the tests data, the researchers concluded that AVATAR accuracy of deception detection is in a range of 80% to 85% depending on the context. This result is 54% higher than the average accuracy of deception detection demonstrated by airport security staff.



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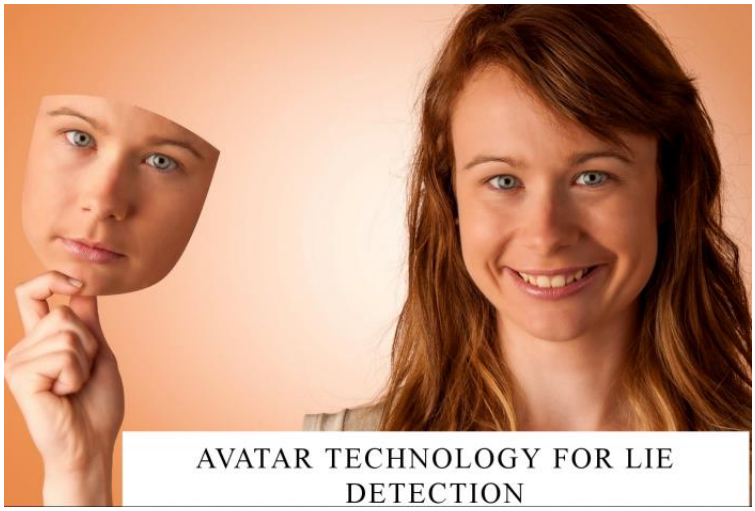
The idea was to make border control procedure rapid, efficient and safe. Virtual agent is able to analyze human behavior and detect potential terrorists.



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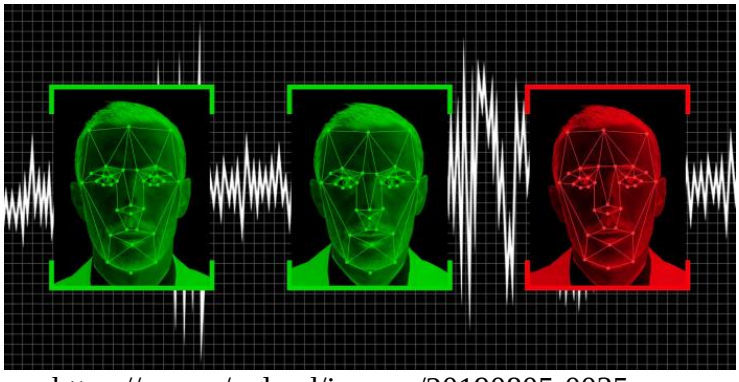
A set of sensors and two cameras are built into this technical device. The virtual agent asks passengers questions and, depending on their reaction, body movements and behavior identifies would-be criminals. Moreover, this device monitors voice changes, facial expression and pupil dilatation during the interview.



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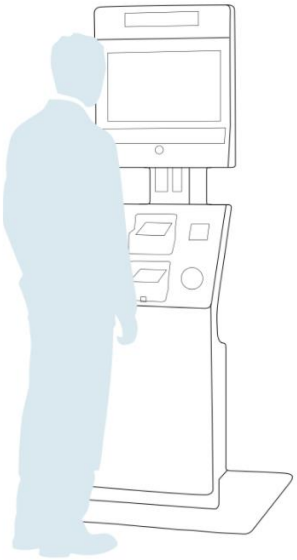

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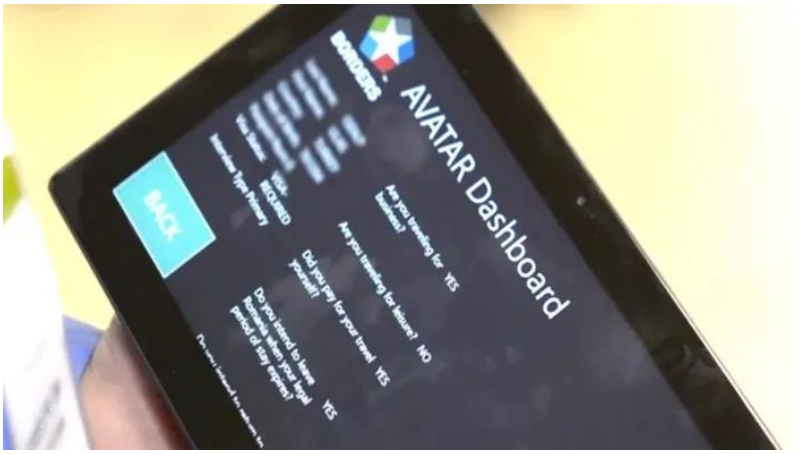
AVATAR has a passport scanner, which is used for checking photo and passenger data and a fingerprint scanner, which allows biometric identification.

After having conducted the survey the virtual agent analyzes their behavior, it sends the data to the operator who views them. If AVATAR notices any potentially dangerous signs, it informs the operator about them.



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AVATAR distinguishes not only English language so it can scan and verify passengers from different countries. AVATAR settings allow it to be used in different countries, but computer based translation of questions into different languages may sound inappropriate. Therefore, to maximize the effectiveness of this technology, it is necessary to develop specific sets of questions in different languages to program the relevant response. These sets of questions and relevant reactions, should take into consideration national characteristics and traditions, so that not to cause an inappropriate reaction from passengers.

AVATAR helps to decrease risks of unlawful interference, carry out profiling of large number of passengers without increasing the staff of airport aviation security service (only one operator is needed).

References:

1. Cavusoglu Huseyin, Kwark Young, Mai Bin, Raghunathan Srinivasan. Passenger Profiling and Screening for Aviation Security in the Presence of Strategic Attackers. Decision Analysis 2013/03/01 https://www.researchgate.net/publication/262160720_Passenger_Profiling_and_Screening_for_Aviation_Security_in_the_Presence_of_Strategic_Attackers

2. Profiling Passengers Pros and Cons

https://www.thoughtco.com/profiling-passengers-pros-and-cons-3209233
3. Ross Davies Point of controversy: does passenger profiling at airports work? 28 November 2019 (Last Updated November 21st, 2019 14:46)
https://www.airport-technology.com/features/airport-passenger-profiling/
4. AVATAR recognizes a lie
https://nag.ru/articles/article/104722/avatar-vyivedet-na-chistuyu-vodu.html
5. Automated interviewing technology reveals deception
https://www.discernscience.com/avatar/

УДК 623.1.7

THE POWER OF THE UPDATED RUSSIAN ARMY

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What is the power of the Russian army? The correct answer lies in the generally accepted criteria: our modern and effective missiles, tanks, planes, ships, and submarines. Obviously, people are highly professional specialists who are able to control all this power and fight with any opponent. But there is still difference between people and the "iron" that they use in their own interests. These are innovative technologies and high-tech products intended for use in the interests of improving the state's defense capability.

Current technologies used in the Russian army show that the presence of all kinds of military gadgets in the troops allows you to conduct a modern battle, where both the soldier and the officer need, rather than muscular strength, but the ability to think when using weapons.

Five years ago, you would have thought that such innovative technologies as radio electronics, integrated security, cybersecurity, aerospace technologies, protective equipment, optics, medicine and many others are from the field of science fiction or computer games. But today these technologies find practical application in our army.

This article analyzes Russian military current technologies that are used in the modern army. It also considers 5 innovations that have been presented by the Russian Ministry of Defense. To analyze the representative material we have used the following research methods: generalization, analysis and the method of description.

Let us start with the description of "Sagittarius". It is a complex that allows you to control the location of military personnel. The complex consists of a watch (bracelet) and a commander's console. The device is put on the hand and monitors the location of the military officer, his physical condition, up to the pulse and heartbeat.

"The filling of the drone" is an on-Board radio-electronic equipment for Russian unmanned aerial vehicles of a new generation. This complex allows you to achieve maximum effectiveness of combat operations by improving the information and communication network and coordination. These capabilities allow command posts and each combat unit integrated into the battle management system to view drone intelligence data online.

"The battery-which doesn’t freeze" is the dream of every car owner. It is designed to work in cold climatic conditions and provides engine start of any military equipment samples. Our paratroopers have already tested it in the Arctic.

"Cryptographic hardware" is a special device for protection of conversations against listening. It connects to smartphones based on the iOS and Android operating systems and protects conversations from listening. The headset also provides security for text messaging and file sharing.

"Strike" is not just the name of a combat vehicle. This is a real strike to the enemy in a real battle (without the use of human force). The Strike remote-controlled multi-functional robotic complex is designed to support combat operations, combat and reconnaissance units, technical and logistics support units of the ground forces and special purpose units.

Thus, the development and supply of troops with advanced weapons is given the closest attention. They relate to any defense component-from Nanofield kitchens to robotic space complexes. The army of the future is an army of innovation.

References:

1. V. Sokirko. Innovations of the Military of the Defense // Zvezdaweekly, No 30 (275), September 2020, pp. 28-35.

УДК 623.7

THE USAGE OF PLASMA GENERATORS FOR RADAR INVISIBILITY OF AIRCRAFT

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Nowadays there are a number of problems associated with ensuring the radar invisibility of combat vehicles. Radar invisibility is one of the most important characteristics of the latest military aircraft. There are several ways to reduce the aircraft's radar signature:

1. Changing the geometry of the aircraft body and the shape of the air intake duct [1,2].
2. Usage of radar-absorbent materials.
3. Creation of a plasma shield that absorbs radio waves (Plasma Stealth) [3].

Each of these methods has a number of disadvantages. A change in the geometry of the aircraft body will entail a deterioration in aerodynamic properties. Usage of radar-absorbent materials and coatings does not provide full absorption of radio radiation.

Plasmas can interact strongly with electromagnetic radiation: this is why plasmas might plausibly be used to modify an object's radar signature. Interaction between plasma and electromagnetic radiation is strongly dependent on the physical properties and parameters of the plasma, most notably the electron temperature and plasma density. The great advantage Plasma Stealth possesses over traditional radio frequency stealth techniques is that plasma is tunable and wideband. When faced with frequency hopping radar, it is possible, at least in principle, to change the plasma temperature and density to deal with the situation.

But plasma stealth technology also faces various technical problems. Plasma tend to emit a visible glow: this is not compatible with overall low observability concept and it is extremely difficult to produce a radar-absorbent plasma around an entire aircraft traveling at high speed, the electrical power needed is tremendous. Also, if the plasma completely covers the plane, it will lose communication with the control center, this is especially critical if we are talking about unmanned aerial vehicles.

I propose a method for reducing radar signature based on the use of plasma generators that would create sources of plasma on the aircraft body.

Plasma sources will be located in areas most vulnerable to radar detection, such as air intakes and engine nozzles (fig. 1). It is also possible to place sources in those places, the change in geometry of which will lead to a deterioration in the aerodynamic properties of the airframe.

Fig. 1 location of plasma sources

Thus, plasma sources will serve as an auxiliary means in achieving radar invisibility of aircraft, which will allow changing the geometry of the aircraft only partially, since radio waves in vulnerable places will be absorbed by plasma sources. And since the plasma does not completely cover the aircraft, but is concentrated only at certain points, the aircraft is able to maintain communication even with the plasma generators turned on, also it is much easier to create plasma souces than to cover the entire surface of the aircraft with plasma. This method of reducing radar signature is technically simpler and also more economical

References:

1. V. A. Kuznetsov Aircraft radar signature reduction method by parametric synthesis of the optimal shapeair intake duct / Kuznetsov V. A. // Control systems, communications and security. 2019. № 2. P. 180-202.

2. Izyumov, D. Scientific and technological problems of complex reduction of the visibility of weapons, military and special equipment of the leading foreign countries/ D. Izyumov, E. Kondratyuk, A. Logunov // Innovatics and expertise. 2017. №3. P. 258-269.

3. Wikipedia – the free encyclopedia [Electronic resource]. Plasma stealth. URL: https://en.wikipedia.org/wiki/Plasma_stealth

УДК 621

MODERNIZATION OF A SCREW PRESS FOR SQUEEZING GRAPE PULP

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Annotation: *This article is devoted to the modernization of the PSGN – 68 inclined press for pressing grape pulp. For this purpose, design and research methods have been developed and presented in five sections: technological, research, design, economic, and labor protection section.*

Keywords: *modernization, inclined press, efficiency*

In most regions of Russia, it is impossible to grow grapes because of climate challenges, therefore the main part of the grape raw material is imported (90%). Currently, the development of

growing vineyards in the southern regions of our country is underway, which is accompanied by the use of modern equipment with high efficiency and economy [1].

Grape juice occupies a certain niche among food products, is widespread and available. Grape juice has a pleasant and natural taste, smell and color, and the technology of obtaining natural juice does not require the use of dyes, flavor enhancers and flavorings, natural substances are allowed for canning [2].

In the technological section, the requirements for raw materials and finished products were determined, the technology for the production of grape juice was considered, and a machine-hardware scheme was built.

In the design section, having considered prototypes of machines, an inclined press PSGN - 68 was chosen as a calculated analogue of a press for pressing grape juice. When analyzing the prototype design, it was revealed that the drive layout and the frame design have significant dimensions. This is due to the location of the drive in the upper part of the axis of the inclined screw. The optimal solution for modernization would be the transfer of the drive station, change of the gearbox layout, recalculation of the dimensions of the working chamber and the required power of the electric motor, which will improve the overall, energy and mass characteristics of the machine [3].

The necessary calculations of technological parameters, such as performance and power, kinematic and strength (verification calculations of key connections, bearing assemblies) were performed in the APM WinMachine software.

In the research section, a strength study of the working body was performed in the Ansys Workbench program, deformations and stresses were determined, distribution fields were constructed by the safety factors of static and fatigue strength. The reactions in the supports are determined. The safety factor of static strength (Fig. 1) has a minimum value of 1.7, the screw design has the necessary safety factor, while the optimal thickness of the screw turns (10 mm) and the walls of the hollow shafts (4 mm) are determined, the design is equally strong [4].

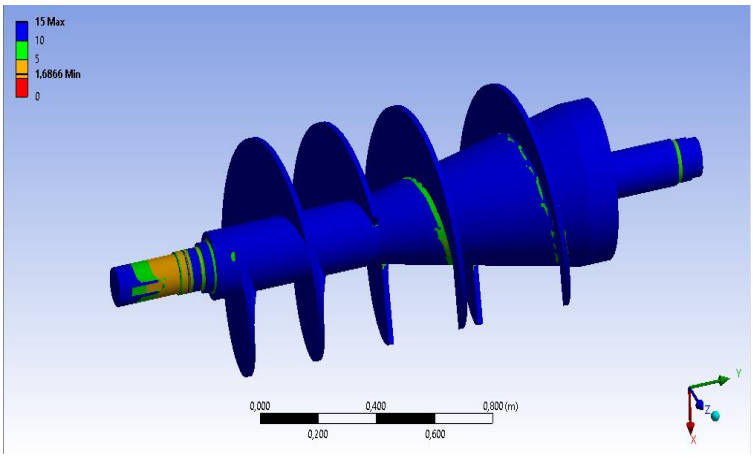

Figure 1 - Distribution field by static safety factor

The labor protection section included the development to increase the safety of a screw press. The design provides a protective casing for the high-speed motor shaft and gearbox shaft. Also, in order to avoid situations dangerous to health, the equipment is provided with emergency stop buttons.

In the economic section, the costs of experimental design were calculated. The total (final) cost of the inclined press was determined, which is equal to 831,410 rubles [5].

Based on the results of the work performed, a comparative table of the designed machine with a prototype was compiled (Table 1).

Table 1 - Comparative characteristics with the prototype

Characteristic	PSGN-68	Engineered machine	Improvement, %
Productivity, t / h	50	50	–
Drive power kW	18	15	16
Screw rotation frequency, min-1	13	14,2	–
Overall dimensions, mm			
length	5020	2720	46
width	3430	2050	40
height	3600	2110	41
Weight, kg	3800	3000	21

In conclusion, we emphasize that during the study of the inclined screw press, the possibility of increasing the energy efficiency and specific indicators of this machine, reducing the mass and overall characteristics was determined.

References:

1. Nosulchak V.A. Analiz mirovogo genofonda vinograda i printsipy formirovaniya ampelograficheskoy kollektsii Rossii / V.A. Nosul'chak, L.P. Troshin // Innovatsii i effektivnost' proizvodstvennykh protsessov v vinogradarstve i vinodelii, 2005. – 124-131 p.

2. Volynkin V.A. Biologicheskaya tsennost' produktov iz urozhaya novykh sortov vinograda slozhnoy geneticheskoy struktury / V.A. Volynkin [et al.] // Vinogradarstvo i vinodeliye, 2008. – 18-23 p.

3. Ivanov M. N. Detali mashin: uchebnik / M. N. Ivanov, V. A. Finogenov. - 8th ed., Rev. – M.: High School, 2003. – 408 p.

4. ANSYS. Spravochnik pol'zovatelya / K.A. Basov - ed. DMK-Press, 2014. – 640 p.

5. Verteshev A.S. Metodicheskiye ukazaniya po ekonomicheskomu razdelu vypusknoy kvalifikatsionnoy raboty bakalavra / A.S. Verteshev, S.N. Lekhin, E.V. Ryzhov. – Pskov: PSU, 2015. – 40 p.

УДК 621

MODERNIZATION OF VEGETABLE CUTTING MACHINE IN THE PRODUCTION OF SAUERKRAUT

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Annotation: *The essence of this article is to modernize the vegetable-cutting machine in the production of sauerkraut. For this purpose, design and research methods were carried out. They are presented in five sections: technological, research, design, economic, and occupational safety.*

Keywords: *modernization, vegetable cutting machine, performance*

The benefits of sauerkraut are invaluable. In winter, it replaces raw vegetables and greens. Its uniqueness is that the amount of vitamins and minerals is several times higher than in fresh

cabbage. This product contains enough useful elements to become a permanent and complete product for everyone who cares about the state of health. Therefore, the relevance of the work is to increase the production of sauerkraut [1].

In the technological section, the technology of production of sauerkraut was considered and its machine and hardware scheme was built, the necessary requirements for raw materials and finished products were determined [2].

In order to increase productivity, it was decided to upgrade shredding machine MSH-10000 with a service life of 8000 hours.

In the design section, we considered analogs of a vegetable-cutting machine. Possible locations of cutting disks were identified, as well as loading and unloading devices. The optimal solution for the implementation of modernization is to increase the number of cutting knives on the disk by 1 – as a result, the number of knives increased up to 12.

Calculations of the necessary technological parameters –kinematic and strength (verification calculations of V-belt transmission, keyway connections, bearing units, cutting disc shaft), as well as performance and power were performed in the APM Integrator program[2, 3].

In the research section, we performed a strength study of the shaft of the working organ in the Ansys Workbench program [4]. The minimum value of the safety factor for static strength is 2.48, and the minimum value of the safety factor for fatigue strength is 4.97. This indicates that the shaft of the working body can withstand all the forces applied to it, as the coefficients exceed 1.0 during the service life of 8000 hours.

Labor protection included the development of improving the safety of the vegetable cutting machine. It was decided to install the casing on an open V-belt transmission and a shield around the cutting disc.

In the economic section, the cost of experimental design development is calculated, i.e. the cost of one upgraded MS-10000 machine, which is equal to 106600 rubles [5].

We created a three-dimensional model of the MSH-10000 vegetable cutting machine in the Solid Edge software product (Fig. 1).

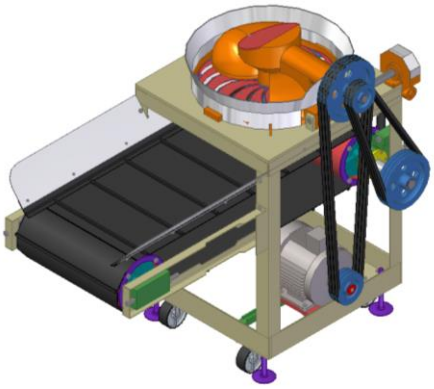

Figure 1 – three-Dimensional model of the vegetable-cutting machine MSH-10000 (the casing is removed)

A table which shows the calculated and predicted characteristics of indicators after the improvement of the working body was compiled (table. 1).

Table 1-Technological characteristics of the MSH-10000 machine

Indicator	Before the upgrade	After modernization
Number of knives, pieces		
Performance, kg/h	before 10000	before 10710
Rotation speed of the knife disc, min $^{-1}$	210	216
Motor power, kW	4,0	4,0
The speed of the belt conveyor, m/sec	2,08	4,5
Overall dimensions, mm	1600x1020x1500	1678x995x1383

In conclusion, it should be emphasized that after increasing productivity, the speed of rotation of the knife disk increased, but the power remained the same. This means that the constant energy consumption of the equipment remains the same.

References:

1. Dubrovin, I. I. Vse ob obychnoj kapuste [All about ordinary cabbage] / Moskva: Eksmo-Press "Yauza" [Moscow: Eksmo-Press "Yauza"] – Moscow, 2009. - 100 p.

2. Elkina V. D. Zhurin A. A., Panichkin L. P., Bogachev M. K. Oborudovanie predpriyatij obshchestvennogo pitaniya. Mekhanicheskoe oborudovanie [Equipment public catering enterprises. Mechanical equipment] - 2nd ed., pererab. - M.: Economics, 1987. - T. 1.

3. Konstruirovanie uzlov i detalej mashin : ucheb. posobie dlya stud. vyssh. ucheb. zavedenij [Construction of components and machine parts studies. student's guide. higher. studies'. Institutions] 11th ed. erased. - Moscow: publishing center "Academy", 2008. – 496 p.

4. ANSYS. Spravochnik pol'zovatelya [ANSYS. User's guide] / K. A. Basov-ed. DMK-Press, 2014. – 640 p.

5. Metodicheskie ukazaniya po ekonomicheskomu razdelu vypusknoj kvalifikacionnoj raboty bakalavra [Methodical instructions on the economic section of the final qualifying work of a bachelor] / A. S. Verteshev, S. N. Lekhin, E. V. Ryzhov. - Pskov: PSU, 2015. - 40 p.

УДК 378.1,004.9

CHALLENGE OF GLOBAL COMPETITION IN INFORMATION TECHNOLOGY INDUSTRY: INNOPOLIS UNIVERSITY

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The research aims to identify strategies that produce challenge of global competition in information technology (IT) industry, and to analyze the contribution of the Innopolis University to national capacity of Russia in the targeted field.

The research methodology – data analysis method – has specified the plan to perform the study: establishing the capabilities of data on the state of competition in IT industry, and if the Innopolis University compliances with this state of competition; establishing the way of achieving the purpose of the research: an objective, resources.

The objective of this study is to establish the regularity of the development of the phenomenon under study – the role of the Innopolis University within the field of IT competitiveness of Russia in the world.

One of the biggest concerns in tech policy is trying to understand how competitive the tech industry really is [1, p. 147]. Tech remains a rapidly evolving industry and competition drives IT products improvement. Companies within IT market need to constantly stay on their toes, as the next startup can knock them down with a better product. Thus, the fact of phenomenon of a competition in IT development is considered to be obvious. That is true both for national IT industry and a global one.

In considering competition in the IT industry we believe it is proper to look not only at the domestic industry but to look at the entire global industry to explore if there can be traced a body to meet crucially high level of being competitive in a current global IT industry. N.Z Safiullin and L.N. Safiullin postulate that the company’s competitiveness is determined by three groups of factors: at the macro level – the competitiveness of the country, sectoral level – the competitiveness of the industry, enterprise level – factors that characterize its (enterprise) own potential and place in

the industry [2, p. 52]. The Innopolis University, Republic of Tatarstan, Russia, nowadays is truly the organization meeting actual demands in training specialists of the highest standards of IT industry with its mission to create a fundamentally new generation of young professionals who will bring the Russian IT industry to an internationally competitive level, which, in turn, will become one of the growth points of the Russian economy. In this regard, the main task of the University is to train specialists at the request of the domestic IT industry, to employ graduates in Innopolis, as well as to promote them further in the domestic labor market.

For the period of less than 5 years, the Innopolis University has become the first non-governmental Russian educational organization specializing in information technology, fully included in the world scientific and educational space. The number of international academic partners of the University is now 32. These are Western universities included in the world thematic top lists. Agreements on the implementation of academic mobility programs have been signed with 14 universities. Innopolis University enjoys a close cooperation with 100 leading IT companies. The university holds the 8th position in the U-MULTIRANK RATING; it became the first Russian University in its U-Multirank category to achieve such a level for the first time in the prestigious international rating, taking the eighth place at once. In total, in the rating 1,700 universities from 92 countries in 10 categories were evaluated [3].

The Innopolis University scientists are currently pursuing research in the framework of the 15 laboratories. The university cooperates with 153 leading IT companies in Russia and 53 academic partners. The Innopolis University has entered the world's top 100 universities-researchers of Games Institutions Active in Technical Games Research. 563 scientific works of the university scientists have been published in scientific journals indexed by Scopus, Web of Science and RSCI. The results of 3 breakthrough studies are published in the journal Nature. Research areas can be listed with the departments of the university: Institute of data analysis and artificial intelligence; Laboratory of data analysis and bioinformatics; Laboratory of artificial intelligence in game development; Laboratory for data analysis and machine learning in the oil and gas industry; Laboratory for machine learning and data representation. Master's Degree students participate in international exchange programs, develop their own business projects, and work for leading companies in the Russian IT market: Yandex, AK Bars, Cognitive Technologies, Infowatch, Sbertech, and others [4].

Students are taught by foreign and Russian professors and researchers who have worked in leading IT companies and major universities in the world. The language of study is English, and the university employs the best specialists to teach in the field of computer science and thus provides students with up-to-date knowledge. It should be mentioned here that in the field of IT knowledge is updated rapidly, so there is no point in translating educational materials into Russian — the translation will quickly become outdated.

Russia occupies only 1% of the global IT market [4]. To increase the circle of communication, go beyond this 1%, expand the circle of clients, one need to choose the niche he or she is interested in and learn the language. The Innopolis University realizes the tasks of expanding knowledge while a huge amount of world scientific, IT information is presented in the English language.

Thus, the objective of this research to establish the regularity of the development of the phenomenon under study – the role of the Innopolis University within the field of IT competitiveness of Russia in the world has reflected 1) the university keeps a model that combines education, science and business. For example, master's degree programs with subsequent employment are available for young professionals and development engineers. 2) The Innopolis University creates a generation of specialists who will make the Russian IT industry competitive in the global IT industry.

References:

1. Butorina O.V. Scientific and technical policy of the EU / European Union on the threshold of the XXI century / ed. by Yu.A. Borko, O.V. Butorina. M.: URSS, 2001, pp. 146-165.

2. Safiullin N.Z., Safiullin L.N. Managing the competitiveness of an enterprise / Monography. – Kazan: Kazan Publishing House. UN-TA, 2008. 189 p.

3. The Innopolis University. URL: https://innopolis.ru/resident/education/innopolis-university/ [Date of access: 16.11.2020].

4. 7 reasons to enter the Master's Degree program at the Innopolis University. URL: https://vc.ru/promo/61549-innopolis [Date of access: 16.11.2020].

УДК 621

FORMING THE QUALITY OF THE WORKPIECE SURFACE LAYER BY SURFACE PLASTIC DEFORMATION USING ULTRASONIC VIBRATIONS

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Abstract

The article deals with methods of ultrasonic processing. Ultrasonic treatment is the most promising method of surface layer quality formation. There are two main schemes for ultrasonic hardening: a scheme in which the hardening is performed by free balls and the use of a waveguide in the form of glasses, as well as a scheme in which the indenter is fixed on the waveguide, which transmits longitudinal vibrations. In the second case, the indenter may be rigidly fixed or not fixed at all, which affects the parameters of the formed surface layer.

Keywords*: deformation, ultrasonic, hardening method*

The service life and efficiency of machine units are increased by increasing the hardness, wear resistance and back-to-back endurance of the surface layer.

The quality of the surface layer determines the characteristics of external friction and wear, corrosion, the development of fatigue, the occurrence of noise, the efficiency of machines and other parameters and characteristics of machines. Therefore, the quality of the surface layer is one of the most important factors that determine the reliability and performance of critical parts and the mechanism as a whole.

To improve the quality of the surface layer, surface plastic deformation treatment, both independently and after some cutting methods is used.

Surface plastic deformation (SPD) is a pressure treatment in which only the surface layer is deformed. With SPD, the defects of the surface layer formed during the previous cutting operations, especially during grinding, are largely eliminated, the layer is strengthened, compressive residual stresses are created in it, the durability of the part increases. During plastic deformation, the metal grains are displaced relative to each other, partially crushed. The crystal lattice of grains is distorted, the pattern of dislocations changes, and a free energy reserve is formed in the surface layer. At the same time, such material properties as fatigue strength, yield and strength limits, and wear resistance change.

SPD methods are divided into static and percussive. The static method is carried out when the deformable material is in static contact with the tool. The tool acts on the machined surface with a constant force P, there is a smooth movement of the focus of the tool on the part on the part, which sequentially passes the entire surface to be machined.

Due to relatively low pressures and strain rates, static methods of plastic deformation do not allow full use of the metal's ability to harden.

In order to use the reserve for increasing the strength of the metal to a greater extent, static methods are replaced by shock (impulse) methods.

The SPD impact method is characterized by multiple impacts on the entire treated surface or its part, while the impact force P in each cycle varies from zero or some minimum value to a maximum. In the case of local impact, the deformation area, as in the static method, consistently and evenly passes through the entire surface to be treated.

The most promising impact method is hardening and finishing with an ultrasonic tool.

Ultrasonic treatment (UT) is an advanced technology for finishing and hardening metal pressure treatment, which allows replacing the classical statistical methods of SPD, such as smoothing and rolling. UT differs from statistical methods of surface plastic deformation by transmitting ultrasonic vibrations with a frequency of 18-66 kHz and a vibration amplitude of 15-60 microns to the deforming tool, and leads to the occurrence of a periodic shock effect of the indenter on the surface to be treated [1].

Ultrasonic treatment today has two types, in the first case, hardening is performed with free balls using a waveguide in the form of glasses, and in the second, hardening is performed by an indenter fixed on the waveguide, which performs longitudinal vibrations.

The first method is based on imparting to the loaded bodies (polymer balls; steel or cast-iron shot; wire mesh; granules from aluminum and non-ferrous alloys), located in a closed space, mechanical energy from the oscillating surface of the waveguide, due to which the work surface is hardened. This method (Fig. 1a) is similar to the vibration impact treatment method. The workpiece 5 is placed in a waveguide (glass) 3, in which the working bodies are located 4. Mechanical energy is supplied to the balls due to the ultrasonic transducer 1, the concentrator 2 and the waveguide (glass) 3. The main process parameters are the intensity of the ultrasonic field, the size and number of working bodies.

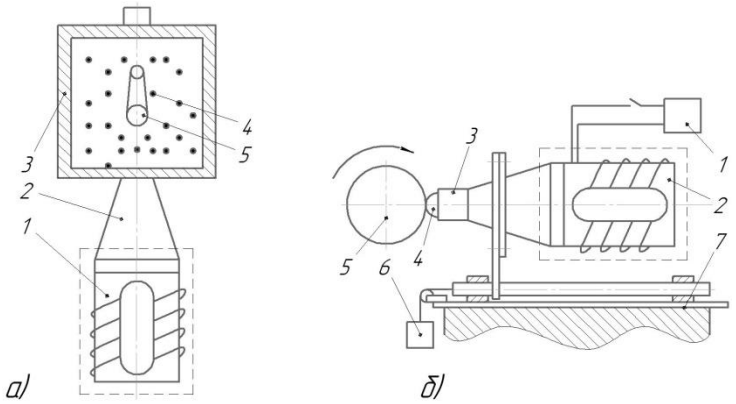

Figure: 1 - Surface plastic deformation using ultrasonic vibrations, a - hardening by free bodies: 1 - transducer; 2 - concentrator waveguide; 3 - waveguide (glass); 4 - loaded bodies; 5 - workpiece; b - hardening at which the indenter is fixed on the waveguide: 1 - ultrasonic generator; 2 - magnetostrictive transducer; 3 - hub; 4 - indenter; 5 - workpiece; 6 - cargo; 7 - guides.

The second method is as follows (Fig. 1b) - working tool 4 under the action of statistical and impact force, formed with the help of an oscillatory system consisting of a magnetostrictive or piezoceramic transducer 2 and a concentrator 3, performs plastic deformation of the surface layer of the part 5. Creating a static force P_{ST} is carried out by means of a spring or load 6. In this case, the loaded device moves freely along the guides 7 and is pressed against the workpiece 5.

The second processing method has two main varieties: hardening with a fixed (Figure 2a) and, respectively, not fixed (Figure 2b) indenter. The first case is quite widespread and, accordingly, well studied. Experimental data have shown [2] that during processing between the indenter and the processing surface there is a periodic contact with the frequency of ultrasonic vibrations. At the moment of contact, the instantaneous stresses are significantly higher than the average ones, which causes severe plastic deformation. In the process of machining with a fixed indenter between the

tool and the workpiece, a sliding friction force arises and the vibration amplitude set by the oscillating system is transmitted unchanged.

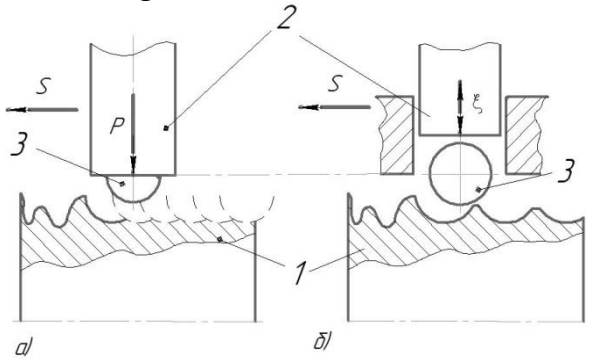

Figure: 2 - Schemes of ultrasonic surface plastic deformation, a - with a fixed indenter, b - with a free indenter, 1 - workpiece, ultrasonic vibrating system, 3 - indenter.

With a loose indenter, in addition to sliding friction, rolling friction arises, since a ball, or another deformable element, has free movement around its axis. Also, the frequency of the indenter and the oscillatory system is different. This design of the device for ultrasonic processing is more technologically advanced, since it allows you to quickly change the indenter. The above differences affect the processing process. It is known a lot about the method with a fixed indenter. The dependences of processing modes and quality indicators have been established. But there is little data about the second method, therefore, a more in-depth study of the features of the formation of the surface layer quality when using a hardening scheme with a free indenter is required.

References:

1. Odintsov L.G., Uprochneniye i otdelka detaley poverkhnostnym plasticheskim deformirovaniyem: spravochnik [Strengthening and finishing of parts by surface plastic deformation: a reference book.] / Moskva: « Mashinostroyeniye » [Moscow: "Mechanical engineering"] – Moscow, 1987. – 328 c

2. Mukhanov I.I. Uprochneniye stal'nykh detaley sharikom, vibriruyushchim s ul'trazvukovoy chastotoy [Strengthening of steel parts with a ball vibrating with ultrasonic frequency] / I.I. Mukhanov, Y.M. Golubev. / Vestnik mashinostroyeniya. [Bulletin of mechanical engineering.] - 1966. - No. 11. - from. 52-53.

УДК: 328

PROPAGANDA AS A TOOL FOR THE FUNCTIONING OF ELECTORAL AUTOCRACY

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In the modern world, with the development of freedom of speech, globalization and supranational ties, propaganda has acquired a negative meaning. With the growth of liberalization of world society, it is generally accepted that no one has the right to tell people how to think and what to think, how to form their opinion and initial assessment of any events or personalities. Moreover, the understanding that the "puppeteer" leads your opinion becomes shameful for the person, makes him try to break the threads, stop being a conformist to the current situation. But, from such a false "insight", the propaganda did not stop fulfilling its main goal – to` form the public opinion needed by any actor. Only the methods of delivering the necessary information to people have changed - they have become "softer" and less noticeable at first glance.

Different systems of government use propaganda for different purposes. In the case of democracies, it is necessary to protect the ideology itself from destruction from the outside,

although this, in theory, contradicts the idea of democracy itself. Autocracies, on the other hand, use propaganda not to unite the people within a certain structure, but to divide the masses in their possible struggle against political elites and distract from pressing problems. The purpose of this paper is to determine how propaganda is used by a political regime such as autocracy, which mimics democracy. To achieve this goal, we will consider the impact of propaganda on both a democratic society and an authoritarian system. Further, taking a hybrid regime, we will find out what it takes from two seemingly antonymous political systems and, on the basis of this, we will determine the contribution of propaganda to the functioning of the electoral autocracy.

What characterizes democracy as a state system? Freedom of speech, human rights, openness and transparency of the bureaucratic apparatus, an honest and incorruptible electoral system in which every voter's vote has a meaning. It would seem that with such liberal principles the existence of propaganda loses its necessity and logic. However, the twentieth century showed the world the first threat to the existence of democracy - human fear.

The past century has marked the rapid growth of authoritarian and totalitarian regimes, which by their existence endangered the existence of liberalism. This is not about military intervention, the path of force, but about diplomatic influence, propaganda. Democratic governments were forced to resist the growth of fascist and Nazi sentiments by banning the activities of organizations promoting the values of these ideologies, which in itself is the first nail in the coffin of the basic tenets of the "spirit of freedom". After the forties, with the final formation of a bipolar world, a real hysteria arises due to the fear of the spread of communism across the globe. A striking example of this is McCarthyism - a kind of American analogue of the witch hunt.

In this case, propaganda acts as a means of protecting ideology from harmful foreign influence. It would be more correct to call it counter-propaganda. In the case of democracies, if political elites feel and understand a threat to the regime or the sustainable existence of society, it becomes vital for them to use “non-democratic” methods in order to return to sustainable existence. In reality, such propaganda is difficult to discern and easily confused with "good intentions." These can be educational programs on radio or television, describing life abroad with the obligatory "fly in the ointment", interviews with people describing the horrors of everyday life, comparisons of the state structure of two opposing ideologies. Propaganda works like information noise, without influencing or ordering a person directly what to think, but implicitly creates the necessary images, a kind of foundation for a person's further opinion. It is interesting that in the future, a person who has fallen under the influence of propaganda will sincerely consider his opinion to be unbiased, non-fabricated and his own.

Modern propaganda, with the development of the Internet, has faced a new challenge. The World Wide Web allows people to instantly receive information based on different opinions and points of view, sometimes even absurd ones. All this brought to naught the classical method of propaganda to create the only true mental images of the masses, which should be adhered to. Instead of this came targeted, targeted propaganda, directed not at all people or certain classes, but at small groups. The bottom line is that with the abundance of information that the Internet provides, people tend to believe either the first source that catches their eye, or the opinion that confirms the knowledge that the individual already has. All this makes the propagandist's job much easier. Now there is no need to deal with the heterogeneity of the opinions of the masses and the possible consequences of how the reported information will be perceived by those strata of the population who were not influenced by the propaganda. It is enough to select the necessary group to be influenced, while the rest of the participants will perceive the propaganda as "white noise" and will not attach any importance to it. This method is used, in addition to political elites, by some companies or certain political lobbies to promote their ideology or values.

It should be noted that only old-style dictatorships are considered, which are practically not represented in the modern world. Dictatorships of a new type and mixed regimes will be considered further as a merger of these two regimes - old authoritarianism with totalitarianism in a private form and no less old democracy.

Political elites in authoritarian countries are more concerned about maintaining their position. The preservation of the regime, although it is a necessary condition, still fades into the background. Propaganda in the old dictatorships or totalitarian regimes is usually presented in the form of a direct, permanent and in no way veiled influence on public consciousness. Full stadiums of people welcoming their leader, eulogies on radio or television, unambiguous propaganda leaflets - the goals are very clear to every actor in this process. In this case, the law is interesting that the more developed authoritarianism and dictatorship in the state, the more comprehensive propaganda becomes and the more it delivers lies to society. But, oddly enough, it is more difficult for people to recognize the "big lie", so this method of propaganda was also successful in the totalitarian and authoritarian regimes of the last century. Now, with the global development of the Internet, this kind of manipulation of public consciousness has sunk into the past (Of course, only in those countries where the “unregulated” Internet has appeared, in other cases such propaganda can still be successful).

A hybrid regime is often a dictatorship or a milder authoritarian regime that has begun the transition towards democracy, but at some stage has slowed down or stopped altogether. Usually, such a transition is slowed down when the political elite is able to make a quick profit, for example, from the country's resources. It is important for such a regime to preserve an "unblemished conscience" before exporting countries, while maintaining its status as a political elite. As a result, in a country in which such a regime was established, one can outwardly observe all the signs of a secular democratic state. However, in reality, the state allows itself to use targeted repression (of course, in comparison with the repression of totalitarian states, this is practically nothing), to hold dishonest elections, in which the votes of people in which have little or no effect on the result, and, of course, propaganda.

Hybrid regimes of the twenty-first century are countries open to the Internet, so the “big lie” does not work in them. Sometimes the regime allows the existence of independent media, several points of view on the events taking place in the country, but often all this is under the censorship of the government. Information that destroys the illusion of a high reputation of the regime is not broadcast on the air, for their place they use fabricated or taken out of context data aimed at shifting public discussion from the situation inside the country to external enemies. In parallel, there is a disintegration of society itself, its differentiation in order to prevent the consolidation of the masses against the regime. Actually, propaganda in them is used by political elites for the same purpose as in authoritarian countries - to retain power. The methods are inherent in democratic regimes - targeted propaganda of certain social groups, the impact on the masses as a whole does not occur.

Electoral autocracies are confidently heading towards democratization, or are only pretending on it. In any case, electoral autocracies in many respects use propaganda techniques similar to real democracies, but, at times, with the goals and "shades" inherent in dictatorships. This is likely due to the development of the Internet, which has negated any aggressive open influence on public opinion. Propaganda itself plays an important role in the management of the state with any political regime. It can be used for relatively peaceful purposes - to train the population to resist propaganda, a kind of counter-propaganda. But, it is more often used for its direct purpose - to manipulate the thoughts of the masses, to direct the movement of the country's policy in the mainstream needed by the political elites and lobbyists. Without emphasizing whether it is good or bad, propaganda remains an important political tool and extremely effective in professional hands.

References:

1. Guy Hermet, Richard Rose, Alain Rouquie. Elections without choise. – 1978. – 250p.
2. URL: https://magazines.gorky.media/nz/2018/4/totalitarnye-i-avtoritarnye-rezhimy.html
3. URL: https://www.eiu.com/topic/democracy-index
4. Taylor P. M. Munitions of the mind: A history of propaganda from the ancient world to the present day. — Manchester; New York, 1995.

СЕКЦИЯ 3

АКТУАЛЬНЫЕ ПРОБЛЕМЫ ПЕРЕВОДОВЕДЕНИЯ

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Секретарь: преподаватель С.Р. Мансурова

УДК 811

THE USE OF ABBREVIATIONS IN ONLINE CHATS AND COMPUTER GAMES

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In the modern world people are constantly in a hurry. Communication using instant messengers and online chats has entered our lives. Tablets, smartphones, laptops, various social networks have replaced live communication. A person constantly tries to simplify and facilitate his life, combining many activities and areas of life: work, study, leisure, friends, family, hobbies. Communities of interest, thanks to the Internet, make it easier for their members to exchange information.

Communication now should be fast, productive, convenient. Social media saves time and money. Online chats allow you to keep in touch anytime you cannot call. In personal correspondence users very rarely adhere to all the rules and norms of the language. Most of them ignore them altogether. After all replacing an entire sentence with an abbreviation of four or five letters is much faster and more convenient. A feature of such communication is the brevity and conciseness of the transmitted information due to various abbreviations. That is why it is necessary to study abbreviations as a means of communication.

The aim of our investigation is to study the most widely used abbreviations and characterize them. To reach this goal we analyzed different chats and computer games.

The trend towards simplification is observed in all languages, most of the abbreviations come from English as it is international. But there is a fundamental difference between Russian and English abbreviations. Russian speakers mostly use simple abbreviations, while English speakers often abbreviate words based on sound similarity.

Abbreviations of words are the omission of individual letters and syllables in a word, and sometimes the removal of part of the word except for some letters. In online chats and computer games, in addition to the generally accepted abbreviations (a.m., p.m., PS., Feb., Mon.), informal, slang words are also actively used.

By the type of formation, abbreviations in correspondence can be divided into the following groups:

1) Using an apostrophe (I'm - I am; I’ve - I have; ’em - them.)

2) The use of initial letters of words that make up a phrase or a sentence, that is, an abbreviation (IDK - I don't know, IDC - I don't care, TU - Thank you, ASAP - As soon as possible, LOL - Laughing out loud)

3) Onomatopoeia (B - to be, U - you, C - to see, R - are)

4) Using numbers with a similar sound (GR8 - Great, 2 - to / too, L8R - later, SOM1 - someone, 2day - today, 4ever - forever)

5) Vowel exclusion (WKND - weekend, PLS / PLZ - please, THKS - thanks)

The most common informal abbreviations in online chats are:

KIT - Keep in touch

GJ - Good job

CYE - Check your e-mail

b2w - Back To Work

ROFL - Rolling on the floor laughing.

XO - Hugs and kisses / love

SUP - What's up?

JK - Just kidding

Examples of common abbreviations that can be used both in chats and in business correspondence:

AKA - also known as
w / o - without
w / - with
X-mas - Christmas
TGIF - Thanks God It's Friday

According to the Global Language Monitoring, which tracks the spread of English words across the globe, O.K is the most popular abbreviation now.

Abbreviations are also widespread in the field of computer games and e-sports. How skillfully a person speaks the game language, understands game abbreviations depends on how experienced gamers will perceive him. Thanks to the knowledge of the terms, even a beginner will be able to make new friends and quickly get used to any game. These acronyms are created either by game developers, or more often by the members of gaming communities themselves.

The requirements for abbreviations in games are the same as in online chats: the ability to transmit the maximum amount of information using a minimum of characters, since players do not have enough time for full correspondence during the game. The language of gamers has already turned from a fashionable trend into a new style of communication on forums, blogs and online chats.

The lexicon of gamers is characterized by a large proportion of neologisms and abbreviations, which are based on borrowings from the English language. The most common ways to form new words are abbreviations, truncations. The most common game abbreviations are:

GGWP - good game, well players - usually written after the match as a thank you or to surrender;

PP - pause, please - usually written by the player who pauses the game;

RDY? - Ready? - with the help of this phrase the player asks the opponent whether he is ready to continue before unpausing the game;

GLHF - good luck, have fun - most often this abbreviation is written at the beginning of a new game. All players exchange this phrase;

AFK - away from keyboard – the abbreviation is used when the writer has left the computer;

NS - nice shot – the abbreviation is mainly used in shooters to praise a well-aimed or valuable shot.

These words quickly scatter across the forums, move from game to game and eventually become common expressions due to their brevity and expressiveness. The language of gamers at the moment is an integral part of youth slang and is gradually becoming understandable even to people who are not gamers.

Certain social factors contribute to the development of abbreviations as a way of word formation. Firstly, this is the principle of saving time. Secondly, the novelty of the way of describing what is designated. Third, the appearance of abbreviations testifies to a new, creative perception of the world, which is reflected in the transformation of the language. Thanks to the use of abbreviations, the correspondence is more dynamic. Abbreviations may be misunderstood, but over time abbreviations penetrate everyday speech, which characterizes the language as a mobile and changeable system. However, all abbreviations are used only in writing. They perform the main task of correspondence - to convey maximum information and meaning using a small number of symbols and a minimum investment of time.

References:

1. Арутюнова Н.Д. Дискурс [Текст] // Лингвистический энциклопедический словарь. М., 1990. С.136.

2. Горошко Е.И. Интернет-жанр и функционирование языка в Интернете: попытка рефлексии [Текст] / Е.И. Горошко // Жанры речи. - Саратов: Издательский центр «Наука», 2009. - Выпуск 6 «Жанр и язык». - С.11-127.

3. Иванов Л. Ю. Язык Интернета: заметки лингвиста [Электронный ресурс] / Л. Ю. Иванов // Словарь и культура устной речи. - М.: Азбуковник, 2000. - С. 131-147. URL: www.ivanoff.ru/rus/ozhweb.htm. Дата обращения: 8.10.2020 г.

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NEOLOGISMS IN THE RUSSIAN LANGUAGE

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Abstract: This paper deals with neologisms which come into the Russian language from the English language.

Keywords: neologism, borrowing, translation.

The mutual influence of languages which are in close contact have been widely analyzed and described in the literature. Such scientists as Aristova V.M., Krysin L.P. and others have investigated this language area. There are those who support the process of borrowing of new words because these words enrich the target language, and there are scientists who pursue for purification of the Russian language. The aim of this paper is to analyze how these words are formed and where they are used.

The neologism is a word or a word collocation used to describe new ideas and concepts. These words appear in the languages due to technological progress and interpenetration of new ideas and concepts. In this paper we look at some of them in order to analyze them. Neologisms can be divided into four groups: for denoting realia and notions which did not exist in the language in the life, for denoting phenomena that existed in the life but did not come into use, for denoting some future developments and for describing notions that are represented by words already existing in the language [1].

We can also group the new words according to the spheres of life they are used in (their functions). The largest group of neologisms is represented by new words that appeared in the language due to invention of new technologies. The words in this group are website, smartwatch, etc. The second largest group consists of words related to political sphere such as a speaker “спикер”, inauguration “инагурация”, etc. In the next group we can see the names of everyday objects such as toaster “тостер”, smartphone “смартфон”, smartwatch “умные часы”, reader “ридер”, credit card “кредитная карта, кредитка”, etc. A lot of new words come from the world of sport and show business.

The neologisms have different structure. They can consist of one word, e.g. reader “ридер, считывающее устройство”, or more than one word, e.g. website. The technological sphere produces a lot of abbreviations such as IoT, HTTP, etc.

Some neologisms are used only in scientific style, e.g. neural network “нейронная сеть”, others come into everyday language (colloquial style), e.g. tag “тэг, метка, ключевое слово”.

These neologisms can be translated by different methods such as loan translation, e.g. Big Data as “Большие данные”; by transliteration or transcription, e.g. site “сайт”; they can be left as they are used in the source language (foreign insertions), e.g. IoT; the combination of methods can be used such as loan translation and transliteration in Internet of things “ Интернет вещей”.

Conclusion

We have analyzed different groups of neologisms, considered their structure, functions and stylistic features. It can be concluded that language development is a constant process and it is affected by the changes in the society. Political, social and technological changes bring new ideas and notions in the language corpus, technology being main source.

References:

1.Maksimov, V.I. Tipy Neologizmov v Sovremennom Russkom Yazyke, 26.11.2012, http://gramota.ru/biblio/magazines/ryzr/rzr2001-03/28_198.

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TRANSLATION OF SOME BASIC TERMS OF THE INTERNET OF THINGS

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Abstract: This paper raises the problem of translating terms that came due to the development of information technologies.

Keywords: software-defined network, ultra-wide band, IoT, smart-meter, wireless sensor network

Novelty and relevance

The concept of the Internet of things appeared not so long ago, but has already spread everywhere. The number of publications on this topic is growing rapidly. New technologies bring new terms that are to be translated correctly, which is not so easy due to the complexity and novelty of developments.

Internet of Things (IoT)

In the Russian literature translation of the term IoT is done in different ways. It is often translated as “Интернет вещей” or it is left as it is (IoT). The term should have only one meaning in one field of science. If it is translated in different ways, it causes difficulties of understanding of the notion. In this case descriptive translation works best, but it makes a text longer and more difficult for translation. We should also note that foreign language insertions are the best method for rendering abbreviations, because they are short and they can be used along with translator’s notes. We would try to consider various terms and the ways of their translation in this paper.

The Internet of things (IoT) describes the network of physical objects – “things” – that are embedded with sensors, software, and other technologies to connecting and exchanging data with other devices and systems over the Internet. The Internet of things refers to home appliances and devices which allow us to access networks and exchange incoming data. Some firms outsource most of their work, which is also an Internet of things system. And all spheres of human life from banking to manufacturing are trying to implement IoT elements.

Analysis of the basic terms

In this paper, we will only analyze some terms that have certain problems with translation into Russian, among them:

- ultra-wide band (UWB)
- software-defined network (SDN)
- smart meter
- low-power wireless sensor network

There are a lot of such terms because the Internet of Things includes elements of other information technologies from network to microprocessor. That is why there are such problems with the untranslatability of terms because new technologies in Russia were introduced much faster than they are translated. However, people who are not familiar with new developments face the problem of understanding how they work, and this requires defining these terms more clearly.

ULTRA-WIDE BAND (UWB)

Ultra-wideband (also known as UWB, ultra-wideband, ultra-wideband, and ultra band, and we can translate it as “сверширокополосная связь”) is a radio technology that can use a very low energy level for short-range, high-bandwidth communications over a large portion of the radio spectrum. A "spark gap" transmitter that emits a very weak, very wide (in frequency) pulse of RF energy. This signal is used mostly for localizing signals. Wide signal bandwidths are good for measuring distance. We need this term to explain the technology of finding the location of an object. The term UWB is also actively used in robotics related to the Internet of things science.

Articles are actively published on the topic of UWB that shows the relevance of this term. This means that it is really necessary for understanding many Internet of things technologies.

SOFTWARE-DEFINED NETWORK (SDN)

The most important component of the Internet of things is the network, but there can be a problem of system security. Because of this, a new technology was developed, that is a software-defined network (SDN). It can be translated into Russian as "программно-определяемая сеть". Software-defined networking (SDN) technology is an approach to network management that enables dynamic, programmatically efficient network configuration to improve network performance and monitoring, making it more like cloud computing than traditional network management. Software-defined network is an approach to networking that decouples control of information flow from the hardware and gives it to a software controller. This term relates to the important issue of the protection systems and a lot of research today is conducted on this important technology. This means that we need to know it in order to understand publications that affect the protection of the Internet of things. This allows for fewer data to travel wirelessly, making it a potential strategy for IoT networks.

SMART METERS

The smart city is a promising Internet of things technology. An important concept is the automatization of urban services, such as utilities. This requires a new version of meters that can read accurate data, which minimizes the cost of electricity, water, etc. These new meters were called "smart meters" (in Russian "умные счётчики"). A smart meter is an electronic device that records information such as consumption of electric energy, voltage levels, current, and power factor. Smart meters communicate the information to the consumer for greater clarity of consumption behavior, and electricity suppliers for system monitoring and customer billing. A smart meter is an important component of the Internet of things because it is closely related to energy, ecology, and economics. The term can be found in many foreign studies on smart cities, factories, etc. Smart meters gather and transmit IoT device information to the central network.

LOW-POWER WIRELESS SENSOR NETWORK

With the development of microelectronics, we have more and more opportunities to monitor the state of any environment, whether it is our home, park, or the human body. Hence, there is a need for a wireless sensor network that can transmit important data to us without spending a lot of energy. Wireless sensor network (WSN, "беспроводная сенсорная сеть") refers to a group of spatially dispersed and dedicated sensors for monitoring and recording the physical conditions of the environment and organizing the collected data at a central location. A low-power wireless sensor network is used everywhere in manufacturing, smart homes, and medicine. This technology is one of the key ones in the Internet of things, it is actively being developed and there is a lot of research done on this topic. LPWSN is a group of spatially distributed, independent devices that collect data by measuring physical or environmental conditions with minimal power consumption. Minimizing power consumption is a key to achieving a longer lifetime for devices on wireless sensor networks.

Conclusion

New technologies are being developed at a rapid pace, and new terms are also being developed. In this regard, there is the problem of reading and understanding advanced scientific publications. These terms are incomprehensible to general public, but they are at the heart of new technologies. We have analyzed some of these terms and we can say that loan translation is used most often, but abbreviations of these terms are in English.

References:

1.Ahmed Alaa, et al., Performance Evaluation of Open Source IoT Platforms // Conference Paper, December 2018.

2. Benakop, P.G., Review on Low Power Wireless Sensor Networks for Various Innovative Applications, January 2018.

3. Kiranmai Marepalli, Role of Smart Metering System in Smart Grid, Journal of Emerging Technologies in Web Intelligence, May 2020.

4. Itrit Waqas, Waqas Mahmood, A Research Survey on Software Defined Networking (SDN) // Conference Paper, July 2019.

5. Pratima Thorat et al., Design of Microstrip UWB Antenna for Wireless Application, vol. 9, Issue 07, July 2020.

6. https://en.wikipedia.org/

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DIFFICULTIES IN THE TRANSLATION OF PHRASEOLOGICAL UNITS IN THE FIELD OF PROGRAMMING

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The proposed research is devoted to the study of difficulties in the translation of phraseological units in the field of programming.

The field of programming is one of the fastest fields in terms of development. Nowadays there is an enormous amount of literature about programming that contains phraseological units and therefore difficulties in the translation appear. Their appearance is associated with three processes: 1) Common words getting new meanings from programmers (bug – insect > error in the program, window > space on the display); 2) Reformation of well-known words and computer terms into computer jargon (processor > stone, computer > confuser); 3) Creation of new words by programmers (gronked – something that is not working, bogon – fictional unit of measurement of inoperability).

I have tested 10 translation services to find out whether they are translating correctly. I have used 2 different phraseological units (He hunted the bug in the program > He fixed an error in a program, He got a core dump > He printed or copied to a more permanent medium the contents of random access memory at one moment in time). Results are presented below

Translation service	Output	Result
Google Translator	1.Охотился на баг в программе 2. Получил дамп ядра	Translation is partially correct
Yandex Translator	1. Он искал ошибку в программе 2. Он получил дамп памяти	Translation is partially correct
PROMT.One	1. Он охотился на жучка в программе 2. Он получил свалку ядра	Translation is incorrect
DeepL	1. Он охотился на жучка в программе 2. Он получил свалку ядра	Translation is incorrect
Reverso	1. Он охотился на жуков в программе 2. Он получил большую дыру	Translation is incorrect

WorldLingo	1. Он охотился на жучок в программе 2. Он получил свалка ядра	Translation is incorrect
WebTran	1. Выловил баг в программе 2. Получил дамп ядра	Translation is correct
Tetran	1.Он охотился на ошибку в программе 2. Он получил ядро свалки	Translation is incorrect
Native English	1.Он охотился на ошибку в программе 2. Он получил ядро свалки	Translation is incorrect
Babylon	1.Он охотился на ошибку в программе 2. Он получил ядро свалки	Translation is incorrect

In conclusion, most of translations were inaccurate or partially accurate. To improve quality of the translations and solve presented problems programmers need to expand the database and do analysis on the level of the text.

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THE DEVELOPMENT OF TRANSLATION TOOLS FOR TECHNICAL LITERATURE IN THE FIELD OF ELECTRONICS AND ELECTRIC POWER ENGINEERING

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The main goal of the work is to design the concepts for solving difficulties in translation of technical literature in the field of electronics and electric power engineering. Problem-solving process will be based on the use of corpora and machine learning technology as the most efficient tool in online translation tools design. Linguistic corpora are tools that give information about the frequency of the word usage in different text sections and words mostly relating to terms. Machine learning is an application of artificial intelligence that provides systems the ability to automatically learn and improve from experience without being explicitly programmed.

Translation of scientific and technical texts is a challenging task for people without a special degree in translation. Technical translation requires a translator to have knowledge about the topic of translation and orientation in terms. Firstly, many terms have different meanings in various areas of scientific and technical knowledge. Secondly, scientific and technical texts have special features that should be taken into account. Such texts refer to the formal type of language which combines both written (mainly) and spoken language. The basis 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 text formation include the syntactic completeness of a

statement, the presence of analytical constructions, the frequent use of clichéd structures, etc. Moreover technical texts are overloaded with special terms, their frequency is extremely high. Terminology in the field of electronics and electric power engineering mainly consists of words based on the mechanism of metaphorization. This aspect complicates the translation process.

Basing on practical experience the process of technical translation may be divided into the automatic and manual parts. The automated translation process has become possible thanks to the development of technologies such as machine learning and working with big data. There are various special programs and online translation tools that apply machine tools for translation. Nevertheless, the attempts to use such apps for purposes of technical translation are not very successful. Users are likely to face inadequate translation. In an attempt to improve the received translation, they will resort to the manual step.

The process of manual translation of scientific and technical texts requires the usage of monolingual and bilingual dictionaries, special directories and catalogues. This step usually includes working with special explanatory and translation dictionaries.

In order to simplify the process of technical translation we suggest using corpora as the material for machine learning. Supervised Machine Learning algorithms can apply what has been learned in the past to new data using labeled examples to predict future events. Starting from the analysis of a known training dataset, the learning algorithm produces an inferred function to make predictions about the output values.

There are two main types of corpora: a single language or monolingual corpus (the most frequent type of corpus) and 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. With the benefit of monolingual corpora we can estimate and predict new trends in the use of special vocabulary. That factor makes corpora the most flexible and suitable tool for application in machine learning.

Terms in the fields of electronics and electric power engineering are usually formed on the basis of metaphorization mechanism. It means that these words have primary and special meaning. Modern terms used to have certain meanings, 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 and especially electric power engineering.

The problem with using conventional translation tools for technical texts is that these tools are intended for translating other text styles and, as a rule, do not provide adequate translation when dealing with technical texts and scientific literature. Such tools are usually not able to translate terms correctly, they, as a rule, give preference to the primary meaning of the word, rather than the secondary meaning, which results in translation mistakes. Moreover translator systems cannot provide the correct translation of clichéd phrases. The use of the texts underlying the linguistic corpora and the data obtained from the analysis carried out with the help of these corpora could allow translators to adapt their usual systems for the translation of technical literature.

The table below shows typical terms in the field of electronics and electric power engineering that are based on the mechanism of metaphorisation. Such terms usually baffle translation tools.

Word	Primary meaning	Secondary (special) meaning
armature	a frame that is covered to make a figure	That part of an electrical machine that converts electrical energy to mechanical energy
growler	someone who makes a growling sound	A test instrument that is used to diagnose some faults with AC motors.

That mechanism of term formation makes the process of finding a correct meaning much more difficult for translation tools, because all the terms have a set of various meanings. According to machine learning such tools would rather give you the translation of the primary meaning of a word.

Corpora may also estimate the frequency of occurrence in various text types. The table below shows the usage ratio of the word “growler” in different parts of the language.

Language types	Spoken	Fiction	Magazine	Newspaper	Academic
Frequency of the word “growler” per million	0.3	0.06	0.14	0.1	0.2

From the table above, we can see that this term like many other terms is usually used in primary meaning rather than in special one.

In order to solve this problem we could set priority to translation of the secondary meaning of a word. Using the priority tool, we can solve the problem of correct translation of terms. The problem of translating clichéd phrases can also be solved with the help of corpora. By their means, it is possible to track the most frequent phrases used in technical texts. With the help of correct translation examples, we can ensure the translation adequacy of clichéd phrases.

Simplification of the process of technical translation may be realised by means of two tools: linguistic corpora and machine learning. The specified methods for solving key problems of technical translation may change the process of translation. Applying to the corpora in machine learning could help translation tools cope with features of technical literature.

References:

1. Aliturlieva, J. T. Features of technical translation / Zh. T. Aliturlieva. - Access mode: // Young scientist. - 2018. - No. 11 (197). - p. 271-274.

2. What is machine learning [Electronic resource]. Access mode: https://medium.com/@yannmjl/what-is-machine-learning-in-simple-english-b0aaa251cb60#dcc1(date of the application: 12.10.2020).

3. Oxfords living Dictionaries [Electronic resource]. Access mode: https://en.oxforddictionaries.com/ (date of the application: 12.10.2020).

4. British National Corpus [Electronic resource]. Access mode: https://corpus.byu.edu/bnc/ (date of the application: 12.10.2020).

5. Wikipedia [Electronic resource]. Access mode: https://en.wikipedia.org/wiki/Text_corpus (date of the application: 12.10.2020).

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COMPARATIVE ANALYSIS OF PHRASEOLOGICAL UNITS WITH COMPONENT ‘SKIN’

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Abstract: This paper is devoted to phraseological units with a ‘skin’ component and the methods of their translation from Russian into English.

Keywords: phraseological units, an idiom, translation.

The modern world makes it possible to communicate across borders. This intercultural communication brings a lot of new meanings into the language. The aim of this paper is to study phraseological units with component ‘skin’ and analyze the strategies used to translate them.

A phraseological unit or an idiom is a fixed expression whose meaning cannot be deduced from its components. The idioms may sometimes retain the image (the inner sense) in some of its components.

These idioms can be translated from English into Russian as: an idiom of similar meaning and structure, an idiom of different structure and of similar meaning, literal translation, and paraphrase.

That group of phraseological units with a component ‘skin’ includes 19 units [1]. They can be divided into the following categories according to their structure:

- a verb + a noun: to be in somebody’s skin “в чьей-либо шкуре”, to change one’s skin “измениться до неузнаваемости”, to get off with a whole skin “выйти сухим из воды”, to get under somebody’s skin “действовать кому-либо на нервы”, to have a thick skin “быть нечувствительным к критике (быть толстокожим)”, to have a thin skin “быть чувствительным к критике”, to jump out of one’s skin “быть вне себя; подскочить (от испуга)”, ready to leap out of one’s skin “вне себя от радости”, to save one’s skin (bacon) “спасти свою шкуру, уйти целым и невредимым”, to smack calf’s skin “целовать библию при принесении присяги в суде”;
- preposition + noun: to the skin “насквозь, до нитки”;
- adjective + preposition + noun: wet to the skin “промокший до нитки”, stripped to the skin “раздетый донага, обобранный”,
- preposition (conjunction) + noun + preposition + noun: by the skin of one’s teeth in (with) a whole skin “едва-едва, чудом”; as the skin between one’s brows “чрезвычайно, исключительно”;
- verb + noun + preposition + noun: skin a flea for its hide “ жадничать”;
- noun + noun: skin and bone “кожа да кости”.

Conclusion

The ‘verb + noun’ group includes 10 phraseological units. In Russian some of the idioms in this group retain the underlying image and an identical structure (to be in somebody’s skin). Some of the idioms seem transparent as the literal meanings of its components are quite clear such as ‘to save one’s skin’.

The adverbial idioms have most idiomatic meanings such as in ‘by the skin of one’s teeth in (with) a whole skin’, ‘as the skin between one’s brows’.

References:

1. Anglo-russkii razeologicheskii slovar, Kunin A.V., 1984.

УДК 81

THE FEATURES OF TECHNICAL LITERATURE TRANSLATION

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Due to the growth of integration and communication between different countries, as well as the increasing of technical and scientific information, the importance of correct translation is significantly important. Taking into account this factor, which has a huge impact on all areas of activity we are in need of competent translators of scientific and technical texts, who can transfer the material sense to meaning, remaining its relevance.

Requirements for translation of technical literature: the explanation must be logical and clear; the content must fully correspond to the original, without adding new information or excluding. In

order to achieve a successful translation it is important to know the features of grammar, phonetics and vocabulary; the ability to apply techniques such as tracing, permutation and replacement - everything related to linguistics. To construct clear and concise sentences, it is necessary to have a sufficient amount of information [1].

In contrast to fiction, technical texts are distinguished by their concreteness, clarity and small volume of the necessary information. Ambiguous sentences and statements in a technical text are not allowed. The translator has no opportunity and need to devote time to the beauty of speech and ornate phrases.

Technical texts are distinguished by an abundance of terms, which implies the requirement knowledge of translation and the ability to apply them in the right place, based on the content and context. If you have any doubts about the correctness of the translation, you should contact a specialist in this field.

Three features should be distinguished in the interpretation of scientific and technical texts: lexical, grammatical and stylistic.

The difficulty is in the large number of terms. This is a lexical feature. But there are also such points as:

1. The interpretation of words and phrases should have only one meaning.

2. If articles in a foreign language can be written in the first person, the translation into Russian must be carried out, excluding "I" and replacing it with "we" or changing to a passive construction.

3. Science consists of facts, the translator has no right to enter his own thoughts.

4. Identity to the source..

The grammatical features include:

1. Preference to present tense verbs. Research has shown that 70% of verbs are present tense verbs.

2. Using the passive voice.

3. Using of introductory words.

Stylistic features:

1. Foreign scientists can use artistic expression, phraseological units, Russian scientists are not allowed to use them.

2. There are references in foreign technical texts. The translator should replace them with neutral sentences [2].

To perform a correct translation, a translator must be proficient in two languages and understand the subject of the text. He must understand the features and rules.

The main requirement is also the adequacy. The translation must be logical and clear.

Translation of technical texts is a demanding job that requires a lot of care and hard work.

References:

1. Ordyan L.A. Typical problems and features of the translation of a scientific text / L.A. Ordyan. - Text: direct // Young scientist. - 2018. - №48 (234)

2. Alekseeva, L.M. Specificity of scientific translation: a textbook for a special course / I. S. Alekseeva. - Perm: 2002.

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SLANG AND ONLINE TRANSLATORS

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Slang is "an integral part of any developed language that arises as an inevitable consequence of the national language codification. Slang ... as the most dynamic part of the lexical and semantic system of the language is updated quickly, so it represents the basic concepts in a concentrated form, a kind of linguistic polygon on which many new elements of the language are tested and then partially assimilated by the standard, literary language " [Voloshin 2000: 10].

The problem of translating slang has always been relevant. Colloquial speech is constantly changing, and this creates even more difficulties in translation, not to mention the use of new loose words. As a rule, slang speakers are young people from 12 to 30 years old. Slang is a constant word creation that can be understood by a certain group of people, the translator often has difficulties to hear these new words.

In order to achieve absolute mutual understanding between the interlocutors the accurate translation of youth slang in foreign language is relevant. The object of this work is the process of translating slang words and expressions from English to Russian.

There are two ways to translate the text:

1. literal translation (direct);
2. indirect translation (indirect).

The first method is not adequate, because when translating each word, the identity of the language is lost, the usual norms of the translation language are violated, and the meaning is incorrect. If a literal translation is not possible, the translator should use the indirect method of translation.

Here are some examples of translation English slang into Russian language and Russian slang into English:

English slang	**Translation into Russian**	**The meaning**
Dig	Копать	Ловить кайф, тащиться
Props	Реквизит	«Респект». Выражение уважения, признания

Slang in Russian	**English translation**	**The value of slang**
Чилить	Chill out	Расслабляться, тусоваться
Втащить	-	Ударить

We see that the translator didn’t manage to cope with the task. For high-quality translation, it is very important. Almost all words of the source text can be easily found in the dictionary. Since

slang is a very flexible and unstable structure, the online translator is not able to reveal its meaning accurately.

Not all online translators are able to reveal the exact meaning of slang. In order to improve the quality of translation, programmers should increase the database of words used by young people, and also keep in mind the context.

Despite the obvious mistakes made by online translators, they are here to stay and are going to be used. Their undeniable advantage is availability and speed. It is important to remember that electronic translators are designed to help.

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A FEW WORDS ABOUT THE EFFECTIVENESS OF ONLINE TRANSLATORS

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In modern world people need to translate certain information from one language to another. It is impossible without language skills. Appropriate translation involves the usage of the online translators, but the quality of translation leaves much to be desired. The understanding of the information depends on the quality of translation.

The purpose of this work is to evaluate the effectiveness of several popular online translators.

Google translator, Yandex translator, Deepl and m-translate.com.ua have been chosen as options. All translators have translated the same part of the literary text taken from the L. N. Tolstoy’s epic novel “War and peace” and a piece of technical writing from the handbook “Metal science and heat treatment of steel” edited by M. L. Bernstein and A. G. Rachsdadt. A reverse translation of the resulting text has been performed in each case. The results of the translations are presented below:

Table 1.

Original	Google translator	Яндекс translator	Deepl	m-translate.com.ua	Translation
from Russian into English:					
Гостиная Анны Павловны начала понемногу наполняться. Приехала высшая знать Петербурга, люди самые разнородные по возрастам и характерам, но	Anna Pavlovna's living room began to fill up little by little. The highest nobility of Petersburg arrived, people of the most diverse age and character, but the same in the society in which they all	Anna Pavlovna's drawing-room began to fill up a little. The highest nobility of St. Petersburg arrived, people of the most diverse ages and characters, but the same society in	Anna Pavlovna's living room started to fill up a bit. Came the highest know of St. Petersburg, people are very diverse in age and character, but the same in society, in	Anna Pavlovna's living room began to fill up little by little. The highest nobility of St. Petersburg arrived, people of the most heterogeneous age and character, but the same in the society in	Anna Pavlovna's drawing room was gradually filling. The highest Petersburg society was assembled there: people differing widely in age and character but alike in the social

одинаковые по обществу, в каком все жили; приехала дочь князя Василия, красавица Элен, заехавшая за отцом, чтобы с ним вместе ехать на праздник посланника. Она была в шифре и бальном платье.	lived; the daughter of Prince Vasily arrived, the beautiful Helen, who had stopped by for her father to go with him to the messenger's holiday. She was wearing a cipher and a ball gown.	which they all lived; Prince Vasily's daughter, the beautiful Helen, came to pick up her father to go with him to the messenger's feast. She was wearing a cipher and a ball gown.	which all lived, came the daughter of Prince Vasily, the beautiful Helen, who came to pick up her father to go with him to the feast of the messenger. She was wearing a code and a ball gown.	which they all lived; the daughter of Prince Vasily arrived, the beautiful Helen, who had stopped by for her father to go with him to the messenger's holiday. She was wearing a cipher and a ball gown.	circle to which they belonged. Prince Vasili's daughter, the beautiful Helene, came to take her father to the ambassador's entertainment; she wore a ball dress and her badge as maid of honor.
From English into Russian					
	Гостиная Анны Павловны стала мало-помалу заполняться. Приехала высшая знать Петербурга, люди самого разного возраста и характера, но одинаковы в обществе, в котором все они жили; прибыла дочь князя Василия, красавица Елена, заехавшая за отцом, чтобы поехать с ним на праздник посланника. На ней был шифр и бальное	Гостиная Анны Павловны стала понемногу наполняться. Приехало высшее петербургское дворянство, люди самых разных возрастов и характеров, но того же общества, в котором все они жили; дочь князя Василия, Прекрасная Елена, приехала за отцом, чтобы ехать с ним на пир к гонцу. На ней был шифр и бальное	Гостиная Анны Павловны начала немного заполняться. Получив высшее представление о Петербурге, люди очень разнообразны по возрасту и характеру, но то же самое в обществе, в котором все жили, пришла дочь князя Василия, прекрасная Елена, которая приехала забрать отца, чтобы поехать с ним на пир	Гостиная Анны Павловны стала мало-помалу заполняться. Приехала высшая знать Петербурга, люди самого разного возраста и характера, но одинаковы в обществе, в котором все они жили; приехала дочь князя Василия, красавица Елена, заехавшая за отцом, чтобы поехать с ним на праздник посланника. На ней был шифр и бальное	Гостиная Анны Павловны начала понемногу наполняться. Приехала высшая знать Петербурга, люди самые разнородные по возрастам и характерам, но одинаковые по обществу, в каком все жили; приехала дочь князя Василия, красавица Элен, заехавшая за отцом, чтобы с ним вместе ехать на праздник посланника. Она была в

	платье.	платье.	гонца. На ней был кодекс и бальное платье.	платье.	шифре и бальном платье.
From Russian into English					
Элементы машин и конструкций, изготовленные из металлов, их сплавов и других материалов, под действием приложенных к ним внешних усилий претерпевают деформацию. Деформацией называется процесс изменения взаимного расположения каких-либо точек твёрдого тела в результате механического воздействия.	Elements of machines and structures made of metals, their alloys and other materials undergo deformation under the action of external forces applied to them. Deformation is the process of changing the relative position of any points of a solid as a result of mechanical action.	Elements of machines and structures made of metals, their alloys and other materials undergo deformation under the action of external forces applied to them. Deformation is the process of changing the relative position of any points of a solid body as a result of mechanical action.	Elements of machines and structures made of metals, their alloys and other materials undergo deformation under the influence of external forces. Deformation is the process of changing the mutual position of any points of a solid body as a result of mechanical action.	Elements of machines and structures made of metals, their alloys and other materials undergo deformation under the action of external forces applied to them. Deformation is the process of changing the relative position of any points of a solid as a result of mechanical action.	
From English into Russian					
	Элементы машин и конструкций из металлов, их сплавов и других материалов деформируются под действием	Элементы машин и сооружений из металлов, их сплавов и других материалов подвергаются деформации	Элементы машин и конструкций из металлов, их сплавов и других материалов подвергаются деформации	Элементы машин и конструкций из металлов, их сплавов и других материалов деформируются под действием	Элементы машин и конструкций, изготовленные из металлов, их сплавов и других материалов, под

	приложенных к ним внешних сил. Деформация - это процесс изменения взаимного расположения любых точек твердого тела в результате механическог о воздействия.	под действием приложенны х к ним внешних сил. Деформация- это процесс изменения взаимного положения любых точек твердого тела в результате механическо го воздействия.	под действием внешних сил. Деформация - это процесс изменения взаимного положения любых точек твердого тела в результате механическо го воздействия.	приложенных к ним внешних сил. Деформация - это процесс изменения взаимного положения любых точек твердого тела в результате механическог о воздействия.	действием приложенны х к ним внешних усилий претерпеваю т деформацию. Деформацие й называется процесс изменения взаимного расположени я каких-либо точек твёрдого тела в результате механическо го воздействия.

Analyzing the data obtained it is clear that all translators changed the meaning of the literary text. Different translators translated the same word differently. The technical text was translated without mistakes and the meaning was preserved.

To sum up, nowadays the online translators are not thought to be used for literary texts in order not to lose the original meaning. In case of technical texts one can use any online translator he likes, the meaning is unlikely to be lost.

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COMPETITION OF LANGUAGES IN THE FIELD OF TRANSLATION

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Researchers use English both to solve complex problems within the same laboratory, and to exchange experience between colleagues located in different parts of the world; the most respected publications are published, again, in English.

But why English? Most scientists believe that English seems to them much more concise than other languages. On average, an article in English is 1.5 times less than in another language.

Of course, it is more effective to have one language! If everyone uses the same language, there is less friction when translating. From this point of view, modern science is advancing at such a staggering pace precisely because we have focused on "science" and not on such superficial things as language. Also, for many concepts, there are simply no equivalents in other languages. Surveys were conducted among scientists and the majority of respondents reported that the monopoly of the English language does not frighten or confuse them. Since the introduction of new terms that are

used in the field, and the attempt to convey their meaning in the native language of the scientist often leads to difficulties or creates the need for transliteration of the finished term. And this term becomes even less clear with this transfer from language to language, because it loses its connection to other words of the language.

It all started back in the 17th century when Newton's optics came out in English. By the end of the 18th century, papers in the basic Sciences were increasingly appearing in English.

After the First World War between the Central powers, the use of German became a crime. By 1923, half of the States restricted the use of German in public places and in the education of children.

Since World War II, history has become increasingly demographic and geopolitical. In contrast to the relatively multilingual approach of the vast British Empire in the 19th century, scholars from the developing American Empire of the 20th did not have to assimilate knowledge in foreign languages. The willingness of Europeans, Latin Americans, and others to join this new monolingual regime also played a role.

References:

[1] https://www.bibliofond.ru/view.aspx?id=885798#text

[2] http://www.sib-science.info/ru/ras/angliiskij-yazyk-v-nauke-29052017

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ANGLICISMS IN THE RUSSIAN MILITARY VOCABULARY IN THE XVI-XVIII CENTURIES

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The article is devoted to the consideration of English military terms in the Russian language in the period from the XVI-XVIII centuries. The authors of the study examine the main stages of the penetration of Anglicisms into Russian speech of this period and give some examples.

The significant penetration of foreign words into the Russian language in the ancient period is associated with the era of Christianization. Borrowings from the Greek language entered the Russian lexical system mainly as words and terms of the Christian religion, morality, philosophy. As for the borrowings from Western European languages, they were insignificant. Until the half of the XVI century Russian military vocabulary was largely free of foreign language influences. The situation changed radically in the second half of the XVI century. In the XVI -VVII centuries the Moscow state is expanding economic and cultural ties with foreign states. The exchange of the material achievements and spiritual culture is taking place more widely and freely; elements of Western culture and technological advances penetrate into Muscovite Russia. Together with them, the words denoting them are often borrowed. This process is natural and takes place in all periods of language development. Among Western European languages, French and German are the most popular. English is accessible only to certain groups of people (some politicians, rich people, etc.).

Speaking about foreign language borrowings, it is necessary to distinguish two categories of words: a) words that name objects and phenomena alien to Russian life, characterizing the life of other peoples; b) words that name objects and phenomena borrowed by the Russian people, included in their everyday life. While the first ones are used only when narrating about the life of other peoples, when describing contacts with them, the words of the second group are used alongside with the native Russian words when describing Russian reality [4].

In modern linguistics, there are three main periods of borrowing Anglicisms, namely: the pre-Petrine era. The era of the reign of Ivan the Terrible, which is characterized by only a small number

of foreign language inclusions into Russian speech, mainly associated with diplomacy. Peter's era, associated with the Navy, and, therefore, has a number of borrowings related to maritime affairs. And finally, the end of the XVIII - the beginning of the XIX centuries as a period of intensification of Anglo-Russian relations [5]. The set expression "translated literature of the" Peter's era ", which stuck to the XVIII century, for example, is found in many sources, since Tsar Peter I took an active part in translations. He not only monitored the works of the translators, their style and language and ordered translations from abroad, but he translated himself. 1724 was marked by the decree of Peter I as the year of educating translators.

Russia's access to the Baltic Sea leads to active relations between England and Russia. The English fleet at that time is very powerful, therefore the most numerous are the groups of Anglicisms, socially conditioned by the need for the internal development of maritime transport and defense capabilities, as well as diplomacy.

In the field of shipbuilding: барк - bark - a large seagoing cargo ship with oblique sails on the rear and straight sails on all the others [5];

бимс - beams: beam - letters. timber, crossbar - "a transverse beam on a ship, connecting the sides and serving as the basis for the deck" [5];

гиг - gig - undecked rowing six or eight oar boat with low sides [5];

шкипер - ship - captain of a commercial vessel; 2. Commander of a river vessel; 3. Person in charge of deck property on sea-going ships. [3];

пумпа - pump - pump [3];

in the field of navigation:

аврал - over all - (lit. all up!) - common, usually urgent work on the ship, in which the entire crew takes part [5];

бенч - bench - (literally, terrace, ledge) - the coastal part of the seabed in the form of a ledge created by abrasion [5];

рында - to ring the bell - (lit. to ring the bell) - ship's (ship's) bell [5];

елботь - boat - boat, boat [3].

Thus, it can be concluded that the penetration of English into Russian was not rapid. Basically, it was associated with sea, as well as military application, since the period of the XVI-XVIII centuries was marked by a large number of wars. The peak of the penetration of English borrowings is noted in the late XVIII and early XIX centuries when the communication between England and Russia becomes active at all levels of life.

References:

1. Agapova O.V. Francuzskie zaimstvovaniya kak istochnik obogashcheniya anglijskoj i russkoj voennoj leksiki// sovremennye nauchnye issledovaniya i innovacii, 2017. № 4 [URL: http://web.snauka.ru/issues/2017/04/79138] (Data obrashcheniya: 15.11.2020)

2. Musina E.V., Tubal'ceva V.A. obshchaya harakteristika razvitiya perevodcheskoj deyatel'nosti v Rossii s anglijskogo yazyka na russkij v XVIIIv. Sovremennye problemy filologii, pedagogiki i metodiki prepodavaniya yazykov: Vserossijskaya nauchno-prakticheskaya konferencii, Kazan' 29 marta 2019 g.: sbornik nauchnyh trudov. – Kazan': Izd-vo KNITU-KAI, 2019. – 126-131s.

3. Musina E.V. Anglicizmy v raznovremennyh perevodah XVIII-XIX vv. (k postanovke problemy). V sbornike: I.A. Boduen de Kurtene i mirovaya lingvistika. Trudy i materialy Mezhdunarodnoj konferencii. V 2 tomah. Pod obshchej redakciej K.R. Galiullina, E.A. Gorobec, D.A. Mart'yanova, G.A. Nikolaeva. 2017. S. 155-158.

4. Sorokoletov F.P. Istoriya voennoj leksiki v russkom yazyke (HI-HVI vv.) / Otv. red. F. P. Filin. Izd. 2-e, dop. — M.: Knizhnyj dom «LIBROKOM», 2009. — 384 s

5. Stepanov E.N. Social'no-kul'turnye faktory leksicheskih zaimstvovanij iz anglijskogo yazyka v russkij v period do XX veka / E. N. Stepanov, Lyu Czin // Mova. - 2017. - № 27. - S. 96-104.

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PRASEOLOGICAL IDIOMS ON THE TOPIC "FOOD" AND ONLINE TRANSLATORS

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Today we can find a lot of information in different languages in the Internet, But not many people can speak foreign languages well. While doing researches they have to use translators to translate scientific articles, words, phrases and texts. We see considerable improvements in online translators work, but the translation of phraseological units and idioms still leaves much to be desired, For example, the English idiom "it rains cats and dogs" was translated into Russian like 'it rains with real cats and dogs', but we know the meaning is "heavy rain'. Translators can translate idioms in completely different ways, One of the main reasons for such incorrect translations are the extralinguistic factors. It aroused our interest, so we decided to examine that question. It is important nowadays, because the quality of online translators should be improved at all levels of the language, from the words to super-complex text formations.

The purpose of our work is to analyze translations of 5 phraseological units on the topic "Food" (big cheese; to bring home the bacon; to be as cool as cucumber, to be of beans; to buy a lemon). made by 3 online-translators (Google translator; translateyandex.ru; Reverso), the object of this research is the phraseological units of two languages with different structures. The subject of the research is online translators and the quality of their translation.

According to many students the most popular translator is Google translate, However, despite its popularity, it was able to translate correctly only one idiom, as well as the Reverso translator, and both translators were able to translate only "big cheese": Other translators failed, they couldn't translate the phrases correctly. Translators lack even the basic idioms in their database.

The reasons for such mistakes can also lay in the ambiguity of foreign words or the cultural characteristics of the language.

Correctness. literacy and authenticity can only be correct if the translation is performed by a specialist who masters the language,

We can conclude that to improve the work of online translators we need to find out the meaning of the idiom. It’s important to expand the database of the online translators, which in its turn needs time and effort of programmers.

СЕКЦИЯ 4

ПРОБЛЕМЫ ПЕРЕВОДА СПЕЦИАЛЬНОЙ НАУЧНОЙ ЛИТЕРАТУРЫ

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УДК 811

DISTINCTIVE FEATURES OF AVIATION ENGLISH AND AVIATION TECHNICAL ENGLISH

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English has widely spread all over the world and ingrained in minds of our society. Actually, it is impossible to imagine such a branch of human life in which there would be no English words, terms or abbreviations. This language has become especially demanded in the technical field, and primarily in aviation. In this paper, we will consider the ‘aviation’ and ‘aviation technical’ variations of the English language and the requirements for both; also, we will try to figure out their distinctive features and define, whether all aviation specialists study the same thing and how flight safety depends on this.

The main professionals who use aviation English within their careers are pilots, air traffic controllers and engineers (from flight mechanics to maintenance technicians and repair specialist). We all know that for pilots and air traffic controllers, the "R/T phraseology" is primarily important, that is namely verbal communication. This is the main peculiarity of their work. After all, the safety of the flight depends on the word heard by the participants of the communication. One misunderstanding can lead to inevitable consequences. And all this depends only on how properly they understand each other. And that is *‘aviation English’*, which is quite different from what is called ‘*aviation technical English’*. That is why there is a special regulative standard for the assessment of the level of aviation English created by the International Civil Aviation Organization (ICAO) [1]. It includes the following aspects, which are used to assess language proficiency: pronunciation, structure, vocabulary, fluency, comprehension, interactions. This once again confirms the fact that pilots and air traffic controllers must have sufficient aviation English to carry out an adequate communication.

Safety in general includes many factors, where the mutual understanding of a pilot and an air traffic controller is only one, but still essential part. The durability of the aircraft structure, the fatigue behavior of aircraft structure elements, flight performance, etc., also play a key role in ensuring safety. But in fact, few people think about who ensures the trouble-free and accurate operation of the structure and the coherence of the work of all systems and mechanisms of an aircraft. That is exactly engineering staff who are involved in the process of service and maintenance procedure, which includes pre-flight check, flight mechanic actions during the flight, pre-flight and post-flight inspection and service. This is just a small part of the tremendous work performed by people who are obliged to follow the Technical Maintenance or Operation Manuals. As nowadays most aircraft fleets are equipped with Boeing and Airbus aircraft types, the manuals are written in English. And this is the main problem as far not all the technical engineers have a good command of English language in general and aviation technical English in particular. Federal Aviation Rules in Russia comply to a certain extent with the internationally recognized Federal Aviation Rules (FAR). The work of aircraft technicians is also regulated by this document. On the one hand it is clearly stated there that "The holder of an aircraft maintenance technician license must demonstrate the ability to read with an *acceptable level of understanding* in the language in which the operating and other documentation managing maintenance procedures is presented." [2]. But what does the term "*acceptable*" mean in this context?

The plane consists of many separate parts (airframe, power plant, landing gear, wing and tail assembly), which consist of units, mechanisms and assemblies, which each in turn consists of a number of elements. And what is most important, all these have their own names, which have their own equivalent term in English, which is not always a direct translation from Russian. One mistake, one incorrect translation of one or another unit or element specified in the manual, can lead to incorrect actions regarding the maintenance of various systems, which in turn disrupt drastically

flight safety. In the English-Russian dictionary of civil aviation, published under the editorship of V.P. Marasanov [3], there are 24,000 aviation terms. The word "valve" appears there in 59 different word combinations! And each of them refers to a certain specific element in the design of the aircraft, and if an engineer makes a mistake and, suppose, repairs, replaces, or simply cleanses another valve, this may lead to fatal consequences. Another example is the word "level" with 76 word combinations, and the word "system" with 475!

Due to the obvious importance of understanding aviation English, as well as its technical aspect, there should be special aviation language centers. Indeed, there are many educational specialized centers for the study of "spoken" aviation English, the most popular of which are: the SELCAL aviation English school, the Volga-Dnepr aviation training center, the Comp Lang aviation training center, the Aviation School of "Aeroflot", as well as the school of general and aviation English "Aloha English Room". All courses of these aviation English centers are based on the development of the necessary language skills for the pilots/air traffic controllers to pass the test to the level established by ICAO - listening comprehension, speaking, communication skills. But at the same time, no one of the centers presented provides services for the study of aviation technical English.

Thus, we can conclude that due to the absence of clear requirements for the level of proficiency in aviation technical English, the absence of special centers for its learning, the airlines themselves have to spend a lot of money on teaching a person to read the documentation properly and correctly and, accordingly, adequately do their job, as well as on involving language interpreters in the procedures of business trips for getting appropriate licenses.

So, taking into account all above mentioned, it should be said that the sphere of aircraft technical maintenance is nowadays at top-priority. And what should be obviously done is introduction of aviation technical English into the curriculum of technical universities for students of technical maintenance program. This has been successfully done in Kazan National Research Technical University where students on this program have English classes not within 2, as most of students do, but within 4 years of education. And the whole program of learning a foreign language is divided into 3 stages to perform a methodically valid system – general English on the first year of education; - general technical English on the following two years; - and aviation technical English during the final year in the University. Within the primary tasks that students fulfill on the final stage on English classes are the functional analysis of specific documentation and professional texts in order to increase the aviation vocabulary and professional awareness [4-5]. Thus, entering the technical university with a low level of language proficiency, by the end of the education, students graduate with an "acceptable" level of aviation technical English, which allows them to perform routine maintenance and after a certain period of required experience take the international EASA Exam in order to get a special License which allows to service foreign-produced aircrafts.

References:

1. Официальный портал ИКАО [Электронный ресурс] Режим доступа свободный - URL: https://www.icao.int/Pages/default.aspx/

2. Официальный сайт Федерального Агентство Воздушного Транспорта [Электронный ресурс] Режим доступа свободный - URL: https://favt.gov.ru/dokumenty-federalnye-pravila/?id=2878

3. Форум AVSIM.su [Электронный ресурс] Режим доступа свободный - URL: https://www.avsim.su/f/misc-24/v-p-marassanov-english-russian-dictionary-of-civil-aviation-37529.html/

4. Лаптева Е.Ю. Формирование иноязычной компетенции у студентов направлений «Техническая эксплуатация летательных аппаратов и двигателей» и «Техническая эксплуатация транспортного радиооборудования. // Иностранные языки в современном мире: состояние и тенденции развития системы оценивания в образовании. Сборник статей VIII Международной научно-практической конференции. Изд-во: К(П)ФУ - 2015. С. 195-203.

5. Лаптева Е.Ю. Система формирования профессиональной иноязычной компетенции у бакалавров в техническом вузе // Иностранные языки в современном мире:

инфокоммуникационные технологии в контексте непрерывного языкового образования. Сборник материалов VII Международной научно-практической конференции под научной редакцией Ф.Л.Ратнер. Изд-во: ООО «Центр инновационных технологий» - 2014. С. 619-628.

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FEATURES OF TECHNICAL TRANSLATION

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Progress is the inalienable quality of uninterrupted conscious development: it consists in a retentive memory and the physiological perfection of man through social life
A. Herzen

Nowadays the relations between nation states are expanding; the percentage of exports is increasing and the main key to success is economic integration. Undoubtedly, based on all these facts we can definitely say about the undeniable role that English language plays in our modern society. For another thing, it acts as a forceful factor of socio-economic, sci-tech and universal cultural progress and as a cross functional and convenient mode of communication between residents from all around the world. At the current level of technical development the demand for experts in translating engineering documentation is growing steadily [1]. The translator should delve into his field of activity and permanently supplement lexical supplies. But actually some obstacles may be come across during the work. So, in this article some particular difficulties will be discussed.

Well then what the translation is. Translation is a special type of human activity aimed at language mediation, so at overcoming linguistic divide connected with the diversity of language. That is why modern translator with lack of competence in their field will not be able to convey the adequate information but will give nutshell paragraph.

In fact, engineering translation includes the translation of dictionaries, reference literature, accompanying documentation, briefs, execution plans, articles, indentures and so on. The main difficult is that the fidelity of the translation must be as the best one can, otherwise the semantic charge of the text can by changed. So, the execution of work can be put only under care of high-end professionals, who can look into a matter and know the specific terms inherent in this field. The specialists must “kill two birds with one stone”: properly enunciate their thoughts in the language of translation and reserve the précis and style of the original text. The style of modern English technical literature is characterized by norms of the language and formally and concise style without emotional coloring. The vocabulary consists of non-Anglo-Saxon origin (Latin and Greek etymology). Also, impersonal sentences and various abbreviations are especially widespread [3].

Clearly, technical progress is inexorably moving forward that makes us come up with new terminology. In this situation lexical-semantic and morphologic methods are used to form new aviation lexis. The first method «provides» aviation vocabulary with terms that were given a new meaning (e.g. single trip – one way flight) and the second one «provides» with derives terms (e.g. screening – inspection). The term-prepositions (e.g. check-in – registration) are used quit often [3].

Beside, one more particularity of English technical literature is an infinitude amount of alphabetic acronyms (TWY – taxiway), syllabic abbreviation (touchpad – touchdown pad) and term forming by compression (manland – landing in manual mode).

It’s not surprising that the main «headache» of scientific and technical translation is the necessity to unite knowledge of a foreign language and knowledge of technical equipment as

competent technical translation requires professional attainments in the relevant field. An important feature of the present step of scientific and technological progress is the mutual penetration of special terminology from one area of expertise to another. As a result, engineering translation demands simultaneous use of definition and field-specific dictionaries for corresponding branches of science and technology such as telecommunication, radiotronics, microcircuitry, numerical engineering, Economics and Finance, advertising and marketing and often media world [2]. Moreover, for useful and high-quality translation it is needed to have sufficiently large word stock, to know specific grammar structures of a foreign language and lexical, grammatical and stylistic rules of diversion.

Along with that during the translating technical texts abbreviation as one of the most common ways of appearing terms in the aviation should be taken into account. Above all two types of abbreviations are used: formed from initial letters (e.g. ICAO – International Civil Aviation Organization) and formed from first-syllable words (e.g. DME – Distance Measuring Equipment).

The majority of abbreviations are translated by directive borrowing from native language because they are widely used in the process of communication between professionals. Accordingly, one of the most counterproductive ways of translation is using Russian abbreviations in order to convey multicomponent English aviation terminology. As a rule, definition of each component of the original abbreviation is used.

Drawbacks that arise during translations can be divided into normative and semantic. In their turn the last can be separated into corruption and omission according to the degree of corruption. Such mistakes can easily deform the meaning and misinstruct the reader. This can tell us with ease about the translator's incorrect perception of the respective technical text.

To sum up let us form the main requirements for engineering translation. First of all, the translator must have well-grounded knowledge in the field of the activity. Secondly, wide ranging vocabulary including obligatory knowledge of technical terminology and even abbreviations is a basis for performance of duty. And finally the translator should take into account the grammatical features of both the source language and the target language.

References:

1. Eisenkot S.M. Training manual for technical translation [Text] / S.M. Eisenkop, L.V. Bagdasarova, N.S. Vasina, I.N. Glyshenko. – Rostov-on-Don: "Feniks", 1999. – p. 288

2. Strelkovskiy G.M. Scientific and technological translation / G.M. Strelkovskiy, L.K. Latisevs. – Moscow: Prosveshenie, 1980. – p. 175

3. Vinogradov V.S. Introduction to translation (general and lexical issues) [Text] / V.S. Vinogradov. – Moscow, 2001. – p. 224.

УДК 811.92

USE OF SIMPLFIED ENGLISH AND SIMPLFIED TECHNICAL ENGLISH IN THE SPHERE OF AIRCRAFT MAINTENANCE

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World globalization, which has affected all spheres of our society, has provided close cooperation of world economies, unobstructed business partnerships and therefore easy exchange of goods between countries. Russia is not an exception, as we use goods of world's manufacturers, starting from household appliances and ending with fleet equipped with foreign aircraft. In everyday life, this is not a problem, considering that, all related documentation is translated into Russian language and certified. However, there are situations when a person needs to read a foreign

language documentation. Especially it concerns the technical field. If a person does not have a proficiency in a foreign (English) language, then one can use Simplified English (SE).

Since the 70s of the last century scientists have been developing the SE. It is a limited set of words and rules for their use, which can be understandable by any user. It was assumed that the use of a simplified version would allow solving a number of problems, such as:

- to avoid ambiguity;
- to ensure clarity, readability and understanding of the material;
- to facilitate the translation process;
- to increase the efficiency of interaction between individuals of different linguistic cultures.

However, in reality, due to the high degree of polysemy of the English language and some other factors, the use of SE does not fully solve these problems. For instance, consider the word «close». The SE rules approve the use of the verb «close» and its cognate adjective «closed». But, in turn, the adjective "close" can mean a warm relationships between people ("intimate, close friend"), and the adjective "closed" can mean "near" ("next / beside / nigh "). As a result, there may be misunderstandings and distortion of the meaning.

SE has its own technical version – Simplified Technical English (STE). STE development started later and covered aerospace. STE is identical to SE in terms of word selection and rules of usage, but is intended mostly for technicians. In this regard, STE is especially relevant in the aviation sphere, since most of the aircraft fleets are currently equipped with Boeing and Airbus aircraft types. Technical personnel must have a certificate of passing the European Union Aviation Safety Agency (EASA) Exam which officially allows the foreign-made equipment maintenance producers [1]. On the one hand, the STE provide easy understanding of the Maintenance Manual book. For example, the STE rules indicate acceptable and unacceptable ways of using certain words [2]:

Key word (Part of speech)	**Approved meaning/ ALTERNATIVES**	**APPROVED EXAMPLE**	**Not approved**
Acceptance (n)	ACCEPT (v)	Before you *accept* the unit, you must do the specified test procedure.	Before *acceptance* of unit, carry out the specified test procedure.
Accessible (adj)	ACCESS (n)	Turn the cover until you can get *access* to the jack that have “+” and “-” marks.	Rotate the cover until the jack marked by “+” and “-” are *accessible*.

However, manuals do not always follow STE rules. It won’t be enough for aircraft maintenance engineers get information from this resource only to be able to read the operating/maintenance manuals, translate and understand the technical information presented there properly.

As an example, we analyzed an extract from ATA 30 Ice & Rain Protection [3]:

ICE AND RAIN PROTECTION (AW)

ICE PROTECTION SYSTEM (IPS) CONTROL& INDICATING

WINGS/ENGINE AIR INTAKES

The Ice Protection System (IPS) is equipped (NAW) with two primary (AW) ice detectors. The signals from the ice detectors automatically (AW) activate(NAW) the Wing Anti-Ice (WAI) and Nacelle Anti-Ice (NAI) systems.

On the overhead ANTI-ICE panel, the WING and L(R) ENG selectors are normally (AW) set (AW) to AUTO. During (AW) icing conditions (AW) the Ice Protection System (IPS) is activated (NAW) automatically (AW) by signals from the ice detectors. Each selector also has manual controls, ON and OFF, for operation (AW) of the individual (NAW) controls (AW) in case (AW) of a failure (AW) of the automatic (AW) function (AW).

PROBE /WINDOWHEAT

The automatic (AW) or manual (AW) mode (AW) is selected (NAW) by the WINDOW PROBE pushbutton switch (NAW) on the ANTI-ICE control (NAW) panel. In normal (NAW) (AUTO) configuration, no lights (AW) are illuminated on the switch (AW). In the automatic (AW) mode (AW), probe and window heat (AW) is activated (AW) when either engine is started (AW).

In case of a failure (AW) of the automatic (AW) control (AW)system (AW),manual (AW) operation (AW) is possible (AW) by selecting the WINDOW PROBE pushbutton switch (AW) to the MAN position. Both (NAW) heating systems (AW) will be activated (AW) with all overheat protections (AW) still available (AW).

where, «(AW)» – Approved Word (allowed by STE rules for being used); «(NAW)» – Not Approved Word (not allowed by STE rules for being used).

After analyzing this part, we can state the following:

1. Words related to STE are about 30%;
2. About 25% of words out of STE mentioned above are “not approved" (not allowed by STE rules).

Thus, the use of STE resources will not be sufficient for clear and correct understanding of the professionally oriented text on the maintenance of aircrafts. Specialists in this field, working with technical documentation, must have a lexical and grammatical knowledge much wider than it is defined in the STE.

References:

1. Лаптева Е.Ю. Формирование иноязычной компетенции у студентов направлений «Техническая эксплуатация летательных аппаратов и двигателей» и «Техническая эксплуатация транспортного радиооборудования. // Иностранные языки в современном мире: состояние и тенденции развития системы оценивания в образовании. Сборник статей VIII Международной научно-практической конференции. Изд-во: К(П)ФУ - 2015. С. 195-203.

2. Simplified Technical English // https://en.wikipedia.org/ URL: https://en.wikipedia.org/wiki/Simplified_Technical_English (дата обращения: 12.10.2020).

3. Technical documentation of Sukhoi superjet 100 // https://www.avsimrus.com/ URL: https://www.avsimrus.com/f/documents-16/technical-documentation-of-sukhoi-superjet-100-65092/zip (дата обращения: 15.10.2020).

УДК 811.111 + 811.161.1

FICTION AND MEDICAL SCIENCE TEXTS: STATISTICAL PROCESSING AND TRANSLATION SPECIFICS

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There are many differences in the styles of writing scientific articles and fiction works. They differ in the purpose and they both have own grammatical and lexical features.

The purpose of our work is to identify grammatical specifics in different writing styles, i.e. fiction and scientific works and compare them inter- and intra-linguistically.

The material of our research work is one fiction text and one scientific text. A fiction text is represented by 'A Straggler of 15' from medical storybook 'Collection of medical stories' by Arthur Conan Doyle (1933). The text comprises 5375 tokens. The story follows the life of old Corporal Gregory Brewster and his stories of his military exploits. We have also studied the Russian translation of the story performed by I. Laukart and A. Mihailov in 2005.

For the scientific text we used the article 'Leukemia, Acute Lymphoblastic Leukemia' from Advanced Clinical Handbook 'Pediatric Oncology Nursing' by Deborah Tomlinson and Nancy E.Kline. The article focuses on epidemiology, etiology, symptoms and clinical signs, staging and classification, diagnostics and treatment of acute lymphoblastic leukemia. The article comprises 5517 tokens. As you can see, the selected work is similar in size.

Research Stage I involved statistical processing of the selected texts using software AntConc. It is designed for text analysis; it is used to find the necessary text structures, word patterns and fragments of the same length. In particular, we focused on categories of words with a suffix '-ing': Participle I, Gerund and Continuous forms.

We found 108 examples of words with a suffix '-ing' in fiction text. Gerunds are used 25 times (23,5%), Participle I 63 examples (58%) and 20 examples (18,5%) of Continuous forms (one example is of Present Continuous, 14 are of Past Continuous and five words are used for Past Perfect Continuous).

The distribution of words with the suffix '-ing' in the scientific text was as follows: 71 examples of Participle I (55,9%), 53 examples of Gerunds (41,7%) and 3 phrases (2,4%) of Continuous forms (two phrases are used for Present Continuous and 11 represent Past Continuous). The total number of examples found was 127.

Examples from both texts are given below (see Table 1).

Table 1. The distribution of words with '-ing' revealed by AntConc

Text	Grammatical form	Examples
Fiction text	Gerunds	'True, she had never seen him, but a rude **painting** at home which depicted a square-faced, clean shaven…'
	Participle I	'He looked at the bony, **trembling** hands, with their huge, knotted knuckles…'
	Continuous forms	'His eyes **were shining** and his bony yellow fingers…'
Scientific text	Gerunds	'…but better **understanding** of the pharmacology of these drugs…', '**Administering** these drugs in the evening'
	Participle I	'It is accepted that **ionizing** radiation is a causal factor in leukemia'
	Continuous forms	'However, as transplantation and chemotherapy **are improving**, these patients are continually subject to review'.

To visualize the frequency of occurrence of different forms of suffix '-ing', we combined the data into diagram (see Figure 1).

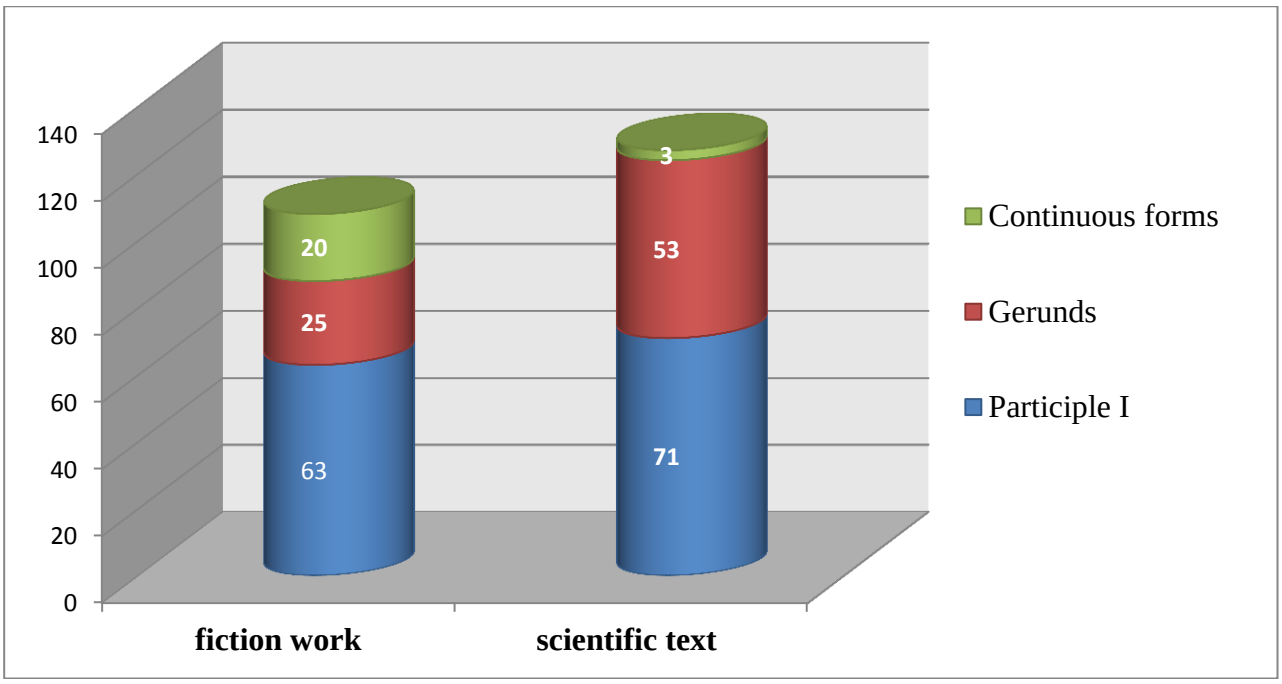

Figure 1. '-ing'

As we see in a scientific text gerunds prevail, since the terminology of a scientific text involves the constant use of noun-definitions, terms, verbal forms.

At **Stage II** we studied the frequency of using the Passive Voice in both texts. In the fiction text the passive voice was found in 10 examples, while in the scientific text the number increased up to 45 examples. However, it is worth noting that the calculation was performed using a special text analyzer that searches for identical letter combinations, namely '-ed' suffix, so we could not search for examples of the passive voice formed by irregular verbs in the look-up of documents. Therefore, our calculation is limited to grammatical constructions of the passive voice with regular verbs.

The passive voice is used more often in scientific texts because the focus is on explanation or description of events and phenomena performed but not on an agent, which is manifested explicitly or implicitly. We are not talking about a person, not about the characters of the fiction work, but about processes and phenomena on 'scientific genre'. Therefore, here the acting role is given to the subjects and the passive voice is used.

Examples of sentences with a passive voice in a scientific article (cases of different times): '*A lumbar puncture* ***is performed*** *to determine any CNS involvement…*', '*…leukostasis* ***was caused*** *by overcrowding of leukemic blasts*', '*Remarkable advances* ***have been made*** *by defining molecular abnormalities …*'.

At **Stage III** obtained results were contrasted and compared. The determined prevailing number of '-ing' forms revealed in both fiction and science texts is due to ubiquitous application of the given form by in English language and a variety of grammatical phenomena nominated. In Russian translation, though, revealed '-ing' forms are represented in various categories, including nouns, verbs and present participles. Revealed passive constructions, though restricted to '-ed' suffixes only, are used more frequently in medical scientific text.

Conclusions: The obtained results reveal the grammatical diversity of English texts, both scientific and fiction. The frequency of using different grammatical constructions is determined by the text style, depending on the purpose of the text and its content.

Fiction story in the Russian version is also wide in the use of different grammatical constructions in translation selected by us figures of speech.

References:

1. Tomlinson, Deborah, Kline, Nancy E. (Eds.) Pediatric Oncology Nursing Advanced Clinical Handbook [Electronic resource] / Access mode:

https://books.google.ru/books?id=X42jS7UQYSUC&printsec=frontcover&hl=ru&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false (Date of access 1.11.2020)

2. A Straggler of '15 [Electronic resource] / Access mode: https://www.arthur-conan-doyle.com/index.php/A_Straggler_of_'15 (Date of access 1.11.2020)

3. Повести и рассказы Ветеран 1815 года [Electronic resource] / Access mode: http://doyle.velchel.ru/index.php?cnt=8&story=tl_37 (Date of access 1.11.2020)

УДК 81

SEMANTIC FEATURES OF PHRASAL VERBS IN PROFESSIONAL AVIATION LITERATURE

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Objectives:

- To conduct a semantic analysis of phrasal verbs in aviation professional literature
- Define features and recommendations for the further implementation

According to the definition in Longman Dictionary of Contemporary English (1995) [3], phrasal verb is comprised of a single verb and an adverb or a preposition, which is used as a verb phrase, such as set off, look after, etc. Phrasal verbs are considered an important characteristic of the English language. The incidence of phrasal verbs exploded in Early Modern English. Shakespeare himself applied the form widely throughout the plays. Despite a long history of phrasal verbs, interest in the lexical-phraseological phenomenon never fades. For years it has been attracting attention of many famous grammarians and linguists, such as Robert Lowth, Samuel Johnson, Dwight Le Merton Bolinger, M. McCarthy, et al.

However, for second language learners of English, phrasal verbs pose numerous difficulties. One challenge is highlighted in the following definition from The American Heritage Dictionary of Phrasal Verbs (2005) [4]: "A phrasal verb is a combination of an ordinary verb and a preposition or an adverbial particle that has at least one particular meaning that is not predictable from the combined literal meanings of the verb and the preposition or particle. The issue of unpredictability is obviously a troublesome one for learners of English". Their meanings range on a cline from purely compositional to highly idiomatic.

Research methodology:

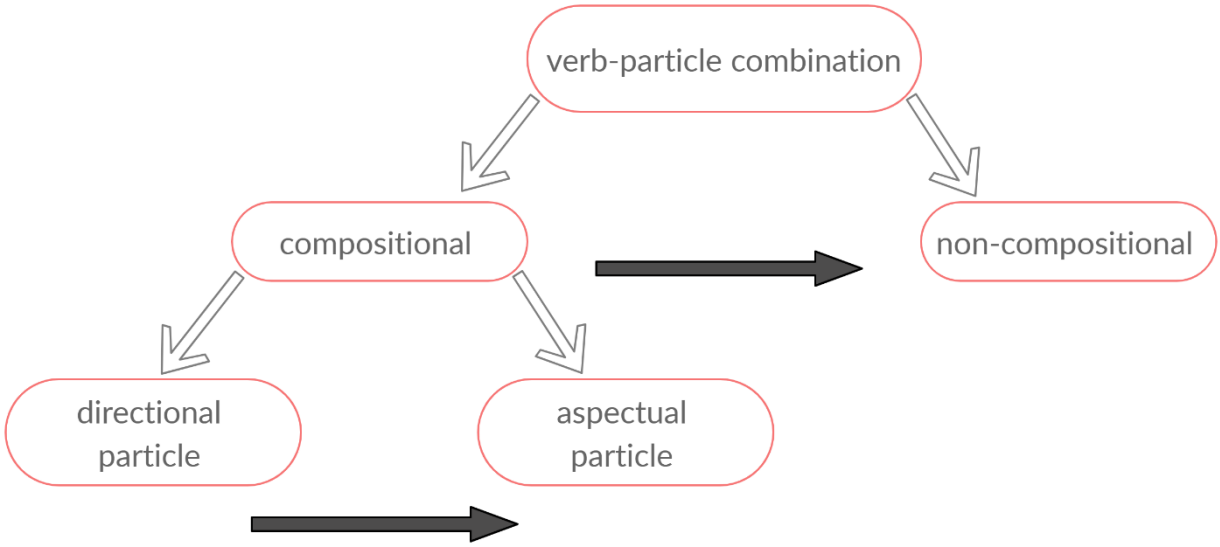
Verb-particle combinations, i.e. phrasal verbs, may be highly polysemous, quite commonly, the meanings range on a cline from purely compositional to highly idiomatic. Classifying phrasal verbs in a semantic way, we should take into account the initial meaning of the components and the derived meaning after the combination of the verb and the particle. In the research I will use Stefan Thim's tripartite semantic categorization of phrasal verbs. (Pic.1)

1. Compositional phrasal verbs – verbs, which meaning can be derived from the meaning of their components. This group, in turn, involves 2 subgroups depending on the particle:

a) Directional particle, which indicates the direction of motion. The particle retains its spatial meaning, e.g. come in, come out, go away, etc.

b) Aspectual particle, which gives the meaning of the completeness of the action, e.g. eat up, cry out, finish up, etc.

2. Non – compositional (idiomatic) phrasal verbs. Their meaning cannot be inferred from the meaning of their elements, e.g. fall out, break in, give up, etc. It's worth noting idiomatic phrasal verbs are certainly the type that has attracted most attention, in particular in the more popular literature and in the teaching of English as a foreign language



Picture 1 - Stefan Thim's tripartite semantic categorization of phrasal verbs

For the research 3 different aviation documents were chosen:

1. ICAO Doc 9432 Manual of Radiotelephony
2. ICAO Doc 4444 Air Traffic Management
3. ICAO SARPS (Standards and Recommended Practices). Annex 11 "Air Traffic Services"

Firstly, all phrasal verbs from the documents were tabulated, counted and grouped by preposition. (Table 1)

Table 1

	Phrasal verb	DOC 4444	DOC 9432	AN 11
1	line up	4	6	1
2	start up	7	12	0
3	make up	5	0	2
4	pick up	1	0	0
5	break up	1	0	0
6	round up	0	0	2

Table continuation 1

7	carry out	11	6	4
8	cross out	9	0	0
9	bound out	0	0	1
10	listen out	0	2	0
11	look out	0	2	0
12	set out	1	0	0
13	taxi out	1	0	0
14	watch out	1	0	0
15	take off	50	38	21
16	make away	1	0	0
17	head away	0	1	0
18	deviate away	1	0	0

19	pass over	4	0	1
20	take into	11	0	4
21	read back	3	14	8
22	come back	1	0	0
23	go ahead	0	1	0
24	shut down	1	0	1
25	write down	0	1	0
26	round down	1	0	0
27	lay down	1	0	0
28	slow down	1	0	0
29	go around	9	3	0
	Total	125	86	45

According to the tripartite semantic categorization, all phrasal verbs were classified and counted by groups. The results are drawn from the analysis is shown in figure 1.

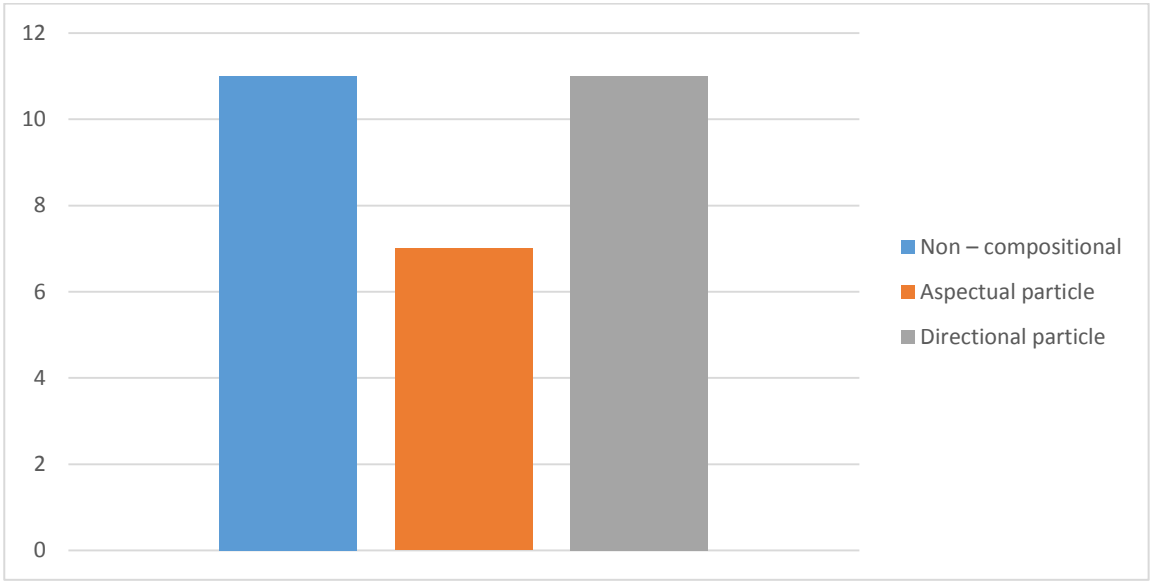


Figure 1 - Tripartite semantic categorization of the phrasal verbs

Therefore, appearances of non-compositional phrasal verbs and compositional phrasal verbs with directional particle is higher than compositional phrasal verbs with aspectual particle. In case of translation or adaptation of any aviation special literature to Russian language (or other) the factor of ambiguity should be taken into consideration, especially if there are non-compositional phrasal verbs.

Conclusion:

As a result of the research we can conclude that there is vast majority of different classifications of phrasal verbs in English. During a semantic analysis it can be seen that often there is a complete or partial narrowing or, conversely, an expansion of the original semantic meaning of the verb component, so the phrasal verb often moves from one group of classification to another.

In aviation literature, attention should be given to the issue of unpredictability and polysemy of some phrasal verbs to avoid serious repercussions in real-time operation. Though, some phrasal verbs are slangy and colloquial, but not all. Others are actually more precise than their single word synonyms. A translator should be careful and must make sure that the equivalent of a non-compositional phrasal verb refers to the the same register of communication, or at least to a neutral.

References:

1. Zabolotskaya A.R. Izuchenie strukturno-semanticheskih i grammaticheskih osobennostej frazovyh glagolov anglijskogo yazyka studentami neyazykovyh special'nostej. – Vestnik TGGPU, 2015. – № 4 (42). – pp. 274-278.

2. Stefan Thim. Phrasal Verbs: The English Verb-Particle Construction and its History. – Berlin and New York: De Gruyter Mouton, 2012. – p. 317.

3. Della Summers. Longman Dictionary of Contemporary English. – Beijing: Foreign Language Teaching and Research Press Pub, 1995. – p. 2220.

4. Houghton Mifflin Company. The American Heritage Dictionary of Phrasal Verbs. – Boston: Houghton Mifflin Co.,2005. – p. 466.

5. Povey J. Phrasal verbs and how to use them. – Moscow: Vysshaya shkola Publ., 1990. – p. 176.

СЕКЦИЯ 5

ФУНДАМЕНТАЛЬНЫЕ И ПРИКЛАДНЫЕ ИССЛЕДОВАНИЯ В НАУКЕ

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УДК 616-006.6

QUANTUM DOTS IN TUMOR DIAGNOSIS

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Cancer is one of the most dangerous and unpredictable diseases of our time. It takes the second place by amount of deaths all around the world. For example, in 2018 at least 9,8 millions of people has dead from this disease. Thus, every sixth person in the world dies from cancer every day.

That's why cancer is one of the most popular topics in biology and medicine over the past years. Nevertheless, there is still no effective methods to detect and to cure cancer. [1]

This issue describes the development of an effective method of tumor diagnostics using quantum dots technology.

The essence of the offering method consists in improvement of already existing method of tumor diagnostics. The method of immunohistochemical analysis of biopsy material, which is named the method of fluorescent hybridization in situ, is taken as a basis. This method is about diagnosis of biopsy material which is taken from patient. The biopsy material covers with solution of fluorescent dyes which are connected with special antibody molecules. A diagnosis can be defined by chemical reaction of the biopsy material with solution of antibodies and fluorescent dyes. [2]

The described method uses traditional organic fluorescent dyes which have a number of disadvantages. This issue offers to replace organic fluorescent dyes with fluorophores based on quantum dots technology.

Quantum dots, due to their quantum mechanical properties, have a number of advantages over traditional dyes; in addition, their properties can be even improved by covering them with additional layers of materials. Thus, the accuracy, speed and efficiency of the fluorescent hybridization in situ method significantly increases. [3]

In this issue will be described the algorithm of quantum dots covering with different types of materials.

References:

1. Global cancer statistics. / Jemal A. [et al.] // CA Cancer J Clin 2011; 61: P. 69-90.

2. Alexander, S. Cancer invasion and resistance: interconnected processes of disease progression and therapy failure / S. Alexander, P. Friedl // Trends Mol Med 2012; 18: P. 13-26.

3. Quantum Dots – Characterization, Preparation and Usage in Biological Systems / Drbohlavova J. [et al.] // Int. J. Mol. Sci. – 2009. Vol. 10, №2. – P. 656–673.

УДК 004

USAGE OF SCIKIT-LEARN LIBRARIES IN ADDITIVE MANUFACTURING

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Additive manufacturing uses technologies of layer-by-layer growth and synthesis of objects. Industries such as aerospace, healthcare, energy, automobile and shipbuilding cannot do without the use of additive technologies (AT) in manufacturing. Despite the seeming versatility, ATs have achieved success mainly in highly specialized production, for example, in the printing of medical

implants that are resistant to the harsh conditions of using machine parts and devices, as well as products with a design that is complex for traditional manufacturing. Recently, in scientific publications, there has been an obvious trend in the use of machine learning in printing processes, which has a positive effect on the quality of the part, reduces the cost of manufacturing and reduces the number of parts tests for compliance with the required parameters. In our work, we analyzed articles where was used machine learning in additive manufacturing processes using the example of using the Scikit-learning open source library in the Python programming language.

In the article [1], the researchers pay attention to the the printing speed and the automatic control system of the additive manufacturing process. The authors have developed a framework to build the system in real time, based on the finite element method (FEM) and a machine learning (ML) model.

Several different machine learning models were considered. The proposed framework uses an ensemble of Extra Randomized Decision Trees (ERTs) as a regression algorithm, reusing previous temperature values in a given volume - a voxel - and laser temperature information to predict subsequent temperature values in the same voxel and reveal the whole picture of the temperature profile.

The Scikit learning libraries were used as the main tool for preprocessing and building most of xgboost models.

Fig. 1. Framework algorithm

It was discovered that the advantage of this model is real-time training during production, the absolute error was less than 1%. Developing a hybrid method that alternately uses FEM and MO to predict the temperature profile of layers in the future is also planned.

In the next article [2], the authors applied computer vision and machine learning methods to quantitatively analyze powders used in additive manufacturing. The researchers' goal was to analyze and prepare the powders that are used for printing.

Due to the morphological features of the powder, it is inappropriate to use traditional methods for studying the structure of the powder. The scientists obtained a dataset based on Blender-generated images of the microstructure of the powder. Using the Bag of Visual Words (BOVW) method, based on the representation of an image using the characteristics of its structure, image recognition was performed. Using the Support Vector Machine method used for image classification and taken directly from the Scikit learning library, the relationship between different microstructures was studied.

As a result of the study, the accuracy was 89 ± 3%. The main obstacle was the initially small data set for training the model. It was proposed to use the image classification method to study the morphological features and powder surface properties.

The article [3] discusses the application of machine learning models, implemented by open source computer program Scikit learning, to improve the quality of parts and prevent defects during their production by the method of selective laser melting (Selective Laser Melting). The method proposed by the authors - a multi-layer classifier for process monitoring (Multi-Layer Classifier for Process Monitoring) - works in 2 stages:

- processing of collective data provided by identical 3D printing machines producing the same part. A ML model built from this data (in this case, the authors used the Random Forest model). Then, using this model, are selected parameters for printing each specific layer.

- control of the printing process for each specific layer, collection of new data and prediction of possible defects by a pre-trained model, which allows the operator to change the printing

parameters during the process and prevent defects.

The proposed method can work with a large amount of data, since it is supposed to upload them to cloud storage. However, to confirm the effectiveness of the method, the authors plan to test it on real data. Presently the proposed structure was tested only on simulation data.

In addition, in article [4], the authors also raise the issue of printing imperfection in AT. The researchers argue that the introduction of additive technologies for the production of final products has a number of limitations [5]. The quality of the produced parts greatly varies. There are no developed standards for additive manufacturing processes. Also, incorrect error values are often encountered that fall outside the tolerance range. The authors' aim was to predict the scale factor for each part depending on its location, orientation and CAD model using the methods of machine production: multi-layer perceptron (MLP) and convolutional neural networks (CNN). The libraries that formed the basis of this work are Scikit-learning and TensorFlow. Keras was used for frontend development. As a result, MLP outperformed CNN in forecast accuracy and root mean square error.

In conclusion, it's important to note that the use of the Scikit-learning open-source library turned out to be quite justified, since its abilities are quite enough for the optimal implementation of the proposed tasks. Another one important result of our analysis is that the application of machine learning models in additive manufacturing has very good prospects, however, more research and testing are required to fully implement them in the production process.

References:

1. Paul, A. et al. A real-time iterative machine learning approach for temperature profile prediction in additive manufacturing processes in 2019 IEEE International Conference on Data Scienceand Advanced Analytics (DSAA) (eds, Singh, L., De Veaux, R., Karypis, G., Bonchi,F. & Hill, J.) 541–550 (IEEE, Piscataway, 2019).

2. DeCost, B. L. & Holm, E. A. Characterizing powder materials using keypoint-based computer vision methods. Comput. Mater. Sci. 126, 438–445 (2017).

3. Amini, M. & Chang, S. I. MLCPM: a process monitoring framework for 3D metal printing in industrial scale. Comput. Ind. Eng. 124, 322–330 (2018).

4. Baturynska, I., Semeniuta, O. & Wang, K. in Advanced Manufacturing and Automation VIII. IWAMA 2018. Lecture Notes in Electrical Engineering Vol 484 (eds Wang, K., Wang, Y., Strandhagen, J. & Yu, T.) 245–252 (Springer, 2019).

5. Yunusov F.S., Yunusov R.F. Investigation of semi-free grinding of local defects // Bulletin of mechanical engineering. 2012. No. 10. S. 46-50.

УДК 551

THE DOMESTIC DELTA ROBOT

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Abstract: *This abstract describes the design of the domestic Delta robot and its creating process.*

Keywords: *robot, delta robot.*

Robotics is an interdisciplinary field that can be defined as the science and technology of robots, their manufacture, design and applications. Due to its nature, this field combines electrical and mechanical components. Robots allow doing high accuracy work; they are also able to replace a person in monotonous operations.

Delta robots come to the rescue of people, when high speed (one action per second or more) and accuracy in actions is required. In 1988, Professor Reymond Clavel, at the Swiss Federal

Institute of Technology in Lausanne, invented the delta robot [1]. There have been made a huge amount of different types of Delta robot. Some examples of engineering creativity are shown in the figure 1.

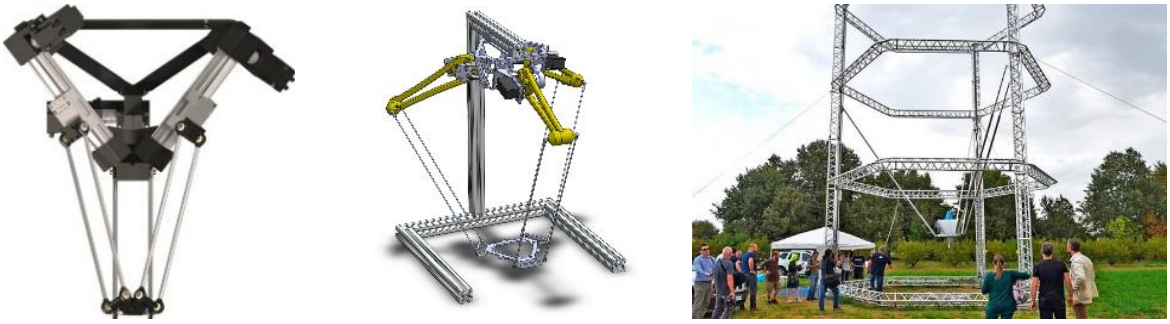

Figure 1 – Examples of delta robot design

Robots with payloads from 1 mg to several tens of kg have been invented. Robots with a lifting capacity of 3 kg are high demanded as most often they can be seen at the enterprises of light, food industries.

In the current work, the Delta robot is being developed step-by-step with payload of 5 kg, reach of 800 mm, and a speed of up to 2 actions/sec. The ABB IRB 360-X-800-STD-3D robot shown in figure 2 was considered as an example.

Figure 2 – ABB IRB 360-X-800-STD-3D

The general principle of a plane-parallel robot and key dimensions have been saved, but the appearance and shape of all components have undergone changes. All components, except of motors, gearboxes, joints and carbon fiber pipes, must be carried out within the production framework. Due to the lack of foundry capabilities, all components must be obtained on a turning, milling machines or on a plasma cutting machine. The workspace is modeled in the Matlab package, 3D models are modeled on the basis of the SolidWorks software package, Ansys Workbench will be used for strength analysis. The next step in the development will be the construction of a prototype and verification of its performance.

The robot is planned to be used in various domestic industries.

References:

1. Delta, a fast robot with parallel geometry / *R. Clavel* // Proceedings of the 18th Int. Symposium on Industrial Robots. – 1988. P. 91-100.

УДК 615.47

DEVELOPMENT OF A CHANNEL FOR MONITORING THE PARAMETERS OF THE MAGNETIC FIELD OF THE MAGNETOTHERAPY SYSTEM

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In the ranking of the causes of mortality among the population, cardiovascular diseases are in the lead. The World Health Organization estimates that 17.5 million people die of heart disease every year. 85% of all these deaths are caused by heart attacks and strokes. The most common disease is acute ischemic stroke. The cause of this sudden condition is acute insufficiency or complete cessation of blood supply to any area of the brain. This is due to a strong narrowing of the lumen of a vessel affected by atherosclerotic plaques, blockage of an artery by a thrombus or cholesterol deposits. In Russia, this problem is especially urgent. Mortality from stroke is 175 cases per 100,000 population per year [1]. The National Stroke Association cites the following data: 31% of stroke patients require special care, 20% cannot walk on their own, and only 8% can return to their previous full life. After suffering a stroke, patients very often need a thorough and long-term rehabilitation.

In the modern medicine, various methods of rehabilitation after a stroke are used: physical and mechanical methods of rehabilitation, massage, non-traditional methods of treatment, psychotherapy, speech therapy assistance, physiotherapy exercises, reconstructive surgery, prosthetic and orthopedic care, spa treatment, technical means of rehabilitation [2]. In recent years, physiotherapy is increasingly used in domestic clinical practice, and, in particular, magnetotherapy. This is due to the fact that medicated therapeutic modality often leads to side effects and allergic reactions. The use of a low-frequency magnetic field has anti-inflammatory, hypotensive, vasoactive, anti-edema, trophic, hypocoagulating and neurotropic therapeutic effects. Magnetotherapy accelerates regeneration processes, enhances local blood flow, and improves blood supply to internal organs. In peripheral vessels, due to relaxation of smooth muscles, low-frequency fields also have a hypotensive effect. These fields play an important role in reducing the coagulation activity of blood, in improving its rheological properties, in increasing vascular and epithelial permeability. When conducting low-frequency magnetotherapy course in the blood, the density of erythrocytes and the content of hemoglobin increases, and consequently, the bone marrow increases its activity. As a rule, with low-frequency magnetotherapy, an increase in the phagocytic activity of leukocytes is noted. The magnetic field acts primarily on the peripheral nervous system. The action of the fields affects the speed of conduction of impulses along the nerve fibers, namely, increases it, which leads to an increase in their excitability and a decrease in perineural tissue edema.

The effectiveness of the transcranial method (TcMT) during rehabilitation depends on the type of stroke and the localization of the lesion: in patients with ischemic stroke localized in the hemisphere, a significant clinical improvement, confirmed neurophysiologically, occurs with the consistent use of low-frequency magnetotherapy and decimeter wave (UHF) therapy. For patients with ischemic stroke localized in the trunk, magnetotherapy has a positive effect on psychomotor recovery, UHF therapy with transcranial use does not affect the recovery of such patients. The pulsed magnetic field has a regenerating effect on the nervous tissue, as well as maximum penetrating ability, and therefore directly affects the brain tissue.

The above properties of TcMT confirm the need to develop and optimize devices for rehabilitation after a stroke by the method of magnetotherapy. The transcranial technique in the post-stroke period involves exposure to the brain tissue, therefore it is very important to choose the correct parameters of the magnetic field and the dosage of exposure. Even a very small deviation from these parameters can lead to undesirable consequences and deterioration of the patient's

condition. This raises the problem of developing a system for post-stroke rehabilitation with the ability to control the therapeutic effect of a magnetic field (its parameters and operating modes).

The analysis of existing analogs showed that a Hall sensor can be used as a sensitive element for sensing the magnitude of the magnetic field. When a current flow through the Hall sensor and when it is exposed to a magnetic field perpendicular to the plane of the sensor, a Hall voltage arises that is perpendicular to the flowing current and proportional to the magnetic flux. The Hall sensor is used as a ready-made module, which includes: a semiconductor rectangular plate, to which four electrical leads are connected [3].

One of the main characteristics of a Hall sensor is sensitivity:

$$\gamma = \frac{\Delta U_{Hall}}{\Delta B},$$

where ΔU_{Hall} is the change in the Hall electromotive force (EMF), ΔB is the change in the value of the magnetic induction.

The sensitivity of the Hall sensor is indicated in the passport data, it can be used to determine the magnitude of the induction of the measured magnetic field:

$$B = \frac{U_{Hall}}{\gamma},$$

where U_{Hall} is the Hall potential difference, γ is the Hall sensor sensitivity.

So, the sensor changes its output voltage depending on the magnitude of the magnetic field passing through it. Since the resulting signal is very small for further processing, it must be amplified. An operational amplifier is used for this. After amplification, the analog signal is fed to the microcontroller, converted to digital and then displayed on the liquid crystal display.

Thus, the report presents the results of the development of a channel for monitoring the parameters of the magnetic field, the introduction of which into the structure of the rehabilitation system of patients in the post-stroke period will allow to control the value of magnetic induction when exposed to a magnetic field on the brain tissue and will allow timely correction of the rehabilitation process.

References:

1. Cardiovascular diseases: site of the World Health Organization [Electronic resource]. – 2017. – Access mode: http://www.who.int/ru/news-room/fact-sheets/detail/cardiovascular-diseases-(cvds). – Access date: 09.18.2020.

2. A.R. Gabdrakhmanova, S.V. Smirnova, Some features of the use of electrical stimulation during the rehabilitation of patients after a stroke // Medical devices and technologies: an international collection of scientific articles / under total. ed. A.Z. Huseynova, N.L. Korzhuk, A.V. Prokhortsov. Issue 8. – St. Petersburg; Tula: Publishing house of the Russian State Pedagogical University named after A.I. Herzen, 2019, pp. 118-120.

3. A.R. Gabdrakhmanova, M.M. Tyurina, Features of the use of magnetic therapy in rehabilitation after a stroke // Biotechnical, medical and ecological systems, measuring devices and robotic complexes – Biomedical systems-2019 [text]: collection of articles. tr. XXXII All-Russia scientific and technical conf. stud., pier. scientists and specialists, December 4-6, 2019 / under total. ed. V.I. Zhuleva. – Ryazan: IP Konyakhin A.V. (Book Jet), 2019, pp. 134-136.

УДК 615.847

LOW-FREQUENCY MAGNETOTHERAPY AS A METHOD OF REHABILITATION AFTER A STROKE

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Stroke is currently one of the main social and medical problems of modern neurology. A stroke is a violation of the cerebral circulation, that is, damage to the brain caused by a blockage or rupture of blood vessels in the brain.

Complications of a stroke can include sleep disturbances, confusion, depression, incontinence, atelectasis, pneumonia, and difficulty swallowing, which can lead to aspiration, dehydration, or malnutrition. Insufficient mobility of the patient can lead to the development of thromboembolism, a general deterioration of the condition, sarcopenia, urinary tract infections, pressure ulcers and contractures. Stroke patients may have impairments to the functions they need to perform daily activities (including walking, vision, sensation, memory, thinking, and speech). The consequences of a stroke depend on which area of the brain and to what extent it was affected by the violation of cerebral circulation. They can be minor and transient, or multiple and severe, making it difficult for a person to return to normal life. But most people who have suffered a stroke become disabled, need rehabilitation and even constant outside care. Thus, stroke is an acute socio-medical problem of modern medicine (neurology), since in most cases it becomes the main reason for the disability of the population.

In modern medicine, various methods of rehabilitation after a stroke are used: physical and mechanical methods of rehabilitation, massage, non-traditional methods of treatment, psychotherapy, speech therapy, physiotherapy exercises, reconstructive surgery, prosthetic and orthopedic care, spa treatment, technical means of rehabilitation [1].

In recent years, physiotherapy, and in particular magnetotherapy, has been increasingly used in domestic clinical practice [2]. This is due to the fact that drug treatment often leads to side effects and allergic reactions. Physiotherapy is an integral component of rehabilitation after a stroke, without it a full-fledged recovery process is impossible, which is why it is included in the standards of medical care and clinical recommendations for the treatment and rehabilitation of patients with stroke, approved by the Ministry of Health of the Russian Federation. Physiotherapy is the only hope of recovery for patients who are unable to actively participate in rehabilitation activities due to immobility or mental impairment. Portable devices for home physiotherapy become a real salvation for a bedridden patient who cannot be transported to a clinic or medical center, especially when there is no way to attract rehabilitation specialists to the home. The main methods of physiotherapy are magnetotherapy and electrostimulation (sensory percutaneous electroneurostimulation, low-frequency neuromuscular electrostimulation). It is worth noting that during electrical stimulation, side effects such as skin irritation and increased muscle fatigue are possible, which can complicate the process of restoring active movements. Therefore, the most effective and safest method of physiotherapeutic rehabilitation is magnetotherapy.

Magnetotherapy implies the use of variable and constant pulsed low frequency magnetic fields, as well as constant continuous magnetic fields of various powers and configurations for therapeutic and prophylactic purposes. A low-frequency alternating pulsed magnetic field is the most effective means in treating the consequences of a stroke. The use of low-frequency magnetic fields has various therapeutic effects, such as anti-inflammatory, vasoactive, anti-edema, hypotensive, trophic, hypocoagulant and neurotropic. Magnetotherapy enhances local blood flow, improves blood supply to internal organs, and accelerates regeneration processes. In peripheral vessels, due to relaxation of smooth muscles, low-frequency fields also have a hypotensive effect.

These fields play an important role in reducing the coagulating activity of blood, in improving its rheological properties, in increasing vascular and epithelial permeability. When conducting low-frequency magnetotherapy with a course in the blood, the density of erythrocytes and the content of hemoglobin increases, and, consequently, the bone marrow increases its activity. As a rule, with low-frequency magnetotherapy, an increase in the phagocytic activity of leukocytes is noted [3]. Systems which are the most sensitive to low-frequency magnetic fields are the following ones: nervous, endocrine and cardiovascular systems. The magnetic field acts primarily on the peripheral nervous system. The action of the fields affects the rate of conduction of impulses along the nerve fibers, namely, increases it, which leads to an increase in their excitability and a decrease in perineural tissue edema.

Modern physiotherapy in relation to the problem of rehabilitation of patients after a stroke in order to restore the normal functioning of the coronary circulatory system suggests the effect of a low-frequency magnetic field on the part of the brain that is most affected by the stroke. Low-frequency magnetic fields play an important role in the normalization of the activity of the autonomic nervous system, having a beneficial effect on cerebral circulation and recovery processes in cerebrovascular pathology. A low-frequency magnetic field activates all these processes, the therapeutic effect of which has a complex genesis due to the acceleration of metabolic reactions.

The magnetic field penetrates almost unhindered, right through the skin and bones of the skull. This is the advantage of magnetotherapy methods of rehabilitation. It is known that the greatest intensity of the magnetic field is recorded directly at the poles of the inductor, and it decreases with distance from them. This raises the problem of developing a hardware-software complex for therapeutic treatment with the ability to control its parameters and operating modes.

Thus, the mechanism of the effect of a low-frequency magnetic field presented in the report, as well as the widespread use of this method in the rehabilitation of various organs and systems, confirms its applicability in post-stroke rehabilitation. Further development of this direction is the optimization of the parameters of the magnetic field and monitoring of its characteristics during rehabilitation after a stroke.

References:

1. A.R. Gabdrakhmanova, M.M. Tyurina, Channel for monitoring the parameters of the magnetic field of the system for post-stroke rehabilitation // "Modern technologies in science and education - STNO -2020" [text]: collection of articles. tr. III int. scientific.-techn. Forum: in 10 volumes. Vol. 6. / under total. ed. O.V. Milovzorov. - Ryazan: Ryazan. state radio engineering. un-y, 2020, pp. 60-63.

2. A.M. Berkutov, V.I. Zhulev, G.A. Kuraev, Systems of complex electromagnetotherapy – M.: Laboratory of basic knowledge. BINOM, 2000, pp. 289-293.

3. G.N. Ponomarenko, I.I. Turkovsky, Biophysical foundations of physiotherapy – M.: Medicine, 2006, pp. 122-125.

УДК 629.7.054.44

AIR FLOW METER

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People spend most of their time indoors. The task of supplying the room with fresh air, the required purity, temperature and humidity is very important today. That is why today such great importance is paid to efficient ventilation and air conditioning systems. Periodic measurements of

various parameters, such as measurement of flow rate, pressure and air, serve to determine the efficiency of equipment. Various techniques and devices have been developed for this important operation. The most important of all parameters is air measurement. The air flow through the ventilation system is carried out at a certain speed, which is influenced by many factors. This parameter, depending on the design and cross-section of the ventilation ducts, is a key criteria for determining the value of the air flow rate in the duct. Currently, many types of air flow meters (flow meters) are used, such as: anemometers, differential manometers, balometer, etc.

The following basic requirements are imposed on air flow meters:

- unambiguous dependence of the output value on the input;
- stability of characteristics over time;
- high sensitivity;
- small size and weight;
- absence of a reverse effect on the controlled process and on the controlled parameter.

If air distributors are used to supply air to a clean room, then the uneven air movement around the diffusers, and as a result, the uneven velocities, make it practically impossible to measure the volume of the supplied air using an anemometer. When air is blown through a final air filter without using air diffusers, the air volume can be determined by measuring the average air velocity. However, due to the inhomogeneity of the air velocity at various points in the cross section and along the edges of the filter, determining the average air velocity becomes a laborious process [1]. When calculating the air volume in this way, the error in determining the air volume increases, both due to the error in measuring the average air flow rate, and because of the error in calculating the filter area. In such cases, to measure the volume of supplied and removed air, it is better to use an electronic device called a balometer. Its structural and functional diagram is shown in Fig. 1.

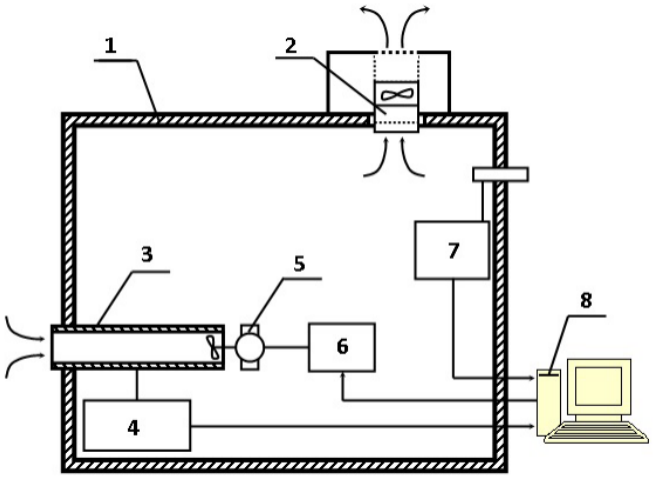

Fig.1. Structural and functional diagram of the air flow meter.
1 - a sealed cube-shaped body with a volume of about 50 liters;
2 - aspiration chamber; 3 - air intake tube; 4 - flow meter sensor;
5 - air blower; 6 is a control circuit that allows you to smoothly change the amount of air sucked into the body; 7 - differential pressure sensor, which registers the pressure difference between the internal cavity of the housing and the atmosphere; 8 - personal computer.

The air flow meter consists of a sealed cube-shaped body 1 with a volume of about 50 liters, with two holes. One of them has a joint unit, the dimensions of which are equal to the inlet part of the aspiration chamber 2. An air intake tube 3 is connected to the other hole, inside which a flow meter sensor is located 4. At the other end of the tube there is an air blower 5 with a control circuit 6, which allows changing smoothly the quantity air sucked into the inside of the housing 1. In addition, there is a differential pressure sensor 7 inside, which registers the pressure difference between the inner cavity of the housing 1 and the atmosphere. The operation of the entire installation as a whole is controlled by a personal computer 8 [2].

The balometer is the most accurate and convenient to use for measurements. To date, this device has no domestic analogues. It is a volumetric flowmeter that consists of a funnel baseand a fabric cap. It is used to measure the volume of gas (air) flowing over a period of time and is used, for example, to test and adjust ventilation systems. The term Balometer is a neologism for ALNOR, which already patented the term in 1983 in the United States as a trademark. Due to the monopoly position of this company and various mergers, the word Balometer is becoming a kind of synonym.

Its method of operation is based on matching the pressure of the inner cavity of the chamber with atmospheric pressure, namely, on the pressure drop inside the chamber and outside it. In turn, the fan selects the air flow rate (back pressure is created), at which the pressure in the chamber will be equal to atmospheric, which allows, relatively speaking, to exclude the resistance of the funnel itself. The air flow measurement in this case is very accurate.

The resulting measurement accuracy largely depends on the characteristics of the flow meter; therefore, a number of specific requirements are imposed on it, namely: low hydrodynamic resistance, high accuracy in a small range of flow rates, and good dynamic properties. Taking into account all of the above requirements, the most suitable flow meter was chosen to be an ion marker. The defining advantage of the ion-beacon sensor is the absence of moving mechanical elements, the absence of structural elements that impede the flow of the flow, i.e. elements that create hydrodynamic resistance, stability of metrological characteristics and high conversion accuracy with a simple device design [3].

To achieve high accuracy and good dynamic characteristics, it is necessary to use an ion-tag flowmeter with a differential recorder, which provides insensitivity to changes in the tag charge over time, high speed and good signal-to-noise ratio.

Thus, the presented balometer which contains an ion-mark sensor is a promising development in terms of measurement accuracy and reliability. It also provides excellent weight and size characteristics that make the balometer a convenient, portable flow meter.

References:

1. Trokhan A.M. Hydroaerophysical measurements. - M.: Publishing house of standards, 1981.- 336 p.

2. RF patent for utility model No. 166715, IPC G01P 5/18, Ion-marking meter of air flow velocity / FA Ganeev, TF Ganeev, MR Minnebaev, IR Urazbakhtin. Appl. 04.07.2016. Publ. 10.12.2016. –Bul. No. 34.

3. Ganeev F.A., Makoveev V.M., Urazbakhtin I.R., Faizulov B.F. Installation for measuring the air flow rate of the aspiration chamber of the air ion counter with an ion-mark flow meter. // Electronic Instrumentation. Scientific and practical collection. Issue 5 (39) - Kazan: CJSC "New knowledge", 2004.

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ION TAG METER WITH INTEGRATION ALGORITHM INFORMATIVE SIGNAL

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According to the results of our analysis of the market of measuring devices, portable and autonomous sensors for measuring non-electrical quantities, in particular anemometers and systems based on them, are in great demand today.

The most common portable, compact and wireless anemometers are based on mechanical, thermal and ultrasonic methods. These methods have many advantages that distinguish them from the rest, but they are not without their own disadvantages.

An example of a mechanical anemometer is a cup impeller, the output of which is the impeller speed. A useful signal of the air flow rate through the cups is obtained indirectly, corrected for friction in the pivot bearings. Over time, the error accumulates, the sensitivity decreases, which subsequently leads to a change in the air flow rate measurement curve, with a high probability of jamming the rotation mechanism.

As for the thermal anemometer, it means a hot-wire anemometer sensor with a platinum thermistor. This method is based on the compensation of heat losses from a heated thermistor to the environment washing it with an air flow. The more heat a resistor loses in a short time, the higher the flow rate. As for the disadvantages of this method, the thermistor is very sensitive to humidity, ambient temperature and degree of pollution. The reproducibility of such a sensitive element is rather low, which makes it necessary to calibrate each instance of the sensor.

And finally, an ultrasonic anemometer, based on the change in the speed of a sound wave from the influence of the incoming air flow. The disadvantage of this method is the influence of external acoustic noise on the readings.

As a competitor to these methods of measuring air flow, we put forward an ion-mark meter. In this method, a kinematic measurement of the velocity of a unipolar ion tag placed in the air flow is observed, which is contactlessly captured by the receiving electrode at a basic distance from the tag generation source. This method is devoid of all of the above drawbacks and is a leader in energy efficiency measurements and has high reproducibility.

At the moment, several prototypes of ion-beacon sensors have been assembled, the tests of which have shown high indicators in energy efficiency, and also surpassed the ranges and accuracy of measuring the air flow of all the listed methods.

The process of forming a useful signal in this anemometer is also important, which consists in the following: an ionic negatively charged mark formed by a miniature high-voltage spark gap is carried away by the flow, acquiring its speed and flying near the receiving electrode, induces electric charges in the latter due to the effect of electrostatic induction. The magnitude of the charge does not remain constant, but changes over time according to an exponential law. Taking into account the properties of the mark, the time signal induced on the electrode is the product of two functions of time,

$$q_H(t) = q_M(t) * f(t),$$

which with the known law of charge change can be written as:

$$q_H(t) = q_0 exp(-\beta * t) * f(t).$$

From the obtained relation it can be seen that the amplitude of the informative signal depends on the time of flight of the mark in the zone of the recording electrode, i.e. is determined by the speed of its movement in the stream. The change in charge per unit of time is the current, and the moment when the sign of the current changes is the moment the mark passes through the middle of the electrode. Knowing the time of flight of the marks to the recording electrode, it is possible to calculate the air flow rate.

With decreasing speed, the time of flight of the tag to the receiving electrode increases. Due to the recombination of ions, the tag loses its charge and, accordingly, the charge induced on the receiving electrode also decreases, which makes it difficult to isolate the useful signal against the background of external interference and internal equipment noise. To expand the working range of the ion-mark sensor in the region of low speeds, designs of receiving electrodes have been developed that ensure the perception of marks with a low charge, as well as circuit solutions aimed at increasing the signal-to-noise ratio.

The existing method of processing a useful signal is reduced to finding the moment of changing the direction of the current, which, taking into account the extremely small generated currents, requires large amplification factors of these currents, which also leads to an increase in the induced noise. The level of the output signal at low speeds is comparable to the level of the induced ones, which greatly complicates the implementation of this sensor.

As mentioned earlier, the main quantity characterizing the position of the mark is the charge, which increases at the moment the mark approaches the electrode, decreases with distance, and at

the moment the mark passes through the middle of the electrode, a maximum charge arises on the recording electrode. This maximum charge is informative.

The charge amplifier is an analog integrator, which is a current amplifier with an integrating RC circuit in feedback. Using this circuit, we give us a scan time limit, which is set once by the characteristics of the circuit. It is also worth noting the scatter of capacitor characteristics and the change in their characteristics over time. Since the current amplifier is devoid of the above disadvantages, you can use it, and use digital integration as an integrator. The rejection of the RC circuit in the amplifier gives us the accuracy of reproducibility, and the use of digital technologies gives us great opportunities in signal processing methods and a large number of data transmission methods, which in turn makes it possible to build portable wireless devices.

Our goal is to expand the speed measurement range to the low-speed region using the integration of the digitized useful signal.

To achieve the goal, the following tasks were set and solved:

1. Construction of a mathematical model of two methods for registering a tag span: finding the moment of changing the sign of the current and finding the moment of the maximum charge;

2. Finding the lowest possible speed for the previously used methods;

3. Implementation of the digital method of integration and subsequent processing of the signal of the ion-mark anemometer;

4. Conducting comparative tests.

As a result of the research and development carried out, a prototype of an ion-meter airspeed meter was created. The measuring circuit is implemented using the stm32f103c8t6 microcontroller (nrf52832 in the Bluetooth version).

The blowdown of the prototype was carried out, the results of which showed that the proposed algorithm for processing the informative signal makes it possible to expand the range to the region of low speeds up to 0.4 m / s.

In conclusion, it should be noted the growth of possibilities in the processing of informative signals with the development of technologies and miniature energy-efficient computers, which made the use of old technologies and methods relevant.

References:

1. Trokhan A.M. Hydroaerophysical measurements. - M.: Publishing house of standards, 1981.- 336p.

2. RF patent for utility model No. 166715, IPC G01P 5/18, Ion-marking meter of air flow velocity / FA Ganeev, TF Ganeev, MR Minnebaev, IR Urazbakhtin. Appl. 04.07.2016. Publ. 10.12.2016. –Bul. No. 34.

УДК 628.165

DESALINATION PLANT FOR EMERGENCIES OR IN SPARSELY POPULATED AREAS

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At all times, fresh water has been considered as one of the most important resources for supporting life on our planet. Every year, the demand for fresh water increases and its quantity decreases. It is unable to resume in a relatively short period of time. Freshwater shortage results in

the reduction of crop yields; increasing incidence of human diseases; dehydration of the inhabitants of the arid regions; increasing mortality of people due to lack of drinking water [1].

This problem can be solved in several ways, for example, by reducing water consumption or creating fresh water storage facilities, but the most popular method of solving the problem of fresh water is the creation of desalination plants. This method is considered to be the most optimal, since the great majority of the population lives in the coastal zone and has access to seawater.

The main methods of desalination of water are without changes and with changes in its aggregate state, but both of them have their drawbacks. Methods without the use of phase transformations do not allow to purify a large amount of water quickly enough, and several stages of purification are required to produce water that can be used as fresh. A common disadvantage of methods using phase transformations is the presence of large heat exchange surfaces, bulkiness and high cost of equipment, incrustation, and corrosion [2]. Therefore, it is not possible to select just one optimal method and assume that it can be used for both stationary and mobile installations. The choice of desalination plant depends on the quality of the source and required water, productivity, economic and technical considerations, and many other factors.

The purpose of our study is to design a desalination plant for seawater desalination by distillation, which enables to carry out processes without incrustation, has small dimensions and a simple structure, does not require complex auxiliary equipment, and is mobile.

The main tasks of our study can be defined as follows:

1) to select a required portable compressor;
2) to perform vortex tube calculations;.
3) to perform thermal calculations of the evaporation process;
4) to perform geometric and thermal calculations of the heat exchanger.

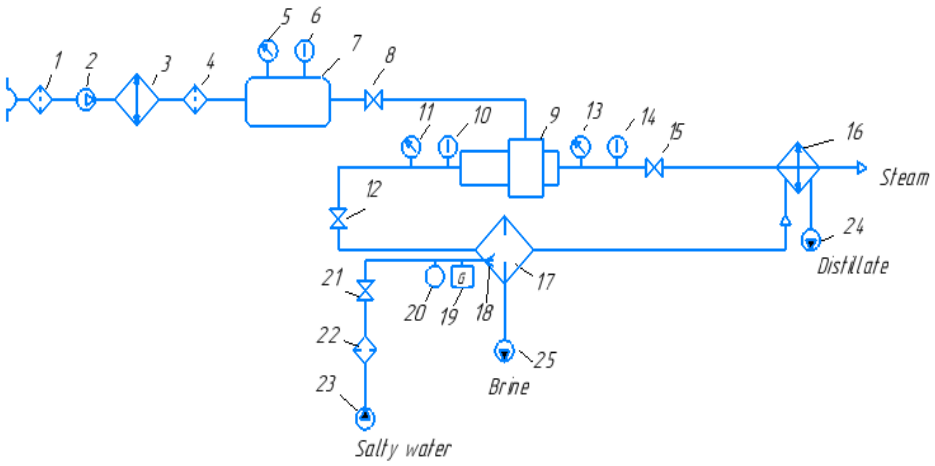

Figure 1. Installation diagram

In figure 1, air from the environment passes through filter 1 and enters compressor 2. Compressor 2 is equipped with a built-in cooler 3. At the outlet of the compressor, we get compressed and cooled air. Then the air passes through the filter 4 and is directed to the receiver 7. A pressure sensor 5 and temperature sensor 6 are installed on the receiver. Then the compressed air enters the Rank-Hilsch vortex tube 9, in the vortex tube the air flow is divided into cold and hot. At the outlet there is a cold stream temperature sensor 14 and a pressure sensor 13. The cold stream passing through the valve 15, enters the heat exchanger-cooler 16, which cools the vapor obtained in a separator 17, and then is released to the environment. The hot flow exiting in the vortex tube 9 also passes the pressure sensor 11 and the temperature sensor 10. Hot air enters the separator 17 through the valve 12. In the separator 17, the desalinated water enters by means of a pump 23, after which it passes into the filter 22, passes through the valve 21 and is sprayed using a nozzle 18. The control unit 20 and a pulse generator 19 allow the process of spraying to be pulsed, as well as to regulate the particle size. Drops that have flown out during the action of the pulse are distributed in

the form of a separate cloud. The flow of warm air exiting the vortex tube 9 passes through the tangential branch pipe, is twisted in the annular gap and through the gaps between the plates is introduced into the inner cavity of the separator. In the separator 17, under the influence of a swirling flow (warm air), the particles of sprayed seawater move along a circular trajectory in suspension, the radial component of the air flow velocity vector in the separator 17 affects the particles of seawater with a force not less than the sum of the centrifugal force and gravity, which allows the particles of seawater to be suspended in the chamber 17 without contacting them with the walls until the particles of seawater turn into water vapor and salt particles. The resulting steam enters the heat exchanger-cooler, condenses, the resulting distillate is pumped out by a pump 24 to the consumer, and the remaining brine in the separator 17 is pumped out by pump 25.

The calculation of installation elements begins with the selecting of a compressor. In our case, oil-injected mobile screw air compressor VK-70 (ASO-VK-5,0/8-PO) is selected. The compressor uses a cf-75d screw unit, a self-contained drive type. Compressor suction capacity is 5.3 m^3/min, for injection 4.5 m^3/min , and maximum working pressure is 8 ATM. The air temperature after the gas cooler is below 50 degrees. Next, we perform the calculation of the vortex tube and the geometric calculation of the heat exchanger.

The designed installation for desalination of seawater by distillation solves the problem of obtaining fresh water in sparsely populated areas or in emergency situations. The selected compressor meets the required conditions - mobility, built-in cooler. The calculation of the Rank-Hilsch vortex tube for producing hot and cold airflow is done. To increase the effectiveness of evaporation process in the separator we use a spray nozzle for desalinated water, the main advantage of which is pulsed spraying. The analysis of the evaporator calculation at different ratios of air and water flow is carried out and the optimal option for our case is chosen. A thermal and geometric calculation of the heat exchanger, designed to condense the formed steam from the evaporator, is performed,

Thus, a replacement for complex and bulky equipment, with installation performance 10.8 kg of fresh water per hour, was found. The unit has a simple design, mobility and the ability to work in any environment with the access to energy sources.

References:

1. Ecological portal [Electronic resource] Access mode: https://ecoportal.info/problema-presnoj-vody/, free. - (date of access: 04/14/2017).

2. Frog, B.N. Water treatment. / B.N. Frog, A.P. Levchenko /. Moscow: Moscow State University Publishing House, 1996.680 p.

УДК 536.423

THE DEVELOPMENT OF CRYOGENIC FUEL REGASIFICATION METHOD OF A COMBINED TYPE

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Nowadays, natural gas is one of the main types of fuel, which is used almost everywhere: in industry, transport, social infrastructure [1, 2]. However, the wide use of this energy resource is often limited by the high costs of its transportation, the need to build huge networks of pipelines. That is why, the connection to natural supply gas networks of a small village, for example, can result in sufficient time and financial costs.

To solve this problem, a system for transportation of liquefied natural gas (LNG) is being actively developed, which, in turn, can help to solve some specific problems [1, 2]. First of all,

natural gas in its liquefied state, can be transported and delivered almost anywhere by any means of transport in specialized containers called cryo-tanks. LNG can also be used as fuel for various types of transport, including aviation, rocket and space technologies. During the process of liquefaction, natural gas decreases in volume by about 600 times, and this allows either to reduce the size of reservoirs, or to transport a larger amount of gas while maintaining their size [1].

Being quite new, gas liquefaction technology faces some technical problems, such as insufficient performance of manufacturer's fitting as well as consumer's fitting. One of the main problems is the loss of the cooling capacity of the fuel during its transportation due to heat influx to the equipment elements.

The purpose of our work is to develop a method of natural gas regasification with simultaneous cooling of a cryogenic liquid.

Two main methods of regasification known today are: regasification proceeding due to external heat supply and regasification due to the loss of internal energy [3].

Based on information research [1,2,3] and analysis of patent information, a combined method of regasification of cryogenic liquid was developed and proposed, in which the following technological processes are sequentially carried out:

- supply of cryogenic liquid from the storage tank forcibly or under pressure of saturated vapors into the throttle device;

-adiabatic expansion of the liquid in the throttle device to a pressure lower than the saturation pressure corresponding to the liquid temperature, with the formation of a two-phase vapor-liquid flow;

- separation of the vapor-liquid flow in the separator into liquid and vapor phases, the temperatures of which, due to the partial evaporation of the liquid, will be less than the initial temperature of the liquid;

- forced return of the separated liquid to the storage tank of the cryogenic product, and the supply of steam to the consumer through a recuperative heat exchanger, mounted in the storage tank.

Due to step-by-step transformation from the liquid to the vapor phase, it is possible to avoid the occurrence of such modes of heat transfer which cause a crisis of heat transfer, when the liquid is heated in recuperative heat exchangers, as well as pulsation of the flow rate and parameters of steam in consumers' pipelines.

The proposed method of regasification of liquefied natural gas makes it possible to provide power plants with gaseous fuel in dynamic load modes and at the same time increases cooling capacity of cryogenic fuel systems and increases the utilization rate of cryogenic fuels, which proves the relevance of the study.

References:

1. Shkarovsky, A.L. Gas supply. The use of gas fuel: a tutorial / A.L. Shkarovsky, G.P. Comina. / Saint Petersburg: Lan, 2019 .-- 140 p.

2. Shibeko, A.S. Gas supply: a tutorial / A.S. Shibeko. / Saint Petersburg: Lan, 2019 .-- 520 p.

3. Tonkonog, V.G. Regasification of low-boiling hydrocarbon fuels / V.G. Tonkonog, S.N. Arslanova, A.L. Tukmakov, N.A. Tukmakova // Izvestiya vuzov. Aviation equipment, 2019. Section No. 4. 144-149.

УДК 62

INVESTIGATION OF THE RADIATION EFFECT ON A 14-BIT DAC PERFOMANCE

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In this paper, the influence of changes in the MOSFET threshold voltage on the 14-bit DAC performance is studied. It has been found that described circuits are practically not affected by changes in threshold voltages.

Digital-to-analog converters (DACs) are widely used in the military sphere, where they need a guarantee of proper operation under the influence of special factors, including increased radiation background.

Radiation has a significant effect on the MOSFET characteristics: the process of ionization leads to the surface states formation and the accumulation of charge in the dielectric, which changes the threshold voltage of the transistor and reduces the steepness of the output I – V characteristics [1].

In addition to a general dynamics slowdown due to a decrease in the steepness of the I – V characteristics of all MOS transistors, there is a problem of dynamic characteristics decrease and even a violation of the operation logic due to a change in the voltages levels of the supply stabilizer, which has a circuit, shown in fig. 1.

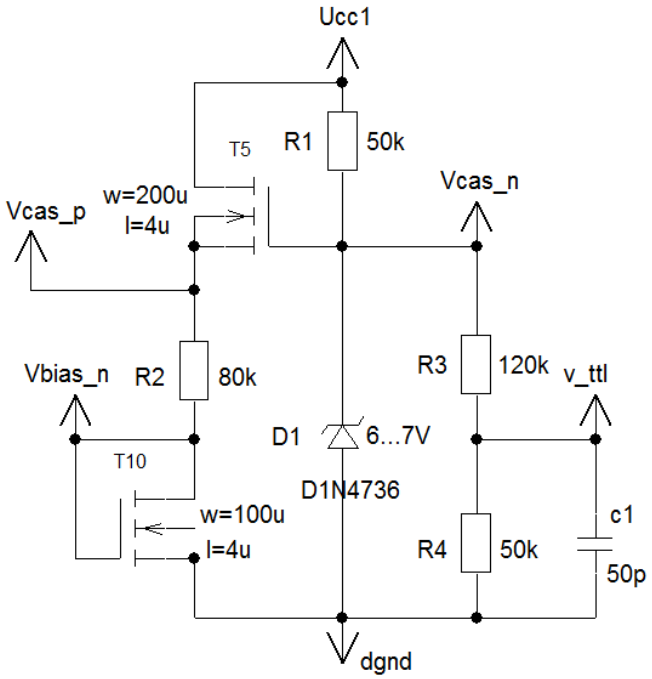

Figure 1. The supply stabilizer circuit

The Vbias_n is a voltage level that is almost equal to the threshold voltage of the n-MOSFET and is used in the level converter block. Therefore, this voltage level should not be constant when exposed to radiation, but should change in the same direction as the change in the threshold voltage of n-MOSFETs. This requirement is satisfied when using a transistor in diode switching, so that the level Vbias_n exceeds the current threshold voltage of n-MOSFETs by a fixed value determined by the resistor R2.

The proposed circuit solutions were investigated using PSPICE modeling in the OrCad 9.2 environment, the result is shown in fig. 2.

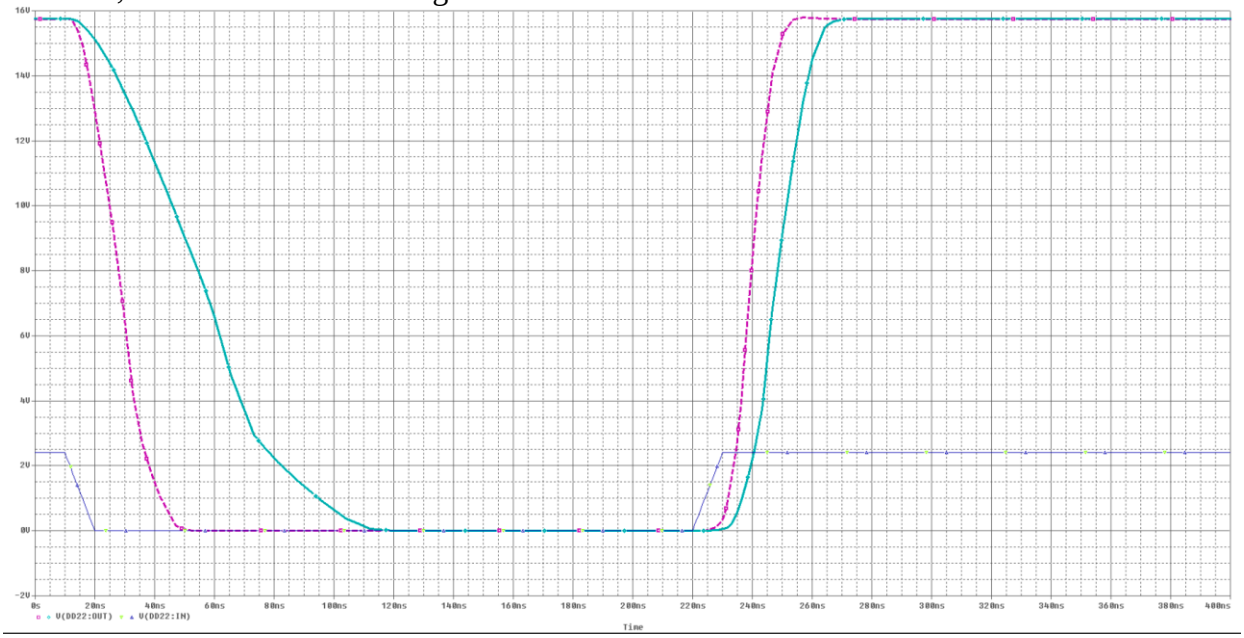

Figure 2 – The time diagram of a level shifter circuit. The solid line is the output signal at a threshold voltage of n-MOSFET 1.8 V, the dashed line at 1.3 V (normal conditions)

One can see from the plot that output voltage line at V_T = 1.8 V has the same pattern, but slightly differs on fall and insignificant differs on rise from the line at V_T = 1.3 V (normal conditions).

As a result of modeling with changing threshold voltages, the level converter and the supply stabilizer circuits showed operability and minor changes in the dynamic characteristics. The conclusion here is that considered changes in n-MOS threshold voltage have little effect on studied device performance and do not obstruct its correct operation.

References:

1. S.V. Pushkarsky Experimentalnie issledovaniya vozdeistviya radiacii na VAH transistorov MOP. [Experimental studies of the radiation effects on the I – V characteristics of MOS transistors]: / Lesnoy Vestnik [Forestry Bulletin], – 2009. – V. 6. – P. 106 – 110.

УДК 629.7.05.67

METER OF INCOMING AIR VALUE AND DIRECTION ANGLE

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Analysis of helicopter accident data [1] shows that most of them are associated with the helicopter overturning on its side in the parking lot and at the stages of launching the engine when the flight restrictions on the magnitude and direction of the wind speed vector are exceeded, with the collision of the tail rotor blades with the earth's surface due to lack of information on the magnitude of the wind speed and direction. For this purpose, it is proposed to construct a measuring device for the magnitude and angle of the direction of the incoming air flow.

Figure 1 shows the structural and functional diagram of the meter of incoming air value and direction, where the ultrasonic measuring channels are implemented using combined emitter-receiver pairs and frequency-packet ultrasonic signals [2].

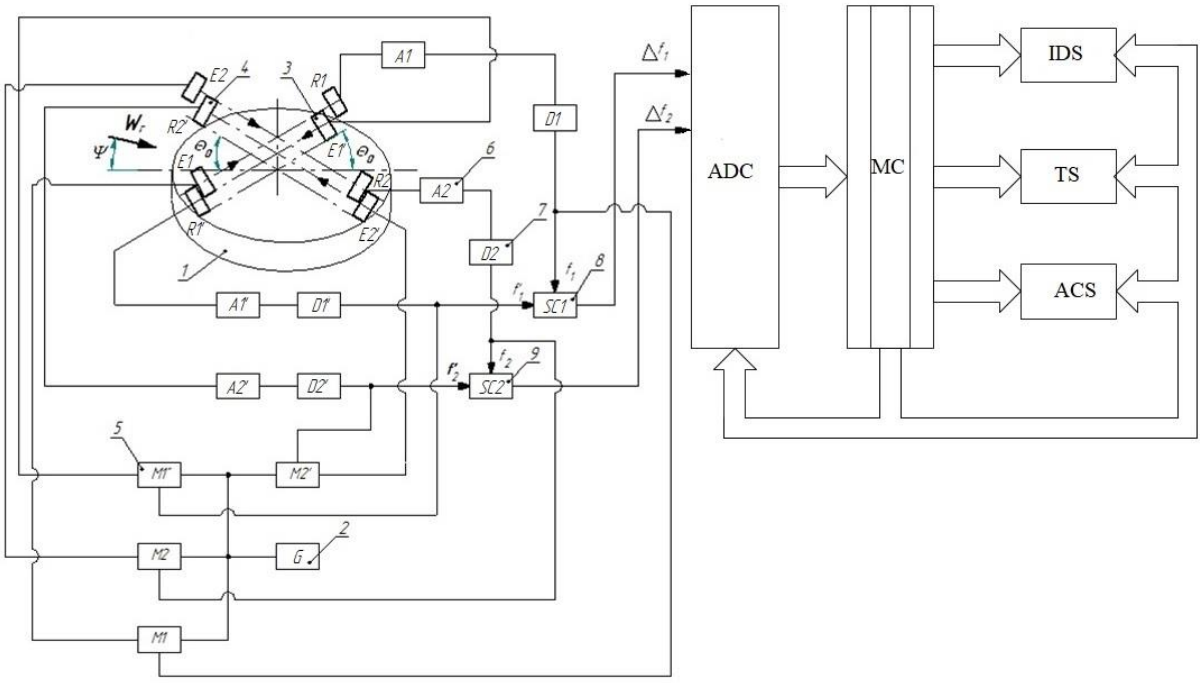

Figure 1 - Structural and functional diagram of the meter of incoming air value and direction angle with ultrasonic measuring channel.

Ultrasonic measuring channels include a board *1* on the external surface, streamlined by an air flow W_Γ, two pairs *3* and *4* of combined piezoelectric emitters-receivers $E_1 - R_1$, $E_1' - R_1'$ and $E_2 - R_2$, $E_2' - R_2'$ are installed. Emitters *3* E_1 and R_1', E_2 and R_2' through modulators *5* M_1 and M_1', M_2 and M_2' are connected to a generator of *2 G* sinusoidal oscillations of high frequency (10 MHz). The combined piezoelectric emitter-receiver pairs $E_1 - R_1$, $E_1' - R_1'$ and $E_2 - R_2$, $E_2' - R_2'$ are installed at an angle Θ_0 to the axis of symmetry of the receiving board, relative to which the positive values of the direction angle Ψ are counted clockwise. Perceived by piezoelectric receivers R_1, R_1' and R_2, R_2' ultrasonic vibrations with frequencies f_1, f_1' and f_2, f_2' are amplified by amplifiers *6* A_1, A_1' and A_2, $A_2'$and are distinguished by detectors *7* D_1, D_1' and D_2, D_2'. The frequencies of ultrasonic vibrations f_1 and f_1', allocated by detectors D_1 and D_1', are fed to the input of the subtraction circuit 8 SC1, at the output of which the difference $\Delta f_1 = f_1 - f_1'$ is formed. Frequencies f_2 and f_2' allocated by detectors D_2 and D_2' are fed to the input of the subtraction circuit *9* SC2, at the output of which the difference $\Delta f_2 = f_2 - f_2'$ is formed. The frequency differences Δf_1 and Δf_2 are informative signals of ultrasonic measuring channels, according to which, in reference to the algorithms considered below, in the microcontroller the value of the velocity W_Γ and the angle of its direction of the incident flow are determined, which are subsequently transmitted to information display systems, technical systems and automatic control systems.

The operation of ultrasonic measuring channels is based on the difference in the transit time of sound vibrations of the combined emitter - receiver pairs.

With regard to the combined emitter-receiver pair $E_1 - R_1$, $E_1' - R_1'$ when measuring the speed W and the angle of direction Ψ of the horizontal vector of the speed of the incoming air stream W_Γ, the time of passage of sound vibrations from the emitter to the receiver will be determined by the ratios:

$$t_1 = \frac{L}{a + W\cos(\theta_0 + \Psi)};\ t_1' = \frac{L}{a - W\cos(\theta_0 + \Psi)}; \qquad (1)$$

$$t_2 = \frac{L}{a + W\cos(\theta_0 - \Psi)};\ t_2' = \frac{L}{a - W\cos(\theta_0 - \Psi)}, \quad (2)$$

The electrical vibrations created at the outputs of piezoelectric receivers *П1*, *П1*' и *П2*, *П2*', passing through amplifiers A_1, A_1' and A_2, A_2' and detectors D_1, D_1' and D_2, D_2', are sent to modulators M_1 and M_1', M_2 and M_2' operating in trigger mode. The modulators close the passage of oscillations from the generator *G* to the piezoelectric elements of the emitters E_1, E_1' and E_2 and E_2' and the sending of ultrasonic vibrations stops. Modulators M_1 and M_1', M_2 and M_2' reopen after the last ultrasonic vibrations of the first pulse packets reach the piezoelectric elements of receivers R_1, R_1' and R_2, R_2' and the supply of electrical vibrations to the modulators stops.

The inputs of the subtraction circuit *8* SC1 and the subtraction circuit *9* SC2 will receive processes with frequencies f_1, f_1' and f_2, f_2', determined by the relations:

$$f_1 = \frac{a + W\cos(\theta_0 + \Psi)}{L};\ f_1' = \frac{a - W\cos(\theta_0 + \Psi)}{L}; \quad (3)$$

$$f_2 = \frac{a + W\cos(\theta_0 - \Psi)}{L};\ f_1' = \frac{a - W\cos(\theta_0 - \Psi)}{L}. \quad (4)$$

At the output of the subtraction circuits *8* SC1 and *9* SC2 informative signals of ultrasonic measuring channels are formed in the form of a frequency difference

$\Delta f_1 = f_1 - f_1'$ and $\Delta f_2 = f_2 - f_2'$, defined by relations of the form

$$\Delta f_1 = \frac{2W}{L}\cos(\theta_0 + \Psi);\ \ \Delta f_2 = \frac{2W}{L}\cos(\theta_0 - \Psi); \quad (5)$$

As a result, the analytical dependence for determining the speed of the incoming air flow *W* and the angle of its direction Ψ in the ultrasonic measuring channels has the form:

$$W = \frac{L}{2}\sqrt{\Delta f_1^{\,2} + \Delta f_2^{\,2}};\ \Psi = \operatorname{arctg}\frac{\Delta f_2 - \Delta f_1}{\Delta f_1 + \Delta f_2}. \quad (6)$$

The obtained ratios determine the algorithms for processing the information of the ultrasonic measuring channels of the measuring instrument of the magnitude and angle of the direction of the incoming air flow with the ultrasonic measuring channel.

References:

1. M. A. Erusalimsky, V. N. Egorov, Information support for helicopter // Aviasoyuz, No. 2, Moscow, 2011, pp. 24-25.

2. Nikitin, V.M. Soldatkin, System for measuring the parameters of the wind vector and true airspeed // Sensors and systems, No. 3, Kazan, 2015, pp. 48-54.

УДК 004.032.26

APPLICATION OF NEURAL NETWORKS FOR PROCESSING AUDIO SIGNALS

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Audio classification is a fundamental problem in audio processing. Basically, the challenge is to extract some markers from the audio and then figure out which class the audio belongs to. Audio signal processing is a complex area for many reasons. One of them is the need for adequate presentation of incoming data. In addition, some encodings create artifacts that can mislead the automatic analyzer.

For further work with the input data, it is necessary to divide it into segments using the discrete Fourier transform. When both the function and its Fourier transform are replaced with discretized counterparts, we get the discrete Fourier transform (DFT). After breaking down into

segments, it is necessary to determine which segment is of interest to the researcher. Depending on the task, this can be a certain pitch, timbre, etc. ... Highlighted indicators can be used for classification.

Recommender systems help you cope with information overload by automatically recommending new music to listeners. Content providers like Spotify and Saavn have developed sophisticated music recommendation engines. [1, p. 1]. These models use the user's past listening history to create recommendation lists.

Spotify relied heavily on collaborative filtering to create its recommendations. The idea behind collaborative filtering is to determine user preferences based on usage data. This information can be used to make recommendations. Collaborative filtering approaches do not use any information about the recommended items: they are content-independent. This makes these approaches widely applicable. Unfortunately, this also turns out to be their biggest disadvantage. Because of their reliance on usage data, popular items will be easier to recommend than unpopular items because more data is available about them. This can make the recommendations boring and predictable.

This is why using neural networks to analyze content itself may actually be a more attractive approach. For basic analysis, a deep neural network, consisting of only two convolutional layers and two fully connected layers, may be suitable, but if you have a larger dataset, it makes sense to add additional hidden layers, which will allow you to achieve more accurate predictions [2].

References:

1. Michael A. Nielsen. Neural Networks and Deep Learning// Determination Press, 2015. C. 12–13.

2. Ian Goodfellow, Yoshua Bengio, Aaron Courville. Deep Learning (Adaptive Computation and Machine Learning series)// The MIT Press,2016. C.665–666.

УДК 67.017

DEVELOPMENT OF COMPOSITE MATERIALS OF REDUCED FLAMMABILITY FOR AVIATION INDUSTRY

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The share of composite materials used in aviation industry is growing rapidly and today its number reaches 40-50%. However, the use of polymer composites instead of aluminum alloys can affect negatively on the safety of the structure, which can be comparable to adding several tons of combustible substance with calorific value close to kerosene to a fire site [1]. The flammability risk of using polymeric materials significantly slows down the process of introducing innovations in many areas of production. Polymer materials, when exposed to a strong flow of heat and flame, not only ignite quickly, but also spread the flame over the surface. Recently, strict requirements for fire safety have been imposed by the State Fire Control authorities. Many countries have already adopted special restrictions on the use of combustible polymer materials in civil and industrial constructions, in the production and operation of vehicles (airplanes, cars, buses, trolleybuses, trams, railway cars, ships), at power plants and in electrical networks, in space and cable industry.

Therefore, the creation of fireproof materials, as well as the reduction of flammability and combustibility of polymers remains one of the urgent problems of modern production, and is especially important for territories with a large number of industrial enterprises of aviation and other branches of transport industry that require the use of composite materials.

At present, all existing methods for reducing flammability and combustibility have a number of disadvantages, since the improvement of one of the properties almost always leads to the

deterioration of others. In addition, the introduction of additives that reduce the fire hazard of polymeric materials can lead to deterioration in physical, mechanical, dielectric and other operational and technological characteristics, as well as to an increase in the cost of the material [2]. To reduce flammability, a large number of various phosphorus compounds are used as fire retardants. One of the new effective ways to reduce the flammability of polymeric materials is the introduction of phosphorus-based flame retardants into their composition. In this case, additives that are directly embedded in the polymer structure are more promising. In this regard, phosphorus-containing epoxy oligomers - glycidyl esters of phosphorus acids - are of great interest [3]. These compositions can be promising as binders for obtaining polymer composite materials with reduced combustibility.

The aim of this work was to study the possibility of using glycidyl esters of phosphorus acids as binders with reduced flammability in the manufacture of aircraft products. The objects of the research are glycidyl esters of phosphorus acids - triglycidyl phosphate, glycophon, glycephate, amine aromatic hardeners.

The objects under the study were investigated in different ways. The rheological characteristics of the investigated compositions were studied on a RheoStress RS6000 (HAAKE) rotary dynamic rheometer. The system curing process was investigated by IR spectroscopy and differential scanning calorimetry. The elastic modulus and glass transition temperature, which were determined by dynamic mechanical analysis on a DMA Q800 analyzer, are important characteristics of a polymer binder for PCM. The fire resistance characteristics of the cured binders were determined according to GOST 21207-81 “Plastics. Method for determining flammability ". Determination of the burning rate and coke yield showed that GEF-based polymers are low-combustible and self-extinguishing.

In response to the results of the study the compositions and modes of curing of the compositions, which could be used as binders for polymer composite materials, were selected. All of glycidyl ethers of phosphorus acids studied in the research can be used as binders. All of phosphorus-containing epoxy oligomers under the study provide a high glass transition temperature and elastic modulus after curing with aromatic amine hardeners. Optimum curing temperatures were selected based on the DSC data. Thus, it was shown that glycidyl esters of phosphorus acids are effective flame retardants for epoxy polymers.

As an example product to be made from the obtained composite material a load-carrying element of a frame of the aircraft seat unit was chosen. It is not by chance that the product was chosen from aviation industry, as the main goal of manufacturing this product from composite materials is to reduce the total weight, which is extremely important in aviation and will undoubtedly play a positive role. The unit itself also plays an important role in aircraft construction, because the strength, reliability and safety of seats for aircraft passengers directly depend on it. It is a hollow round tube.

The development of a 3D model of the product was carried out using the NX program - the flagship CAD / CAM / CAE system manufactured by Siemens PLM Software. For shaping the product, a shaping tooling was also designed.

Thus, we can conclude that:

- Based on the conducted studies of the rheological, fire-resistant and thermophysical properties of glycidyl esters of phosphorus acids, their ability to act as a binder for a composite material of reduced combustibility was revealed, since they have low viscosity, retain it during the entire impregnation process, and the cured matrix has the required level strength and rigidity.

- Based on the obtained results, suitable compositions and modes of curing compositions based on glycidyl ethers were selected. Thus, the most successful combination turned out to be a composition based on triglycidyl phosphate and the hardener DETDA.

- The process of creating a tube of a load-carrying frame of the aircraft seat unit from the obtained material has been modeled.

- The possibility of using the obtained material on an industrial scale was identified.

References:

1. Barbotko S.L. Fire safety of aviation materials / S.L. Barbotko // Aviation materials and technologies. - 2012 - No. 9. P. 431–439

2. Babin A.N. Binders for new generation polymer composite materials / A.N. Babin // Proceedings of VIAM. - 2013. - No. 4.

3. Suprakas Sinha Ray, Malkappa Kuruma. Halogen-Free Flame-Retardant Polymers. Next-generation Fillers for Polymer Nanocomposite Applications. Springer International Publishing, - 2020. - 113 p. DOI 10.1007/978-3-030-35491-6

УДК 621.31

DYNAMIC COMPENSATOR OF VOLTAGE DISTORTION FOR INDUSTRIAL POWER SUPPLY SYSTEMS

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Nowadays the problem of the quality of power supply is becoming more and more urgent due to the increase of the number of electricity consumers, the complication of technological processes of enterprises and the increase of automation equipment. The main causes of power supply disruption of consumers are short circuits, voltage dips, overvoltages, impulse voltages, etc. A high-quality power supply failure is the main reason of such undesirable consequences as damage to expensive equipment, product defects, personnel injuries and environmental pollution.

One of the solutions of this problem is the use of a special system a dynamic compensator of voltage distortion. The main goals of this device are elimination of phase asymmetry and nonsinusoidality in the normal operation of the power supply system of the enterprise, ensuring reliable and continuous power supply to consumers due to the IGBT converter and booster transformers in the event of emergency and abnormal modes in electrical networks. The operation diagram of the dynamic compensator of voltage distortion is shown in Figure 1.

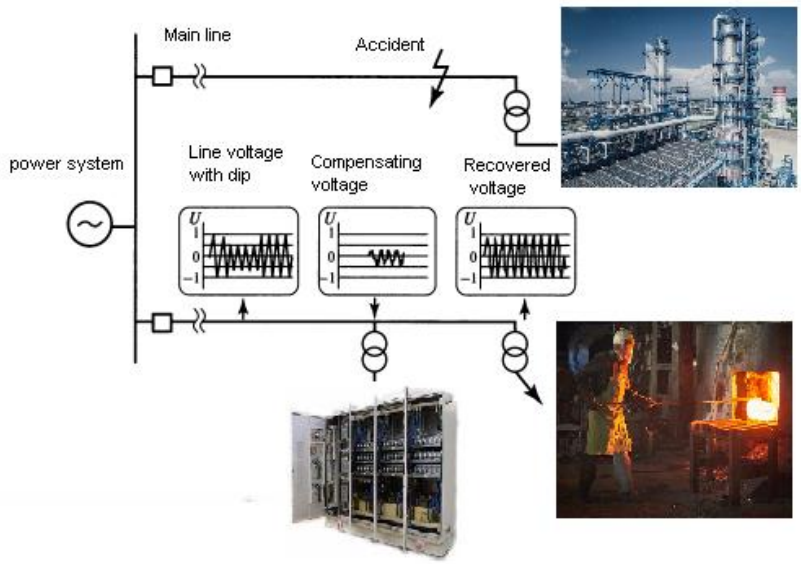

Fig.1. Diagram of the operation of the dynamic compensator of voltage distortion in the event of a power failure

The control system continuously monitors the supply voltage and compares it with a predetermined voltage threshold. If the supply voltage is less than the specified value, the voltage source converter immediately starts to inject the differential voltage and maintain the rated voltage on the load side. The dynamic compensator of voltage distortion is a device with a double voltage conversion the input of which is connected to the power supply system. The output is connected to the load through a controlled inverter and a booster transformer. The secondary winding of the booster transformer is connected in series with a three-phase load. The voltage is induced in this winding to compensate for the voltage drop in the power supply system.

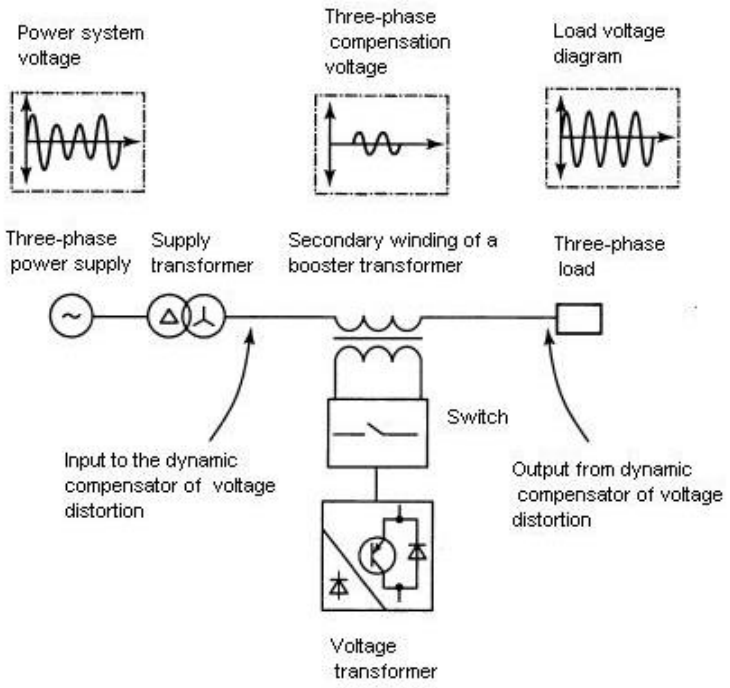

Fig. 2. Electrical work diagram of the dynamic compensator of voltage distortion

This device provides full compensation for voltage dips within the nominal range at overcurrent levels of 200% for at least 30 s, partial correction for three-phase voltage dips up to 50% and single-phase dips up to 55% for at least 30 s. The response to short-term power outages is much higher than that of similar voltage correcting devices.

The result of the use of a dynamic compensator of voltage distortion the power supply is carried out without interruption and is maintained within a nominal value. A dynamic compensator of voltage distortion is cheaper than uninterruptible power supplies for use in power supply systems up to 1000 V. The power of such a device designed for a voltage of 380 V is one third less than the rated power of an uninterruptible power supply used for the same purposes.

References:

1. Zolotov I.I., Zolotova L.P. Dynamic Supply Voltage Distortion Compensator for Processing Equipment. Proceedings of the IV International Scientific and Technical Conference (Reznikov Readings). 2015. pp. 230-236.

2. Glibin E. S., Shevtsov A. A. Modelling the Functioning Of Compensation Systems In Resistance Welding Equipment. Welding International. 2010. V. 24. № 12. pp. 969-972.

УДК 616-71

DEVICE FOR MEASURING THE EFFORT OF THE MAXILLOFACIAL MUSCLES

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Language advisor: E.Yu. Lapteva, Associate Professor
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Dentistry has always played a very important role in human life. Therefore, it is very important to diagnose and prescribe treatment in time for most diseases of the oral cavity [1], [2].

For example, without accurate data on periodontal endurance, we plan pressure on the supporting teeth at random. Therefore, an adequate load is not always created, and more often periodontal tissues are overloaded, which leads to their dystrophy, followed by more severe, irreparable losses in the form of tooth destruction and irreversible processes in the underlying tissues [4], [5].

Based on the existing conditions, the elimination of this disadvantage is very relevant. Therefore, the purpose of this work is to create a gnathodinamometer device for determining the functional state of the maxillofacial system.

Selection of the method and justification of the structural scheme of the device

Among the available methods of functional characterization of periodontal teeth for orthopedists, methods for determining the threshold load on the tooth and the degree of its mobility are of particular importance.

For more than a century, the threshold value of the load on the tooth has been used for the functional characteristics of periodontal teeth. For this purpose, different methods have been applied [3].

To simplify the method of determining the effort of the maxillofacial muscles, you need a simple, affordable, not time-consuming and not expensive hardware method.

One of the most effective methods is gnathodinamometry, that is measurement of the force of chewing pressure on the tooth, which is set using special devices-gnathodinamometers.

We propose a gnathodinamometer device with the structural scheme as in figure 1.1.

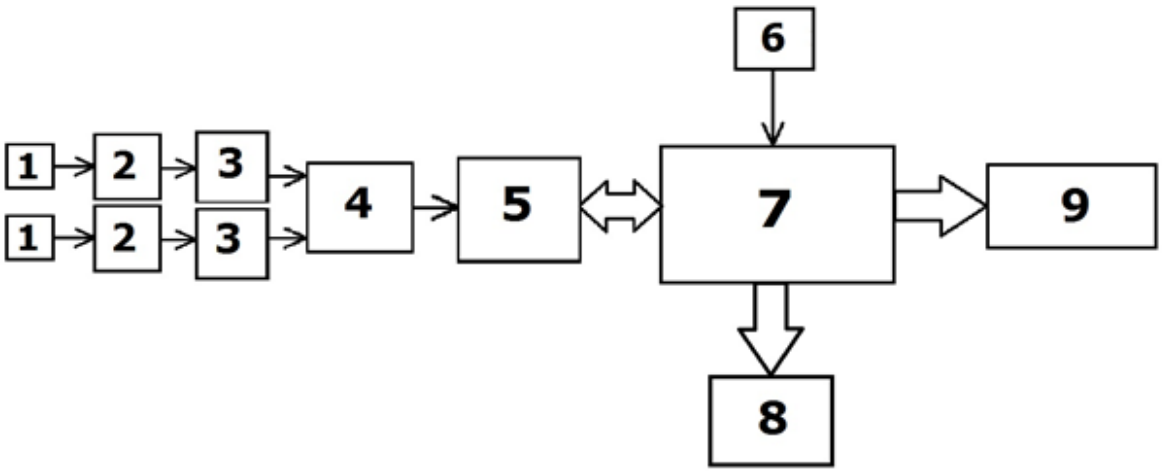

Figure 1.1. Structural scheme of the device for determining the functional state of teeth

A modern gnathodinamometer is an electronic gnathodinamometer, which is constructed on the basis of: 1- sensors; 2-biopotential amplifiers; 3 – low-pass filter; 4-multiplexer. 5-external

analog-to-digital Converter; 6-buttons; 7-microcontroller (MP core). 8-device memory; 9-LCD indicator.

When developing the structural scheme of the device for determining the functional state of teeth, much attention was paid to meet the following requirements:

- functional (measurement error ranges);
- structural and technological (small dimensions and acceptable for the production of structural forms of the main elements of parts);
- operational (ease of use when conducting research and measuring parameters of the functional state of teeth, electrical and sanitary safety, serviceability);
- cost (acceptable cost that ensures competitiveness in the domestic and foreign markets).

Taking into account the opinion of specialists (dentists), as well as a number of experimental studies, we can conclude that it is advisable to develop a device with an operating range of 10-1000 N. the main measurement error, the given value should not exceed 2.5 percent.

Tiny tensoresistive sensors can be used as a sensitive element of the device. The sensors used must be highly sensitive.

Figure 1.2. Example of a miniature compression force sensor F1222

It should be noted that the design of the device should completely exclude the possibility of electric shock to the patient.

The above-mentioned clinical and diagnostic concepts of the dental system, requirements for the design, range, and accuracy can be used as the basis for developing a device for determining the functional state of teeth.

As a result of this work, an electric gnathodinamometer with an optimal structural scheme was designed and the method of its functioning was determined, which defines the functional state of the maxillofacial system. This corresponds to the goal.

This device is a huge step in the development of dentistry, as it is compact and easy to use.

The designed device is still far from being perfect, but it is going to be improved in the future.

References:

1. Gavrilov E. I. Orthopedic dentistry / E. I. Gavrilov, A. G. Shcherbakov. - M.: Medicine, 1984. - 576 p.

2. Kopeikin V. N. Errors in orthopedic dentistry. Professional and medico-legal aspects / V. N. Kopeikin, M. 3. Mirgazizov, A. Yu. Maly. - M.: Medicine, 2002. - 240 p.

3. Zhulev E. N. Fixed prostheses: theory, clinic and laboratory equipment / E. N. Zhulev.- N.: publishing house of the Nizhny Novgorod state medical Academy, 1998. - 365 p.

4. Kopeikin V. N. Orthopedic treatment of periodontal diseases / V. N. Kopeikin. - M.: Triada-X, 1998.-175 p.

5. Kankanyan A. P. periodontal Diseases: new approaches in etiology, pathogenesis, diagnosis, prevention and treatment / A. P. Kankanyan, V. K. Leontiev. - EP.: Tigran Mets, 1998. - 360 p.

УДК 004

APPLICATION OF GENETIC ALGORITHMS FOR SOLVING THE PROBLEM OF STRUCTURAL COMPONENTS OF AIRCRAFT ELECTRICAL EQUIPMENT

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Abstract: The main issues considered in this article: an example of the application of genetic algorithms for solving the optimization problem of the layout of structural components of electrical equipment.

The task of layout of structural units of the aircraft electrical energy distribution system is to combine elements of electrical equipment into structural units. In the modern world, aircrafts are subjected to strict requirements for weight and size characteristics in order to optimize their flight performance.

The solution of the layout problem allows us to formalize the process of placing structural units and to make wiring of electrical circuits. The layout problem is generally formulated as follows: it is necessary to divide the set of elements E to be composed into α disjoint subsets E_s, which constitute an element set of structural nodes.

The most acceptable layout criterion is the criterion for minimizing the number of connections between structural nodes. It reduces the mass of products, minimizes mutual interference, increases reliability, and simplifies the design.

The most common ways to solve this problem are methods based on graph theory. The most trivial and at the same time effective of them are sequential algorithms for composing nodes into sets and iterative algorithms for cutting the graph.

However, there are alternative ways to solve layout optimization problems. One of the most promising and efficient one is to use genetic algorithms. A genetic algorithm is a method that reflects the natural evolution of problem-solving methods, primarily optimization problems. [1,2,3]

The essence of using genetic algorithms is based on the three principles: coding, evaluation, and reproduction.

Encoding refers to the way data is presented in genetic form.

The point of evaluation is to distinguish individuals depending on how "successful" the corresponding encoded solutions are.

The main goal of reproduction is to obtain new candidate solutions from existing ones.

The scheme of the genetic algorithm is shown in figure 1.

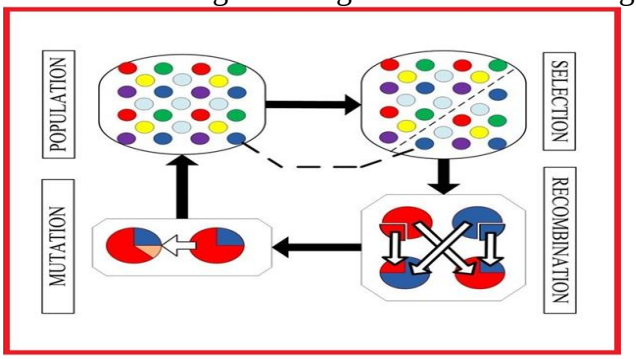

Figure 1-The scheme of the genetic algorithm

The problem of layout of structural units of the aircraft electric power distribution system is one of the possible variants of optimization problems.

Any unconditional optimization problem looks like this:

$$max(min)f(\bar{x}) \text{ , где } \bar{x} = (x_1, x_2 \dots x_n) \quad x_i \in [a, b] \qquad i = \overline{1, n} \qquad (1)$$

, where $f(\bar{x})$ – a maximized (minimized) objective function that has a single global extremum.

By the solution of the problem (1) we mean the range of values $\bar{x} = (x_1, x_2 \dots x_n)$. The optimal solution to the problem (1) is the range of acceptable values of $\bar{x}$, where the objective function $f(\bar{x})$ takes the maximum (minimum) value.

Let's consider the solution of the optimization problem using genetic algorithms, which is applicable to the layout of structural nodes by separate switching bundles. [4,5]

Let's assume that we need to find the global minimum of an arbitrary function that reflects connections between several constructive nodes [0;7].

$$f(x) = x_1 + x_3 + x_2^2 + x_4 + x$$

, where x - is the structural unit of the electric power distribution system of the aircraft with connecting elements (harnesses, cables). For simplicity, let's assume that x takes only integer values, i.e. $x \in \{0,1,2,3,4,5,6,7\}$. This assumption significantly simplifies the presentation, preserving all the main features of the genetic algorithm. If randomly select several numbers on the segment $[0; 7]$: $\{2,3,4,5\}$, we will consider these numbers as trial solutions to our problem.

This algorithm can be represented by four stages (processes), such as encoding solutions in binary form : $\{010, 011, 100, 101\}$ and assigning them the fitness parameter $\{-0.33, 7.25, 10.33, 7.92\}$, selection between selected individuals using the crossing operator, mutation, and the formation of a new population. Taking into account all the changes received during the stages, we will get a new generation presented in table 1.

Table 1 - Formation of a new population of parent and descendant individuals

№	Individuals	Fitness	New population	Fitness of individuals in the new population
1	010	−0,33	001	−5,42
2	011	7,25	010	−0,33
3	101	7,92	110	5
4	100	10,33	011	7,25
5	001	−5,42		
6	110	5		
7	100	10,33		
8	111	12,58		

In this case, taking the fittest individual 001 in the second generation, we can say that the minimum of the objective function is the value 5.42 corresponding to the argument $x = 1$.

We take the most adapted individual from the new population and add it to piece 1, which is physically a switching node of electrical equipment. If you need to place several devices, we can take 2 or 3 of the most adapted individuals.

The use of genetic algorithms is applicable for solving optimization problems, but their mutual application with graph theory algorithms that are specialized for performing certain tasks with the smallest input data will be considered the best.

References:

1. Beyer H.-G., Schwefel H.-P., Wegener I. How to analyse Evolutionary Algorithms. Technical Report No.CI-139/02. – University of Dortmund, Germany, 2002. – 238 p.

2. Panchenko, T. V. Genetic algorithms [Text]: educational and methodological guide / ed. by Yu. Yu. Tarasevich. - Astrakhan: publishing house "Astrakhan University", 2007. – 87 p.

3. Norenkov I. P. Fundamentals of computer-aided design: textbook for universities / I. P.

Norenkov.- 2nd ed., reprint. and add. Moscow: Bauman Moscow state technical University, 2002, 336 p.

4. Norenkov I. P. Information support for high-tech products. CALS-technologies / I. P. Norenkov, P. K. Kuzmik, Moscow: Bauman Moscow state technical University, 2002, 320 p.

5. Kovshov A. N., Nazarov Yu. F., Ibragimov I. M., Nikiforov A.D. Information support for the life cycle of engineering products: principles, systems and technologies of CALS / IPI: textbook. manual for students. higher education institutions / A. N. Kovshov, Yu. F. Nazarov, I. M. Ibragimov [et al.]. - Moscow: Akademiya, 2007. - 304 p.

УДК 159.9

MODIFICATION OF SIGMUND FREUD'S CONCEPTION OF HUMAN PSYCHE IN THE FIELD OF HUMAN ENERGY TRANSFORMATION

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Sigmund Freud's conception of human psyche is a huge part not only in psychology but in social philosophy as well. That conception consists of three main parts presented at Figure 1.

Figure 1 - Elements of Freud's conception

- Id – it is the basis of our Unconscious Mind: instincts, needs. Id is our part from ancient times, from the animal world. In according to Freud, Id includes in itself sexual energy that called libido.
- Ego – it is the basis of our Conscious Mind: something that human can understand, recognize, realize. Ego is the reality.
- Superego – norms, morality, ideals: something created by society with the purpose to control human's behavior.

Id and Superego are always in conflict: Id wants to be satisfied but Superego wants to limit Id. Ego tries to find the solutions for that conflict [1, 2]. Here are the possible solutions:

- Repression – automatic deletion of forbidden thoughts and feelings from Conscious Mind to Unconscious Mind.
- Sublimation – process of sexual energy's transformation to social important and effective activity (creativity).

- Rationalism – search of situation's reasons.

Let's consider sublimation process. The main question here – what is the source of effective activity? Freud's answer is libido energy which related to Id. And what about energy in Ego and Superego? Does that energy exist? If that energy exists, so, why it couldn't be as a source of effective activity? So, we can make a hypothesis that Ego and Superego also has energy elements which don't have a relationship with libido and those energy elements could be classified as a sources of human's effective work.

First novelty in this work is proposing "something we like (to do)" as a source of human energy in Ego mainly because when we are doing something we like to do in reality positive trend have been placed in the terms of spirit. That positive trend also could be evaluated as a motivation power: in according to [3] good mood is the main part of effective work and achievements.

Let's move to Superego. And here is the very relevant question needed to be asked: "Did our society create something that could be classified as a source of human energy?" Of course, it should be consisting of positive (with the purpose to support) or negative (with the purpose to confront) and here are some examples:

- Positive: propaganda of healthy lifestyle, being a volunteer in different fields.
- Negative - injustice.

Let's call those phenomena "Mass energy" and propose it as a source of energy in Superego. That is the second novelty in this work.

Modifications in Freud's conception of human psyche in the terms of human energy transformation presented at Figure 2.

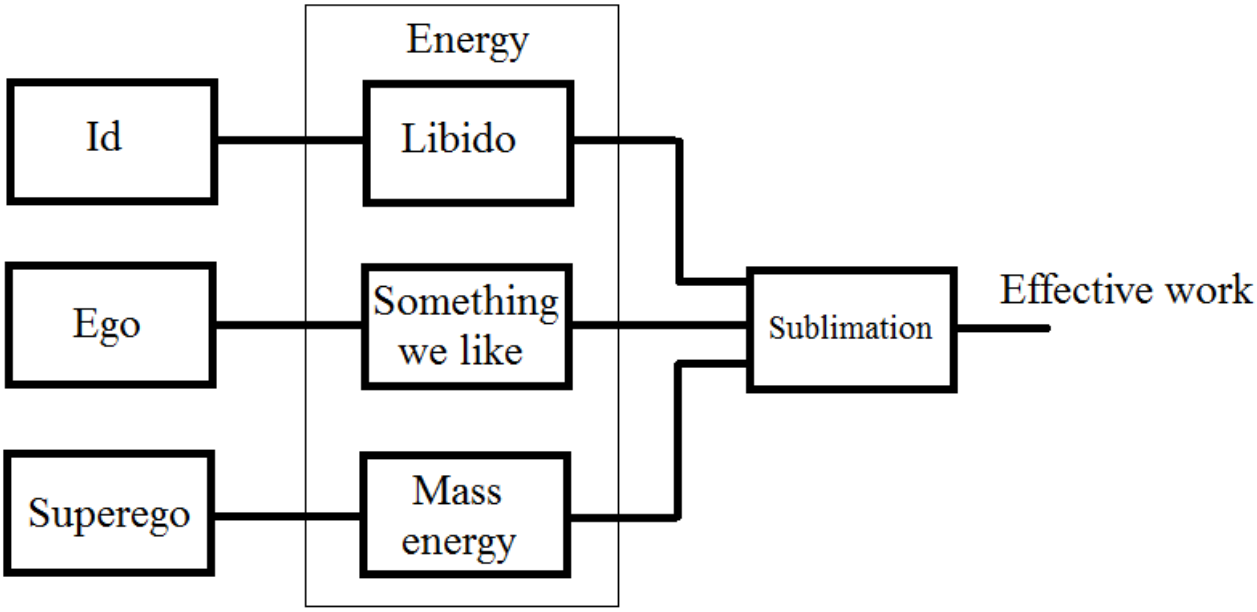

Figure 2 – Transformation of human energy to effective work

Due to presented novelties we can review "sublimation" term: it is a process of human energy's (including sexual energy) transformation to social important and effective activity.

That conception might be practically applicate in the fields of social philosophy, psychology and personal time-management.

References:

1. McLeod S. A. Simply Psychology [электронный ресурс] / S.A. McLeod - Id, ego and superego, 2019, September 25 – Режим доступа: https://www.simplypsychology.org/psyche.html (дата обращения 01.11.2020).

2. Солодухо Н.М. Систематический курс философии: Квинтэссенция: Учебное пособие. Казань: Изд-во Казан, гос. техн. ун-та, 2002. 106 с.

3. Harvard Business Review (Россия) [электронный ресурс] / Т. Амабиле, С. Крамер – Что общего у простых смертных и гениев?, 28 июля 2011 – Режим доступа: https://hbr-russia.ru/karera/lichnye-kachestva-i-navyki/a10999 (дата обращения 01.11.2020).

УДК 621.398

THE RESEARCH OF VENTRICULAR LATE POTENTIALS' PRESENCE AT ELECTROCARDIOSIGNAL USING THE PHASE CRITERION

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Ventricular late potentials (VLPs) are low amplitude signals located at the end of QRS-complex or within the ST-segment at electrocardiosignal (ECS). VLPs' presence could be classified as a marker of future arrhythmias: usually ventricular tachyarrhythmia after myocardial infarction. Ventricular tachyarrhythmia is a form of ischemia. In according to [1] ischemia is the main reason of death in Russian Federation: 24,5 % of cases. That is why the task of VLPs' detection is very relevant.

In [2] we proposed the approach based on getting a phase spectrum of ECS by I standard lead. As a criterion of VLPs' detection we proposed the phase of ECS by I standard lead. There were 50 ECS researched: 25 ECS with VLPs (VLP+) and 25 ECS without VLPs (VLP-).

In this work we increased the samples' statistics to 80 cases: 40 cases for VLP+, 40 cases for VLP-. Averaged phase spectrums for both classes presented at Figure 1.

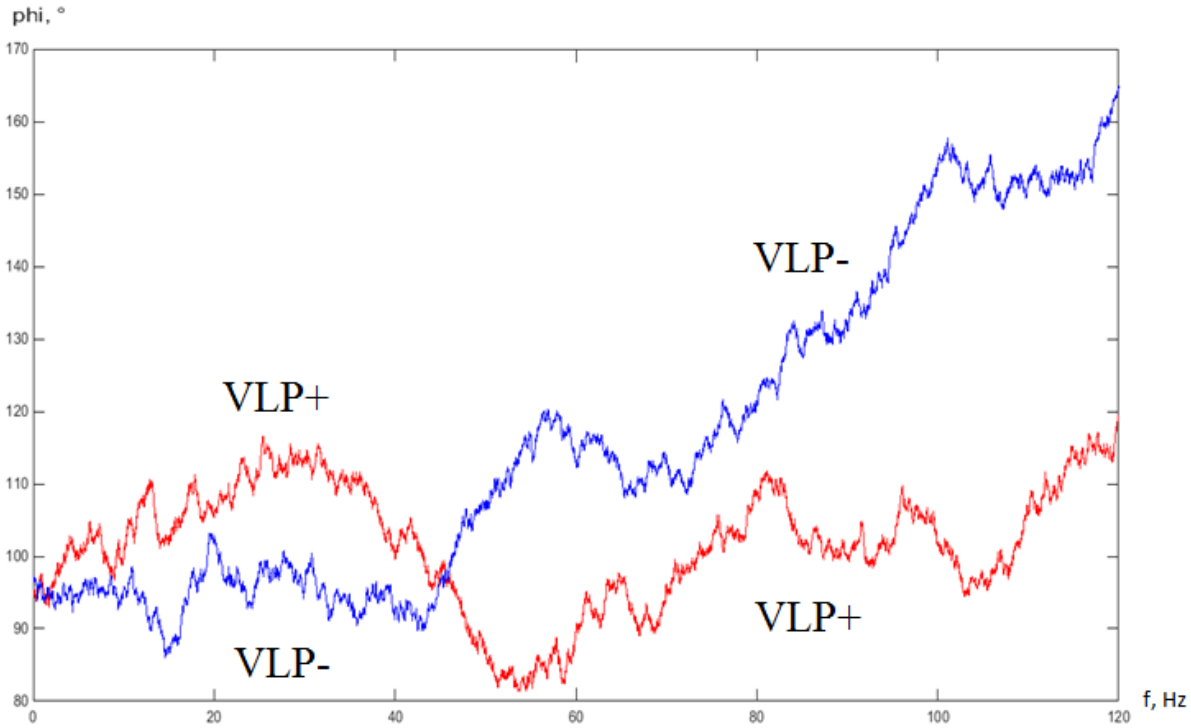

Figure 1 - Phase spectrums for VLP+ and VLP-

As we may see at Figure 1, the differences between the averaged phase spectrums for VLP+ and VLP- are obvious. We can make a hypothesis that VLPs' detection criterion exists: we propose a phase criterion which was mentioned earlier:

$$\Phi = \varphi(f_t),$$

where f_t – threshold frequency.

We choose f_t in according to:

1. The biggest difference between VLP+ and VLP-:

$$\Delta\Phi = |\Phi_{VLP+} - \Phi_{VLP-}|.$$

2. The biggest accuracy of proposed algorithm:

$$Acc. = \frac{TN + TP}{TN + TP + FN + FP} * 100\%,$$

where TN: diagnosis – norm, result of experiment – norm (VLP-); TP: diagnosis – pathology, result of experiment – pathology (VLP+); FN: diagnosis – pathology, result of experiment – norm; FP: diagnosis – norm, result of experiment – pathology [3].

The biggest ΔΦ ≈ 51,028° registered at frequency f = 105 Hz. The biggest Acc. = 60% registered at frequency f = 110 Hz. So, we select f_t = 110 Hz. At that frequency threshold parameter Φ_t = 98,6°, TP = 21, TN = 27, FN = 19, FP = 13. Probability density functions for both VLP+ and VLP- classes at f_t = 110 Hz presented at Figure 2.

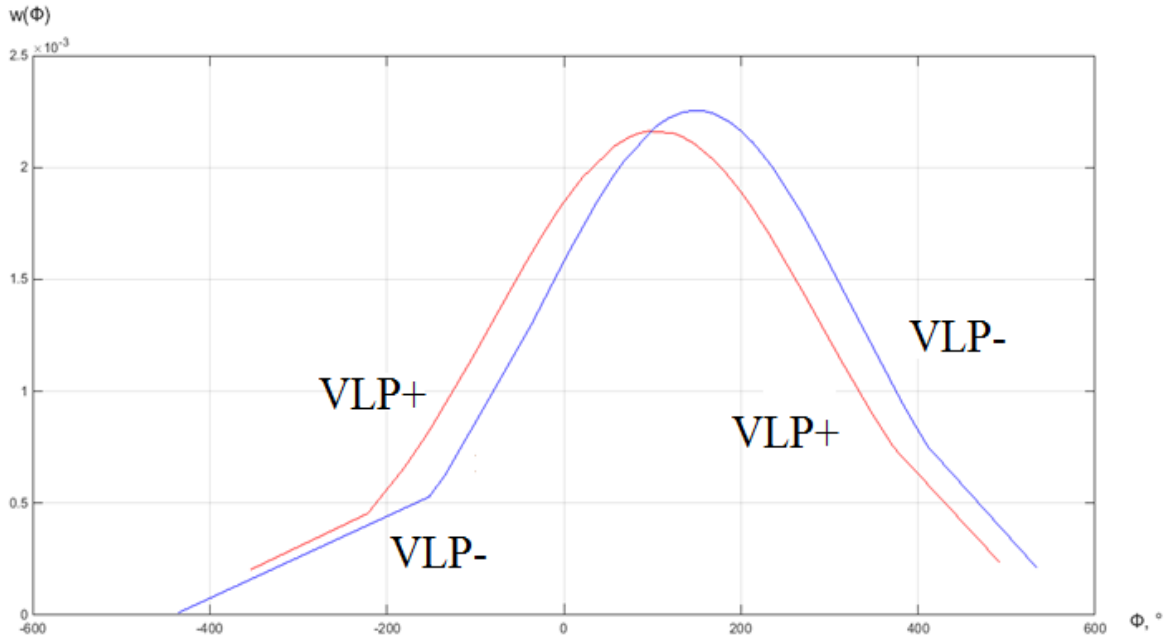

Figure 2 - Gaussian distributions at f = 110 Hz

Main features of phase a criterion of VLPs' detection:

1. Little variety of Φ_t: Φ_t = 95,7° at [2]; Φ_t = 98,6° in this work.
2. High amount of root mean square with frequency increasing.

References:

1. Сведения о смертности населения по причинам смерти по Российской Федерации за январь-март 2020 года [Электронный ресурс]. URL: https://www.gks.ru/free_doc/2019/demo/t3_3.xlsx (дата обращения: 10.11.2020)

2.Mukhametzyanov O.A. Phase as a criterion of low amplitude potentials' detection in the mobile telemedicine system // Английский язык в сфере профессиональной коммуникации: Сборник тезисов докладов 4-й Всероссийской молодёжной научной конференции, Казань, 23 ноября 2018 г.: Материалы конференции. – Казань: Изд-во КНИТУ-КАИ, 2018, с. 70-72.

3. ГОСТ Р МЭК 60601-2-51-2008. Изделия медицинские электрические [Текст] – Москва: Стандартинформ, 2009 – 71 с.

УДК 697

THE USE OF ENERGY EFFICIENT SYSTEMS IN THE DESIGN OF A RESTAURANT COMPLEX

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One of the main tasks facing geotechnical specialists is to increase the efficiency of the applied constructions of buildings and structures through the development and implementation of energy-efficient constructive and technological solutions into construction practice. Energy efficiency is a beneficial (rational) use of energy resources in order to optimize the amount of energy used to maintain a constant level of energy supply to a building or structure [1].

At present, energy efficient constructions of buildings and structures are successfully used in Canada, the USA and most European countries, as well as in countries with tropical climate. In Russia, energy saving technologies have been introduced more intensively into construction practice since 1996, after the adoption of the Federal Law "On Energy Saving". In accordance with the law, a set of regulations was subsequently put into practice [2]. These documents determined tightening of the requirements for the reduced resistance to heat transfer of building envelopes, as well as the classification of buildings and structures by energy efficiency. The rise in prices for thermal energy and energy carriers also determines the need to improve the thermal protection of buildings and structures at the stage of their operation. Despite this, energy efficient technologies are not yet widely used in construction practice in our country [1].

The purpose of this study is to analyze and find possible application of energy efficient solutions in the design of engineering systems on the example of a restaurant complex.

The parameters for outdoor air were taken according to СП 131.13330.2018 [4] based on the geographical location of an object (Russia, The Republic of Tatarstan, Kazan). The building under the study is a multifunctional 3-storey building with a ground floor.

The study began with the development of a structure of layers of a building envelope. Extruded polystyrene foam was taken as a heater. Building envelope design was selected on the base of the required value of thermal resistance in accordance with regulations [2].

The next step was the calculation of heat loss through the building envelope structures, which consisted of heat losses through separate structures in the building. The value of heat loss directly depends on the adopted enclosing structures and the parameters of the outside air [4]. The calculation was carried out with the use of formulas of A.N. Skanavi [5].

Further, the heating system of the restaurant complex was developed. The heating system of the building is connected to the heating networks according to an independent scheme through a block heating station of the company «Danfoss». The selection of the block heat point was carried out using the online selection program from the company «Danfoss». The selected substation is equipped with an automation system, which ensures the energy efficient operation of the system. The calculation of heating devices was carried out according to the recommendations of the scientific and technical firm "Vitaterm" [4]. Thermostatic valves «Valtec» with thermal heads were installed on the connections to the radiators of the heating system. This solution ensures the rational use of thermal energy by maintaining the desired temperature in the room. The hydraulic calculation of the heating system was carried out using the method of specific linear pressure loss.

The next step of our research was the development of a ventilation system of the building, which was based on the required values of air exchange rates, with the exception for rooms being calculated. The ventilation system in the building was performed to be automatic. With the use of temperature measuring sensors, the state of inside air in the room was constantly monitored. In a dancing hall, located on the 1st floor of the building, heat recovery in a plate recuperator was

applied. This solution is energy efficient due to the heat transfer from the extract air to the supply air.

The graphical representation of design solutions was carried out in the graphical editor AutoCad 2016.

Thus, the use of automation systems, recuperation, effective enclosing structures made it possible to perform the desired object in an energy-efficient design. Having applied energy efficient solutions in our research, we have achieved an adequate economical effect of energy resources.

References:

1. Энергоэффективные конструкции в строительстве [Электронный ресурс] : электрон. учеб. пособие / А.В. Захаров, Е.Н. Сычкина, А.Б. Пономарев. – Пермь : Изд-во Перм. нац. исслед. политехн. ун-та, 2017. – 103 с.

2. СП 50. 13330.2012. Свод правил. Тепловая защита зданий. Актуализированная версия СНиП 23-02-2003. Тепловая зашита зданий / Минрегион России. – М.: ФАУ «ФЦС», 2012, - 88 с.

3. Рекомендации по применению алюминиевых и биметаллических секционных отопительных радиаторов «Vivaldo» – научно-техническая фирма ООО «Витатерм», 2014.

4. СП 131.13330.2018. Свод правил. Строительная климатология. Актуализированная версия СНиП 23-01-99*. Строительная климатология / Минрегион России. – М.: ФАУ «ФЦС», 2012. – 109 с.

5. Сканави, Александр Николаевич: Отопление: Учебник для студентов вузов, обучающихся по направлению «Строительство», специальности 290700/ Л.М. Махов. М.: АСВ, 2002. - 576 с.

УДК 81

BROUGHT INTO BEING BY PANDEMIC: COVID-ASSOCIATED NEOLOGISMS AND OCCASIONALISMS IN ENGLISH

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Covid-19 pandemic, which broke out in 2020, divided the life of entire humanity into before and after. The social environment has changed drastically, including the standards of living, acting, handling daily tasks. The language, being the central means of expression, has been no exception either. The mankind, having come across the new phenomena, swiftly produced a series of brand-new terms and lexical units, mirroring the unfolding thrilling events.

These terms, newly coined, deserve receiving particular attention because of the number of reasons. First, they convincingly indicate the strong bond between the language and the social consciousness, illustrating the ability of the former to quickly illustrate the changes, taking place within the tissue of the latter. Second, they appear to be increasingly instrumental from the linguistic viewpoint, allowing the scholars to analyze the productivity of concrete word building types.

The most obvious linguistic novelties are those words, which derive proximately from the proper name of the disease, sharing its root: covid-. For example, modern dictionaries have not long ago added up such lexical units, as: *‘covidiot’, ‘coroned’, ‘be/get coroned’, ‘coronic’, ‘coronials, ‘covidivorce’, ‘covodicide’*. The Urban Dictionary website provides the following definitions:

1. covidiot (blending, Covid + idiot): someone who ignores the warnings regarding public health or safety. A person who hoards goods, denying them from their neighbors; [3]

2. coroned (noun-type affixation, compare: bipatride, apartheid; the original terms adds the suffix, thus becoming a slangy noun, used for referring to someone, who has been infected with the notorious virus. Also here: be/get coroned – to catch the ailment in question); [3]

3. coronic (adjective-type affixation, compare: iconic, supersonic; with a further conversion: not only does the word describe 'the state or characteristic of being infected by COVID-19', but it also labels 'a person who has contracted coronavirus'; [3]

4. coronial (analogy, compare: millennial; 'the name of the generation of babies that will be born in December 2020 after Coronavirus quarantine'; [3]

5. covidivorce (compounding, Covid+divorce; 'a divorce resulting from the covid house arrest where the parties realize that a parting of the ways might be best'); [3]

6. covidicide (blending, Covid + suicide; 'going into a crowd of people not wearing personal protective gear without regard for one's own safety or the safety of others'. [3]

Although the other group of terms does not recall the 'contagious' root, it as well makes reference to the scope of virus-inspired things and actions. For instance, the pandemic social context gave birth so the following vocabulary units of current interest, like *doomscrolling* (according to Los Angeles Times, this is a 'slang for an excessive amount of screen time devoted to the absorption of dystopian news'; type of word formation – compounding) [1], *zoombombing* ('the harassing intrusion into a private video conference'; compounding) [1], *quarantini* ('a mash-up of quarantine and martini, describes one palliative for the housebound'; type of word building - blending) [1], *infodemic* (overabundance of information, both online and offline). [2]

Finally, it is worth noticing that specific epidemiological and medical terms sprang from exclusive use to wide public discourse, hence turning every average Joe into a savant-virologist. The terms like pathogen, asymptomatic, super-spreader, incubation period, respiratory, red zone and some others have confidently passed into general circulation.

The examples, considered above, allow us making proper conclusions with regard to the ongoing global processes and provide us with a chance to better understand what is going on. First, the rapid emergence of neologisms demonstrates the social nature of the language, which is always predetermined by social relations to a huge extent. Second, it ensures the performance of two essential language functions: the integral and axiological ones. Elaborating a kind of situational vocabulary, people therefore outline the fact of residing in the same boat; a recognizable verbal code makes the problem relatable, and, as a result, less formidable. Third, from the linguistic viewpoint the appearance of the lexical units, mentioned above, proves the relevant productivity of such word building types in modern English, as blending, compounding, and suffixation.

References:

1. 'Quarantini.' 'Doomscrolling.' Here's how the coronavirus is changing the way we talk https://www.latimes.com/world-nation/story/2020-04-11/coronavirus-covid19-pandemic-changes-how-we-talk (accessed 16.11.2020).

2. Managing the COVID-19 infodemic: Promoting healthy behaviours and mitigating the harm from misinformation and disinformation https://www.who.int/news/item/23-09-2020-managing-the-covid-19-infodemic-promoting-healthy-behaviours-and-mitigating-the-harm-from-misinformation-and-disinformation (accessed 16.11.2020).

3. Urban Dictionary website https://www.urbandictionary.com/ (accessed 16.11.2020).

УДК 621

MODERNIZATION OF THE A9-UTO-6 TRIER INSTALLED IN THE MALT PRODUCTION LINE.

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Abstract: *The essence of this article is to upgrade the A9-UTO-6 Trier installed in the malt production line. On the subject of this direction, a literary review was made, during which various designs of machines for cleaning grain were studied. The calculation part includes technological, energy, kinematic, structural and strength calculations in the APM WinMachine program. In the research section, deformations and loads acting on the shaft are investigated. The occupational safety section analyzes potential hazards, microclimate requirements, room lighting requirements, noise and vibration analysis in the workplace, electrical safety requirements, fire safety requirements, and develops safety instructions for personnel. In the economic section, the costs of development are calculated.*

Keywords*: modernization, trier, productivity, metal consumption.*

Currently, one of the main tasks of grain processing enterprises is to separate foreign impurities from the source bulk material.

Depending on the type of impurities, different principles of separating bulk materials into fractions with different physical properties and geometric dimensions are applied. To separate bulk materials, the following characteristics are used: particle density, linear dimensions, aerodynamic properties, ferromagnetic properties, and the state of the grain surface. Thus, pneumatic separation machines - triers are used to remove volatile particles.

In the technological section, the technology of malt production was considered and its machine and hardware scheme was built, the necessary requirements for raw materials and finished products were determined [1].

As a result of studying triers of this type, shortcomings in their design were revealed. In particular, the Trier disk has an unused side surface. Using this surface will increase the working surface of the Trier disk, and, consequently, increase the performance of the machine, with the same dimensions and weight. At the same time, increasing the productivity of the machine is not advisable, since the rest of the equipment on the production line is matched to the corresponding productivity. Therefore, it is advisable to reduce the size of the machine, while maintaining its performance, which will affect the metal content, and therefore the cost of the machine.

Also, reducing the size and weight of the machine allows you to reduce the load on the frame, which makes it possible to make it from standard metal plates, corners and channels in contrast to the used disk triers, which have complex expensive frames.

Calculations of the necessary technological parameters – performance and power, kinematic and strength (verification calculations of V-belt transmission, keyway connections, bearing units, cutting disk shaft) were performed in the APM WinMachine program.

In the research section, we performed a strength study of the shaft of the working organ in the Ansys Workbench program. It was found that the minimum value of the safety factor for static strength is 1.03, and the minimum value of the safety factor for fatigue strength is 4.7. This indicates that the shaft of the working body can withstand all the forces applied to it, because the coefficients exceed 1.0 during the service life of 9000 hours.

The labor protection section focuses on the health and safety of working conditions that contribute to increased productivity, employee satisfaction with their work, the creation of a good

psychological climate in work teams, which leads to the decrease in staff turnover and the creation of stable work teams.

The measures presented in this work include protection of personnel from the possibility of injury, exposure to electric current, and improvement of the working area by maintaining the necessary microclimate and lighting conditions.

In the course of the analysis of the economic section, several important calculations were performed, and the cost of the experimental development of the A9-UTO-6 Trier was estimated. The calculation of the actual and conditional number of parts of this machine is n=177 PCs. and n=166.4 PCs., the complexity of the development is T=1.15 months. All possible deductions and wages of employees involved in the design are also calculated. In total, development costs amounted to 198414.05 rubles [2].

We created a three-dimensional model of the A9-UTO-6 Trier in the KOMPAS software product (Fig. 1).

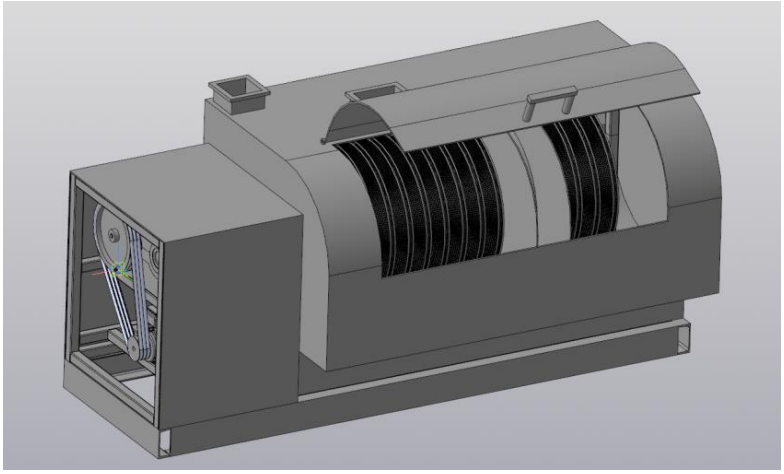

Figure 1-Three-Dimensional model of the A9-UTO-6 Trier

A table was compiled that shows the calculated and predicted characteristics of indicators after the improvement of the working body (table. 1).

Table 1-Technological characteristics of the A9-UTO-6 Trier

Design change		Advantages	Influence on the formation of economic effect	
In base variant	In the upgraded version		On its intermediate indicators	Directly on its size
22 disks	14 disks	Simplicity of the machine design. Higher maintainability.	Reduced metal consumption of the machine	The cost of the product is reduced
The weight of the trier m=1100kg	The weight of the trier m=650kg			

In conclusion, it should be noted that the main idea of the design is to reduce the unit costs per unit of production by reducing the metal content of the machine and changing the design of the working body. The performed calculations indicate that this project is appropriate and its practical implementation will allow achieving the set goals, i.e. reducing metal consumption while maintaining labor productivity.

References:

1. Butkovsky V. A., Melnikov E. M. Technologia proizvodstva muki, zerna i kombikormov (c bazovymi osnovami ecologiyi). [Technology of flour, grain and feed production (with the basics of ecology)]. - Moscow: Agropromizdat, 1989. – 464 p.

2. Kerzhentsev V. A. Technologicheskoe oborudovaniye dlya proizvodstva pishevyh productov. Chast' 1. Proizvodstvo machanicheskogo oborudovaniya. [Technological equipment for food production. Part 1. Mechanical equipment]. – Novosibirsk: NSTU, 2008 – 140 pages.

УДК: 616-72

PHOTOTHERAPY DEVICE FOR THE TREATMENT OF SKIN DISEASES

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Skin is a reflection of the state of the body and diseases of internal organs. Skin diseases differ from diseases of other systems as the symptoms are evident immediately in the early stages of development.

According to the Ministry of Health, the problem of skin diseases in the Russian Federation in recent years continues to remain steadily high - 4,710.5 per 100,000 population. Most of the reported incidence is attributable to atopic dermatitis (234.3 per 100,000 population) and psoriasis (65.8 per 100,000 population). In the United States and Europe, skin diseases are in 4th place in terms of the number of disabilities received. [1]

The identified causes are drugs to treat treatment choices. The most common physiotherapy methods are [2]:

1.Ultrasound therapy is a medical method using mechanical vibrations over 20 kHz; 2. PUVA photochemotherapy is a procedure that includes the consumption of a photoactive substance and exposure to long-wave UVA rays of the skin; 3. Laser therapy based on the use of optical radiation, produced by laser; 4. UV radiation - the method of ultraviolet radiation (UVB 280-315nm, UVA-rays 315-400nm) on the layers of the skin.

The last method is the most effective because it has not only anti-inflammatory, but also antibacterial effect on the affected focal area.

When using UV therapy, the task of controlling the distance from the emitter arises. This will avoid unpleasant consequences and make the result of the procedure more effective and stable. The optimum distance is 20mm-30mm.

Based on the analysis of similar devices, the following block diagram of a phototherapeutic device for the treatment of skin diseases, shown in Fig.1., was developed [4]:

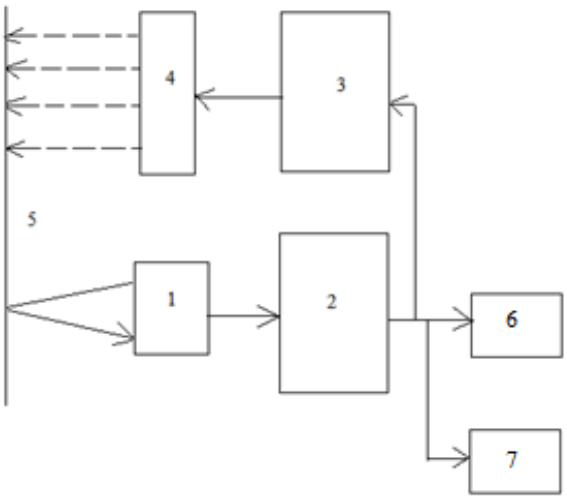

Fig 1 Block diagram of a phototherapeutic device
1- Distance sensor, 2-interface controller, 3-power supply, 4-UV-emitter, 5-patient's skin, 6-information display system., 7- sound indication.

The phototherapy device contains an emitter based on an excimer XeCl lamp, which emits narrow-band ultraviolet light at a wavelength of 308 nm. It provides a sufficiently high stability of UV radiation and a long service life.

Additionally, a sensor that monitors the distance from the patient's skin to the surface of the UV emitter was introduced. If the distance goes beyond the optimal permissible values (normally 2-3 cm), the SDI and ZI will inform about this. This will prevent UV burns on the skin, which can lead to the formation of new growths, and increase the effectiveness of the procedure.

To carry out the metrological and parametric synthesis of the channel for determining the distance to the biological object, the calculated block diagram, shown in Fig. 2, was taken, [3]

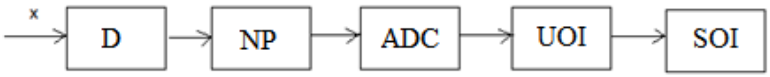

Fig.2 Block diagram for the synthesis of the design diagram of the phototherapeutic device.
D- sensor, NP- normalizing converter, ADC- analog-to-digital converter, UOI- information display device, SOI- information display system.

The calculation was carried out according to the following parameters of the informative signal and interference:

Measurement range …….20mm-30mm
Max.output signal ……..... 5V
Frequency spectrum …… 0.5-5Hz
Recovery error ……3%
Interference spectrum ……. 50-100Hz
Noise level ……....0.1V

According to the results of metrological synthesis, the error was distributed:

$$\Delta X_{calc} = \Delta X_d + \Delta X_{np} + \Delta X_{adc} + \Delta X_{uoi} + \Delta X_{soi}$$

$$\Delta X_{calc} = 0{,}15mm + 0{,}153mm + 0{,}153mm + 0{,}15mm + 0{,}15mm = 0{,}756mm$$

$$\sigma\Delta X_{calc} = \sqrt{(\sigma\Delta X_d)^2 + (\sigma\Delta X_{np})^2 + (\sigma\Delta X_{adc})^2 + (\sigma\Delta X_{uoi})^2 + (\sigma\Delta X_{soi})^2}$$

$$\sigma\Delta X_{calc} = \sqrt{6{,}25^2 (mm/V)^2 \cdot 0.02^2\, V^2 + 3{,}05^2 (mm/V)^2 \cdot 0.04^2\, V^2 \cdot 2 + 1^2 \cdot 0{,}122^2\, mm^2 \cdot 2} = 0{,}656$$

On the basis of metrological synthesis, a parametric synthesis was carried out, which made it possible to select the element base of a phototherapy device. The results are presented in Table 1.

Table 1 Results of parametric synthesis

Name functional element	Specification	Item type
Sensor	1.Measuring range ..... 20-30mm 2.The error of recovery ..... 3% 3.Frequency range of signal ..... 0.5-5Hz 4. Supply voltage of the sensor ..... + 5V	HC-SR04
NSP	1.Input impedance ..... 30kΩ 2. Gain factor……...2 3.Conversion time……0,5-5Hz	LM324 built into the sensor
ADC	1.Number of digits ..... 6 2.Clock frequency ..... 4MHz 3.Conversion time 0.00005s	PIC16F877
IOI		
SOI	1.The length of the bit grid ..... 3 2.Number of digits 5	MT-16S2

In accordance with the Technical Specification Terms, a device was developed for the treatment of skin diseases such as psoriasis and dermatitis. The device is not inferior to domestic and foreign counterparts. It is based on exposure of the damaged area with a medium-wave UV emitter and control of the distance from the emitter to the skin.

References:

1. Fomina A.V., Solovieva S.Yu. Medical and social characteristics of patients with chronic dermatoses // Modern problems of science and education. - 2017. - No. 6.; [Online resource]:

URL: https://scienceeducation.ru/ru/article/view?id=27064 (date accessed: 10/17/2020).

2. Methods for the treatment of psoriasis and dermatitis. [Online resource]: URL: https://www.pravda.ru/navigator/lechenie-psoriaza.html

3. Porunov A.A., Soldatkin V.M. Calculation and design of measuring and computing systems for medical purposes. - tutorial. Kazan: KSTU, 1997, pp. 128-130

4. Pat. Russia № - RU160730, MKI A61B 5/06. Device for the treatment of skin diseases. / Shitz Dmitry Vladimirovich. Application. 08/20/2015. Publ. 27.03.2016.

УДК (623.455.1)

ANALYTICAL COMPARISON OF DESTRUCTIVE POWER FOR VARIOUS TYPES OF AVIATION PROJECTILES

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This article examines the efficiency of ammunition for aircraft weapons on the example of Second World War projectiles. The relevance of this research paper is determined by the need for a systematic approach in the study of the damaging effect produced by various types of projectiles on the flight performance of the target being hit, as well as an increased interest in this problem in connection with the 75th anniversary of our country's victory in the Great Patriotic War. The issue of determining the most destructive and powerful type of main aircraft weapon shells of WWII has

been a long-standing subject of controversy among military historians. If we resolve this question, we might be able to understand which filling of cannon and machine-gun cartridges is the best and possibly, design the most effective projectile for each type of weapon on the basis of these conclusions.

In this article, we will consider the most basic calibers of aircraft guns: arms cartridge ammo (7.62 mm); high-caliber rounds (12.7 mm); 20 mm cannons.

For the sake of brevity, certain abbreviations will be utilized (according to the International Ammunition Organisation[5]): T - tracer projectile, AP - armor-piercing projectile, I - incendiary projectile, H E - high-explosive projectile, F - fragmentation projectile.

From the point of damaging the target, ammunition can be divided into three types[3]:

- single action - a projectile that causes damage by only one parameter, i.e. I (fig. 1),
- double action - a projectile that causes damage in two ways, i.e. API (fig. 2),
- triple action a projectile having three properties, i.e. HEFI (fig. 3).

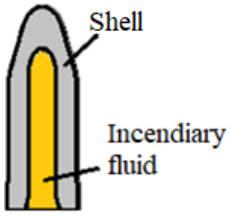

Fig.2

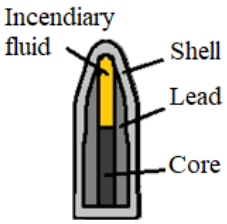

Fig.3

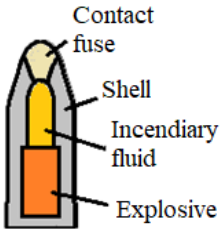

Fig.1

Armor-piercing ammo

Armor-piercing shells (fig. 4) are intended to pierce armor but their destructive power is very low. To increase the performance and destructive force, one has to turn a single action AP into double action projectile by adding mixture that does more damage.

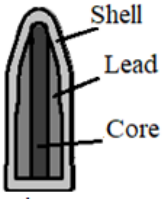

Fig.4

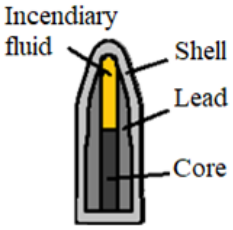

Fig.5

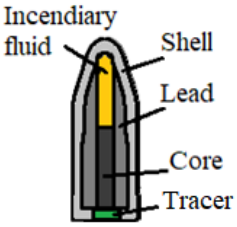

Fig.6

If AP simply pierces the planes and flies out further (fig. 7), then API (fig. 5) and APIT (fig. 6) work well against the armor and set fire to flammable substances located behind this armor (if such substances are present) (fig. 8).

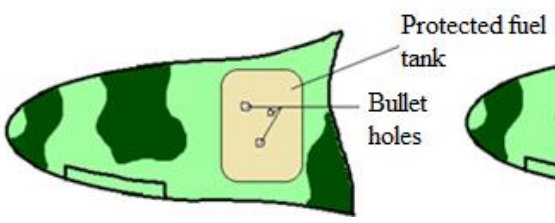

Fig.7

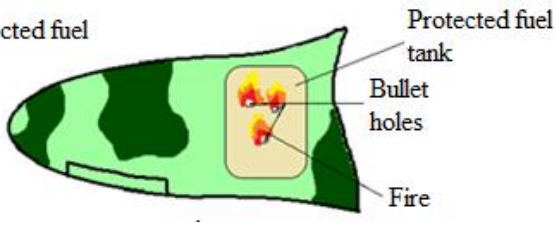

Fig.8

Such shells are most often used in 7.62mm and 12.7mm machine guns, because the size of the projectile is not large enough to inject the explosive inside, unlike cannon ammo.

High Explosive ammo

There are no shells with a single high-explosive action, because the explosive is placed in the shell and the substance explodes, scattering the fragments of the shell in different directions upon contact with the surface. That means, each HE projectile is an HEF.

HEF projectiles (fig. 10) are the most efficient ones, because they impact an airplane with an explosion causing huge damage to both the skin and the supporting structures of the aircraft (fig. 13). HEFI (fig. 9) acts more efficiently than API, because even though there is no flammable

material behind the surface, the incendiary fluid inside the projectile will still ignite because of the explosion temperature (fig. 14). HEFIT and HEFT projectiles (fig. 11 and fig. 12 respectively) contains tracer mixture in the bottom part of the projectile that helps with aiming.

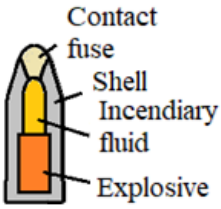

Fig.9

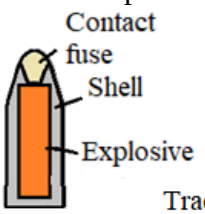

Fig.10

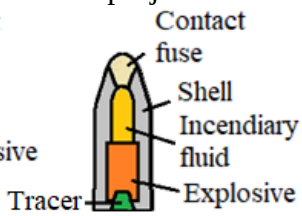

Fig.11

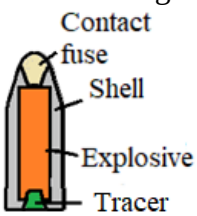

Fig.12

The performance of HEF and HEFI ammo depends directly on the capacity of the shell. In a large projectile it is reasonable to add only explosives because the damage inflicted by the projectile will be greater in comparison with the same projectile, but with the addition of an incendiary fluid, because its addition takes up space and reduces the amount of explosives, and hence the explosion strength. For the reasons listed above, it becomes clear why high-explosive shells were added to gun cartridges: there is not enough space for explosives in machine guns.

Fig.13

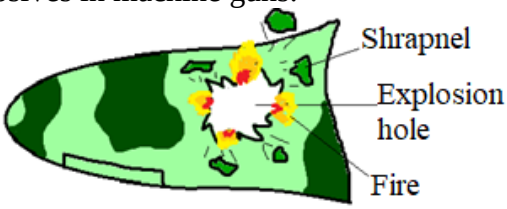

Fig.14

Incendiary ammunition

When I-shell (fig. 15) hits areas protected by armor, the bullet “crumples” and does no damage (fig. 16). However, if there is no armor, the bullet does much more damage compared to AP and API, because there is more flammable substance in it, and it is not necessary to pierce the armor (fig. 16).

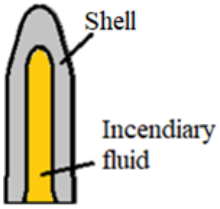

Fig.15

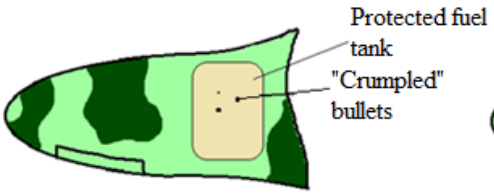

Fig.16

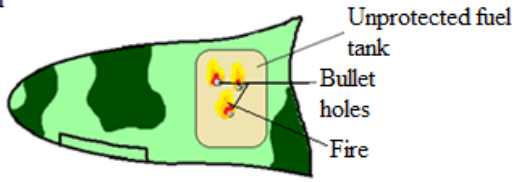

Fig.17

I-shells are used in rifle caliber machine guns in cartridges mixed with P because there is not enough space for the core in the 7.62 ammo.

This theoretical information is confirmed by research of actually used aircraft weapon projectiles. From the table 1[1] we can see that 7.92 Mauser projectiles had just AP action, destruction power of this projectile is very low.

Table 1

Cartridge	Type	Damage	Power
7.92x57	AP	10	1
12.7x81SR	AP / HE	27 / 31	3
12.7x99	API	46	4.6
12.7x108	API	57	5.7
20x72RB	HE	123	12
20x80RB	API / HEIT / HE(M)	90 / 89 / 206	14

20x82	API / HEIT / HE(M)	110 / 109 / 236	16
20x110	HE (Mk II / Mk V)	201 / 194	20

In 12.7 cartridges, double-action APIs are the most damaging projectiles, while HE is not that destructive. However, the opposite is true for 20mm projectiles, the most destructive filling being HE. The most damaging air combat belt fillings are APIs and Is for 7.62 mm projectiles, APIs for 12.7 mm caliber, HE and HEI for 20 mm projectiles.

Conclusion.

In the future, in order to increase the projectile performance, it is necessary to make more space for a larger charge of incendiary and explosive substances. It is best to fill 20mm ammo with a thin shell with explosive and incendiary substances. Fragments from a thin shell are not big enough to cause serious damage. Projectiles with a thicker shell must be filled mostly with explosives, because the fragments of their shells have high kinetic energy and, consequently, higher destructive power.

References:

1. Military Guns & Ammunnition [Electronic resource] / ed. Anthony G. Williams, Emmanuel Gustin, Henning Rush - Electron. Dan. - 2019. - URL: http://www.quarryhs.co.uk/WW2guneffect.htm - caption from the screen. (date of access: 08.10.2020)

2. Fedorov V. G. Evolution of firearms. Part 2. Development of automatic weapons. - M .: State military publishing house of the USSR People's Commissariat of Defense, 1939. - 315 p.

3. Anthony G. Williams, Emmanuel Gustin, Flying Cannons of the Second World War. - The Crowood Press UK, 2003 .- 336p.

4. Aviation encyclopedia "Corner of the sky" [Electronic resource]: The database contains information about aviation - Electronic Data - [M.?], 2016 - URL: http://airwar.ru - Title from the screen. (date of access: 08.10.2020)

5. International Ammunition Organisation [Electronic resource]: The database contains information about ammunition – Electronic data – [Lincoln], 2000. – URL: http://cartridgecollectors.org/ - Title from the screen (date of access: 30.10.2020)

УДК 621

AUTOMATION OF THE HARDENING PROCESS FOR SPECIAL BOLTS

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Abstract: *The necessity of modernizing the means of automated control of the process of hardening bolts for special purposes used in aircraft construction is shown. A digital twin of the device for hardening and the model of the hydraulic component of the control system, creating an effort in this device, as well as preliminary results of computer simulation of their operation have been introduced.*

Keywords: Hardening, device for running in, model, digital twin, solid-state 3D-model, hydraulic system.

There are parts in the aviation industry that are imposed to strict requirements. Among them there are special purpose bolts. Their production includes such a responsible technological process as hardening. In the production conditions of the branch of *Sukhoi* Company PJSC Novosibirsk Aviation Plant named after *V.P. Chkalov*, the technological process of hardening of special-purpose bolts occurs by rolling in the necessary (most loaded) sections of the bolt surface on a 1K62 turning screw cutting machine by means of a special device, driven by a hydraulic drive. The operation of such equipment is controlled by the operator's command using contact-relay automation connected to a personal computer.

Such organization of the process and the workplace is accompanied by a number of unnecessary operator actions and flaws, which can be detected partially at the workplace and completely only at the inspection site. Due to this and other circumstances, discussed in the paper, the problem of eliminating the influence of the factors mentioned above both on process quality and operator productivity is urgent.

The solid-state 3D model of the hardened bolt and the digital twin of the device are formed in the Siemens Solid Edge ST19 CAD environment, and the hydraulic component of the control system is MatLab & Simulink [1].

The created solid-state 3D model of the hardened bolt (Fig. 1) is intended for computer experiments to evaluate the quality of hardening and simulation modeling of the running-in process by the control system.

This bolt is a critical part in the assembly of aircraft, which is subjected to increased loads. In this regard, hardening of the most loaded sections of the product is required.

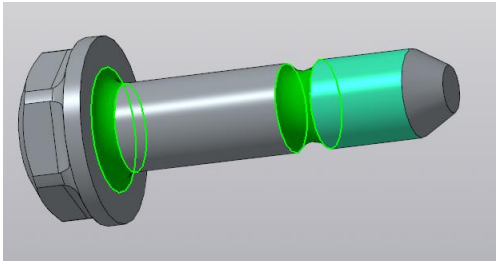

Fig. 1. 3D model of a special-purpose bolt (processing points are highlighted)

Digital twin of the fixture

The digital twin of the fixture (Fig. 2, fig. 3) is an integral part of the control system model discussed in detail in the paper.

With the help of the *Measurement function - Physical properties* integrated in the CAD (Computer-aided design) system of Siemens Solid Edge ST19, the mass of the entire product, as well as its individual parts, is calculated. The analysis of the device design for running parts is carried out. In addition, the complexity of its automatic assembly is evaluated.

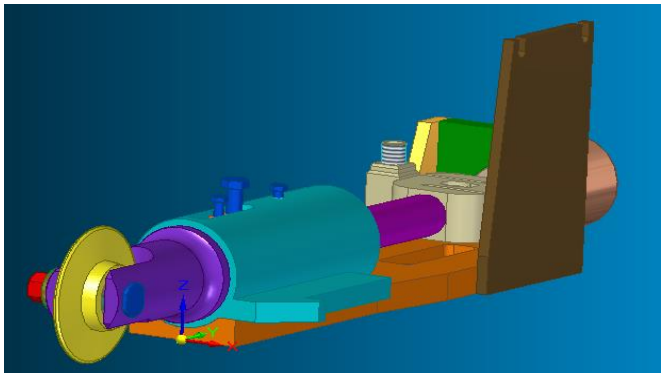

Fig. 2. Digital twin of the fixture for hardening

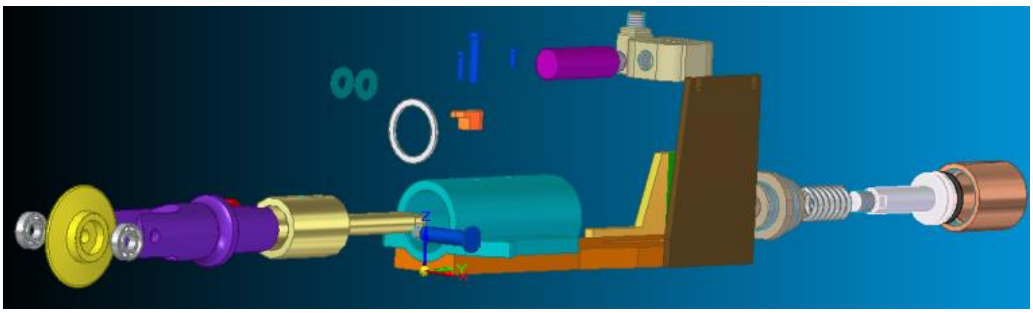

Fig. 3. Solid-state 3D model of the fixture for hardening

As a result of calculation by a known method, it has been found that:

• the whole product rediness for automatic assembly is determined to be 12.4, which corresponds to automation of average difficulty. It requires testing and experimental verification of operations;

• the manufacturability of the assembly of the entire product is 19.52 (the first category of complexity);

• the average complexity category of assembly automation is 1.9.

Control system for applying force to the device

In order to study and optimize the necessary operating modes of the control system, it was created on the basis of the circuit diagram of the hydraulic unit used and its model (Fig. 4).

The model uses a constant flow pump unit. To control the fluid flow to and from the cylinder, a 3-way directional valve is used. Pressure control is performed by the pressure control valve block. The pump motor is presented as an ideal source of angular velocity [1].

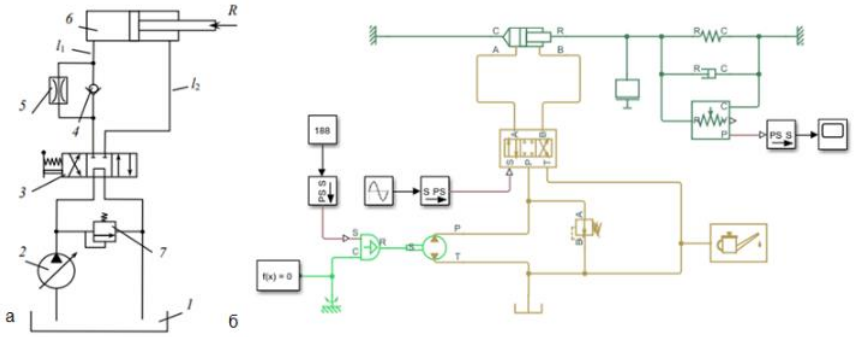

Fig. 4. Hydraulic installation:
a - a circuit diagram; b - Simulink model

A solid-state 3D model of a special-purpose bolt has been created to simulate its technological features during the process of hardening. A digital twin of the device for running in the parts is formed, which is necessary for the simulation of the operation of the technological installation. The estimation of the device preparedness as a whole for automatic assembly, manufacturability of the assembly, and the complexity category of assembly automation has been calculated. A model operation of the hydraulic installation control system has been created and studied. The results obtained relate to the initial stage of designing a system for automated control of the technological process of rolling in bolts for special purposes, which is useful both for the enterprise and for educational purposes.

References:

1. Ruppel' A.A., Sagandykov A.A., Korytov M.S. Modelirovanie gidravlicheskix sistem v MatLab. [Modeling Hydraulic Systems in MatLab] / Uchebnoe posobie. – Omsk: SibADI. [Tutorial. - Omsk: SibADI,] 2009 .—172p.

УДК 629.7.054.44

FEATURES OF CONSTRUCTION OF THE ION-TAG METER OF AIR SPEED FOR VENTILATION SYSTEMS

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The ventilation system has become an integral part of the infrastructure of modern residential, office and industrial premises, as well as large sports and shopping centers. Modern technologies being in development in a number of industries (electronics, precision instrument making, pharmaceuticals, etc.), in medicine and other areas, require clean spaces. To ensure the required quality of air supplied to these premises, rather complex ventilation and air conditioning systems are created. Effective automatic control of these systems requires information on many parameters of the air flow (temperature, humidity). One of them is the air flow rate in the ducts. Currently, there are certain requirements for the operational and metrological characteristics of airspeed meters for ventilation systems:

- Ability to measure low flow velocities (from 0.2 m / s).
- Long-term stability of metrological characteristics. Long calibration interval or no need for verification during the entire service life.
- The design of the meter should provide ease of installation without compromising the duct strength. To measure the speed of the air flow in the duct, a special technological hole is made through which the measuring device is placed into the duct. The size of the hole must match the size of the meter. To maintain the strength and increase the operational reliability of the air duct, the technological opening should be of the minimum size, which imposes restrictions on the dimensions of the measuring devices used.
- Wireless transmission of measurement results via a radio channel for control and monitoring systems, storage and processing of measurement results to a tablet computer, laptop, smartphone or other device.
- Availability of built-in functions of diagnostics of the state of the meter.
- Long period of autonomous work, without recharging or replacing the battery. High energy efficiency. Low cost of maintenance.
- Manufacturability of design, good reproducibility of characteristics during serial production, low production cost, which does not require complex, expensive equipment.

All speed meters used in the adjustment and regulation of ventilation and air conditioning systems are subdivided into tachometric (vane) anemometers, hot-wire anemometers and differential manometers.

The disadvantage of a tachometer meter is low reliability due to the presence of a moving element - the impeller. During operation, the impeller supports become dirty, which leads to an increase in friction for the impeller rotation which in turn breaks down the established dependence of the rotation speed on the air flow speed. In addition, the presence of friction and imbalance in the moving part limits the ability to measure low air flow rates. There is a fundamental dependence of the sensitivity of such a meter on the impeller size, which imposes restrictions on its miniaturization. The error of the tachometer is 3-5%.

A thin (several microns) platinum thread stretched between needle holders is used as a hot-wire anemometer sensor. Such a sensor has low reliability. More reliable are the so-called hot film anemometers, which are a ceramic plate with a sprayed-on metal layer of micron thickness.

Both wire and film hot-wire anemometers are susceptible to contamination during operation, which leads to a change in heat transfer with the environment, and this leads to measurement errors. To eliminate this error, it is necessary to periodically clean the sensor, which complicates the

operation of hot-wire anemometer meters. Low technological reproducibility of the sensitive elements of anemometers at the production stage require individual calibration of each sample, which leads to their rise in price. The principal feature of hot-wire anemometers is the high-power consumption for heating the sensor, which limits the implementation of a battery-powered meter. The error of hot-wire anemometer is usually 5%.

The differential pressure gauge measures the pressure created by the air flow on a probe placed in the duct. The disadvantage of this measurement method is its low sensitivity and large measurement error at low flow rates (2-8 m / s) is about 5-7%.

To achieve high metrological and operational characteristics of the meter, it is proposed to use the physical principle of measuring the flow velocity, which is based on measuring the travel time of the ion mark together with the flow of a given distance. An ion tag is a local area of the air flow with an increased concentration of unipolar (positive or negative) ions and is created using a small-sized corona discharge arrester produced in the air flow. Such a mark can be formed in a small flow volume, and its gas-dynamic properties practically do not differ from the properties of the air medium, which ensures full compliance of the mark movement parameters with the characteristics of the air flow. An important advantage of unipolar ionic markers is the possibility of their registration in a non-contact way, namely with the help of metal electrodes, on which, due to the effect of electrostatic induction during the passage of a charged mark, a pulse signal is induced. In this case, the electrodes can be isolated from the flow by a dielectric material, which ensures high reliability of the converter operation when exposed to moisture, dust, etc. The result of measuring the flow rate with an ion-tag meter does not depend on changes in temperature, pressure, density and other destabilizing factors.

A typical circuit of an ion-tag airspeed meter includes a flow channel in which a small-sized corona discharger and a recording electrode are located. The tag generator at the moment t_0 generates a short high-voltage pulse, which is transferred to the arrester. As a result of the corona discharge, the air flow region adjacent to the arrester is ionized. The formed ion cloud (mark) is carried away by the air flow along the flow channel. The mark, flying near the annular recording electrode, induces a pulse signal, the time position of which t_1 is fixed by the mark recorder. The time interval t_1-t_0 = τ depends on the speed of flight of the mark with the basic distance L_b between the spark gap and the electrode. Thus, the air flow rate will be equal to $V = L_b / \tau$.

The generation of ionic marks (GM), their registration of RM, the transformation and processing of informative signals are carried out by electronic devices, which allows solving successfully the problems of their miniaturization, reducing energy consumption, cost, and increasing reliability. The use of modern element base and information technologies for the implementation of an ion-tag sensor makes it possible to create a small-sized device with an autonomous power supply and the ability to transmit measurement results via a radio channel to a personal computer or other mobile device that supports a Bluetooth interface or Wi-Fi, for example, a tablet computer, laptop or smartphone. Achievement of the design parameters of the ion-tag sensor will provide it with a competitive advantage in terms of stability of metrological characteristics, operational reliability and relatively low cost. It is difficult to measure low air flow velocities because of the short lifetime of the ion tag, which is a local area with an increased concentration of unipolar ions formed due to a pulsed corona discharge produced in the air flow. With decreasing speed, the time of flight of the tag to the receiving electrode increases. Due to the recombination of ions, the tag loses its charge and, accordingly, the charge induced on the receiving electrode also decreases, which makes it difficult to separate the useful signal against the background of external interference and internal hardware noise. To expand the working range of the ion-tag sensor to the low-speed region, designs of receiving electrodes have been developed that ensure the perception of tags with a low charge, as well as circuit solutions aimed at increasing the signal / noise ratio. Energy-efficient circuits of an ion marker generator and channels for converting informative signals have been developed, which provide a long-term autonomous operation from a battery power source. To ensure ease of use, software and hardware have been developed for wireless transmission, storage and processing of measurement results to a tablet computer, laptop or

smartphone. The results of the developments were used to create an experimental sample of the basic model of the ion-tag meter and metrological tests were carried out, which confirmed the effectiveness of the adopted technical solutions.

References:

1. Ganeev F.A. On the dynamic properties of an ion-tag flow rate transducer (Abstracts of the All-Union Scientific and Technical Conference "Methods and Means for Measuring Mechanical Parameters in Monitoring and Control Systems") Penza, 1992 – 62p.

2. 2. Rezunov I. A. Features of the construction of an ion-tag air speed meter for ventilation systems // XXIV Tupolev Readings (School of Young Scientists): International Youth Scientific Conference, November 7–8, 2019: Conference proceedings. Collection of reports. - In 6 volumes; T. 1. - Kazan: publishing house of the IP Sagieva A.R., 2019 .-- 526 p.

3. Rezunov I. A. Ion tag recorder with an algorithm for integrating an informative signal // XXIV Tupolev Readings (School of Young Scientists): International Youth Scientific Conference, November 7-8, 2019: Conference proceedings. Collection of reports. - In 6 volumes; T. 1. - Kazan: publishing house of IP Sagieva A.R., 2019 .-- 530 p .

4. Patent for a useful model of the Russian Federation No. 194370 09.12.2019 "Air flow rate meter for ventilation systems" / Ed. Ganeev F.A., Minnebaev M.R., Rezunov I.A.Publ. in bul. No. 34, 2019.

УДК 535

DEVELOPMENT OF A METHOD FOR OBTAINING CaF2 / (Si + CaF2) / CaF2 / Si HETEROSTRUCTURES WITH OBSERVATION OF PHOTOLUMINISCENCE IN THE VISIBLE RANGE

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This paper discusses a method for obtaining CaF_2 / (Si+CaF_2) / CaF_2 / Si (111) heterolayers with quantum-size effects. The technological parameters for the production of silicon nanoclusters in a calcium fluoride matrix are described. The observation of photoluminescence in the visible spectral range is confirmed.

The creation of a radiation source, the technology of which would be fully compatible with the industrial planar technology, would allow the creation of monolithic integrated optoelectronic devices, which could be used both in household appliances and for optoelectronic diagnostics in medicine. Therefore, after observing photoluminescence in porous silicon, a vigorous study of the properties of this material and the search for various methods for obtaining silicon nanostructures began[1]. Over the past twenty years, several methods have been proposed for creating silicon-based structures capable of luminescence both in the infrared and in the visible region of the spectrum. Various methods have been used to increase the quantum yield of photoluminescence. For example, there are the introduction of special impurities into silicon with a high efficiency of intracenter transitions Er^{3+} [2, 3], as well as defects created by the implantation of oxygen, fluorine and ions of groups III and V. An effective way to increase the quantum yield of silicon luminescence is to use the properties of a nanostructured material, in which the band structure of the material changes due to the quantum size effect. These nanostructured materials can be obtained by molecular beam epitaxy.

The use of calcium fluoride for creating Si-based radiation devices has been known for a long time [3-4]. In these works, multilayer Si/CaF_2 structures were created, in which quantum-size effects appeared due to the small thickness of the Si layer (1.5 nm). However, if silicon deposition is used simultaneously from two sources, then silicon inclusions ($Si+CaF_2$) can be formed in the fluoride matrix, the size of which corresponds to the grain sizes in porous silicon. The method for obtaining these structures is described below.

"Katun-100" molecular beam epitaxy unit equipped with a fast electron diffractometer to control the growth process was used to obtain the $CaF_2/(Si+CaF_2)/CaF_2/Si(111)$. The growth was carried out in a closed technological cycle on a Si substrate with the (111) orientation. The substrate was of hole conductivity with a resistivity of 20 Ω/ cm. A resistive source with a glassy carbon crucible was used as a source of the calcium fluoride molecular beam. The silicon beam was formed by electron beam evaporation. A standard pre-epitaxial treatment of silicon substrates was performed to reduce the defect formation during the growth of the heterostructure. The treatment included purification in organic solvents, etching the surface oxide in HF, and the formation of passivating oxide H_2O: H_2O_2: HNO_3. Then the substrate was placed in a growth chamber to remove the passivating oxide in a weak silicon flow at the temperature of 700 ℃. The Si buffer layer was grown until a diffraction pattern (7 × 7) appeared at a temperature of 650 ℃.

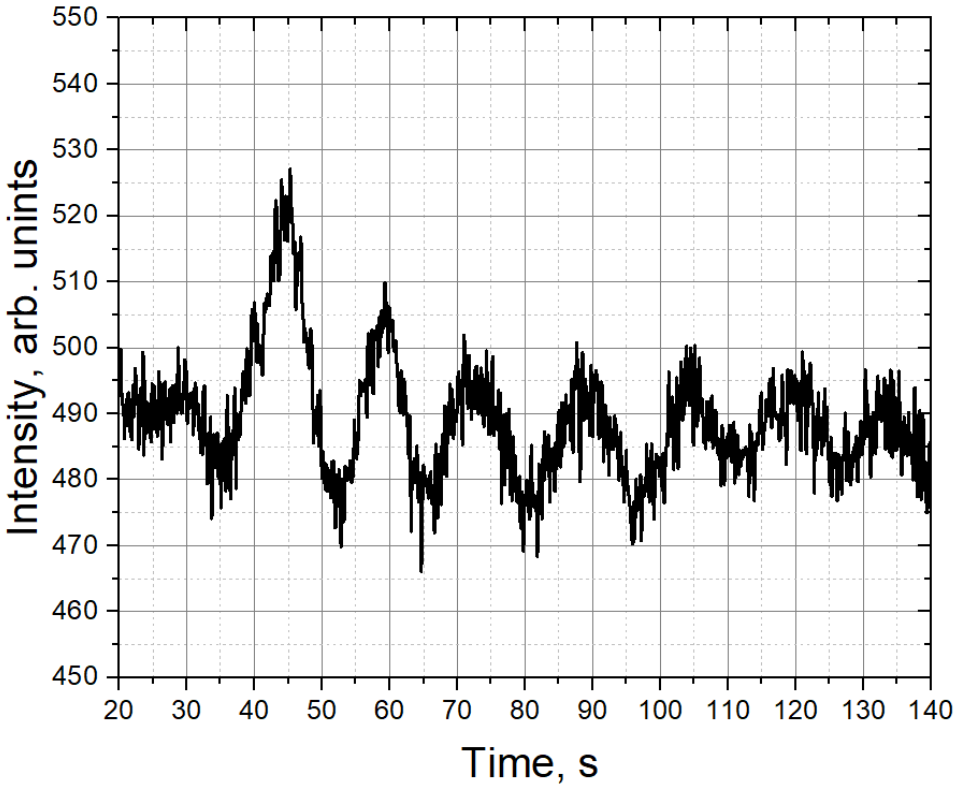

Figure 1. Oscillations of the specular reflection intensity of the buffer layer.

The growth rates of Si and CaF_2 were tuned using the diffraction pattern from the oscillations of the intensity of the specular reflection (Fig. 1). The deposition rates of silicon and calcium fluoride were 0.17 Å/s and 0.6 Å/s, respectively.

The $CaF_2/(Si+CaF_2)/CaF_2/Si$ (111) heterostructure consisted of 10 pairs of layers to increase the intensity. The pairs of layers consisted of a CaF_2 separating layer and a layer with nanocrystalline silicon inclusions in a fluoride matrix ($Si+CaF_2$). Silicon nanocrystalline inclusions are formed by sputtering fluoride and silicon from two sources. The thickness of each layer was 2 nm. The final layer of the heterostructure was a CaF_2 layer, which is necessary to provide protection against the formation of unwanted Si-O bonds. Final annealing was performed at a temperature of 650-700 ℃ for 10 minutes.

Visible spectrum of emitting was observed when the heterostructure was illuminated by a laser with a wavelength of 270 nm and a power of 0.8 mW. Visible emitting indicates that the structure exhibits photoluminescence. Consequently, molecular beam epitaxy makes it possible to obtain heterolayers with photoluminescence.

References:

1. John G.C., et al, Theory of the photoluminescence spectra of porous silicon. // Phys. Rev. B. 1994. V. 50. № 8. P. 5329.

2. Ioannou-Sougleridis, et al, Charging effects in silicon nanocrystals within SiO2 layers, fabricated by chemical vapor deposition, oxidation, and annealing // Materials Science and Engineering, – 2003. – V.101. – P.324 – 328.

3. Ioannou-Sougleridis V., et al, Electroluminescence from silicon nanocrystals in Si/CaF2 superlat-tices// Appl. Phys. Lett, – 2001. – V.79 (13). – P. 2076 – 2078.

4. F. Bassani, et al, Improvement in the luminescence properties of Si:CaF2 nanostructures // Materials Science and Engineering, – 2000. – P.340–344.

УДК 533

PROSPECTS OF USING PLASMA

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This article is devoted to the fourth state of matter-plasma. Its application in science, namely in nuclear physics and in experiments on controlled thermonuclear reactions. We will also talk about the prospects of plasma in the near future.

Matter is what surrounds us everywhere, the whole universe, the stars, the planets; we are made up of matter. As many people know, matter has three basic states: liquid, solid, and gaseous. However, very few people know about the existence of another state of matter-plasma or "radiant matter".

The first mention of the fourth state of matter appeared in 1928 in the article by the American chemist Irving Langmuir, who studied ionized gases [1]. This American chemist, physicist, and engineer was awarded the Nobel Prize in Chemistry in 1932 for his work in surface chemistry. Langmuir's most famous publication is the 1919 article "The Arrangement of Electrons in Atoms and Molecules" in which, building on Gilbert N. Lewis's cubical atom theory and Walther Kossel's chemical bonding theory, he outlined his "concentric theory of atomic structure"[2]. Langmuir became embroiled in a priority dispute with Lewis over this work, although the credit for the theory itself belongs mostly to Lewis[3]. While at General Electric from 1909 to 1950, Langmuir advanced several fields of physics and chemistry, invented the gas-filled incandescent lamp and the hydrogen welding technique. The Langmuir Laboratory for Atmospheric Research near Socorro, New Mexico, was named in his honor, as was the American Chemical Society journal for surface science called Langmuir.[4]

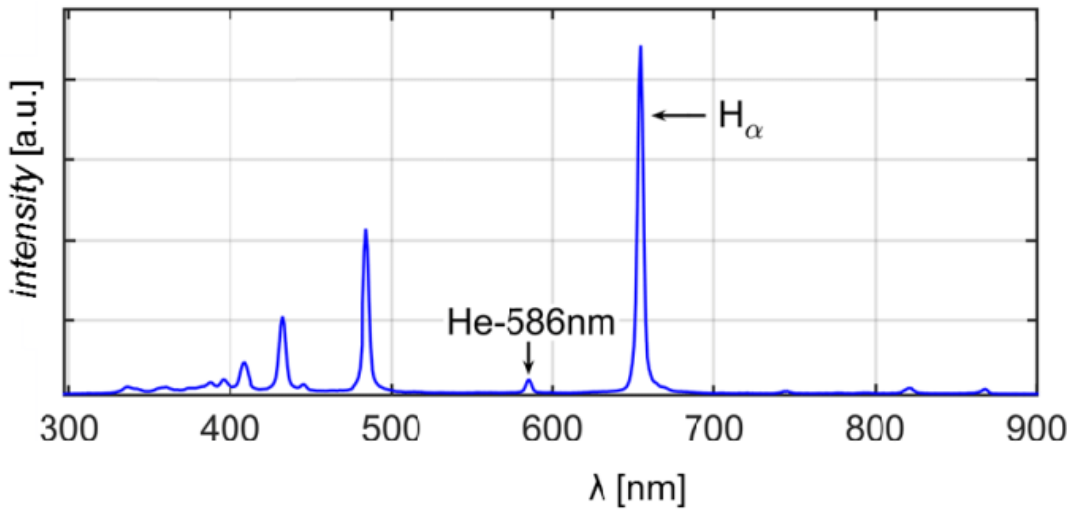
Plasma is a special gaseous state that is rarely found on our planet, the trick is that it contains free electrons, as well as positively and negatively charged ions. This means that it is very easy to generate a current, which is why the plasma is often called a conducting gas. (pic.1)

Pic.1.Plasma

For example: when we see lightning or the Northern lights, we see plasma. The most interesting thing is that plasma does not just appear; there is a certain temperature range at which it occurs (about 20000 ^{o}C).

The most important task for scientists today is to "tame" the energy of plasma. This is an environment in which controlled thermonuclear reactions are possible. Just imagine how much science and technology will advance if we can «tame» it. As scientists say, this is the most powerful alternative energy source that could ever be. With this energy, we could create space-based electric propulsion systems that would allow rockets to go beyond our galaxy. Sounds unrealistic, don't you agree?

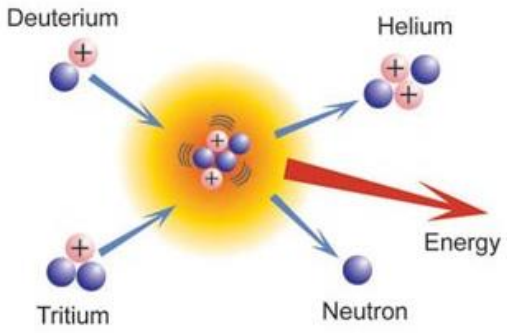
Nevertheless, physicists and chemists all over the world are trying to use plasma to carry out controlled thermonuclear fusion. To connect the H nuclei with the He nuclei, you need to bring them as close as possible (about one hundred billionth of a centimeter). Next, the nuclear forces themselves will go into action. However, such a convergence is possible only at very high temperatures (hundreds of millions of degrees), only in this case the kinetic energy of positively charged nuclei will be enough to surpass the electrostatic repulsion. Therefore, such complex reactions require a high-temperature hydrogen plasma (pic.2).



Pic.2. Helium-hydrogen reaction

Here the first problems begin to arise: the energy of the hydrogen plasma is not enough, the best way is to use mixtures of heavy hydrogen isotopes, and they need an even higher temperature. The second problem immediately arises: for such a reaction, the plasma must be dense, and the particles that fall into the reaction zone must not leave it quickly, otherwise the loss of energy will exceed its release.

There is a certain formula, derived in 1955 by the English physicist John Lawson, according to which the product of the plasma density by the average retention time of all particles should always be greater than the value that depends on the temperature, the composition of the thermonuclear fuel, and so on. This formula is still considered the main criterion for a controlled thermonuclear reaction (pic.2). Lawson was noted for his 1955 paper, published in 1957, "Some Criteria for a Power Producing Thermonuclear Reactor" [5], where he presented for the first time to the public his famous criterion: Lawson criterion.

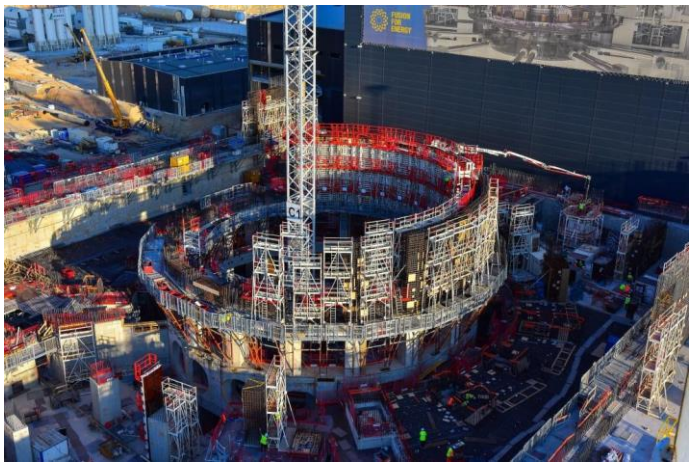


Pic.3. Thermonuclear reaction

And the third problem: keeping the plasma in a compressed state. Now scientists are using "magnetic traps". They create several magnetic fields. The most famous are tokamaks-closed traps in the form of a torus (proposed in 1950 by the Russian scientist Sakharov [6]). They help to get as close as possible to the Lawson criterion. The race to contain a thermonuclear reaction has been going on for decades. At the moment, the only countries that managed to hold the process for a fraction of a second are Germany and China.

In 2012, physicists from the max Planck Institute for plasma (Germany) managed to obtain and hold a plasma made of helium for a fraction of a second. And later were first obtained by hydrogen plasma at a temperature of 80 million degrees Celsius (a temperature higher than that of the upper layers of the Sun). China has managed to maintain the reaction in 102 seconds (set EAST).

It is the ability to hold the plasma inside the reactor and not to allow her to cling to surfaces, is the key to the possibility of extracting high-energy particles and thermal energy. In 2007, construction of the international experimental thermonuclear reactor ITER (pic.4) began near the city of Marseille. In the future, scientists for the next 30-35 years, it is at this reactor to demonstrate the first prototype of an environmentally friendly and safe power plant running on the energy of thermonuclear fusion. The first plasma is planned to be produced by December 2025, and in the 2040s the world will be able to see the first thermonuclear electricity.



Pic.4.ITER

Who knows what awaits us in the future, whether it will be possible to implement our plans, to create such a powerful source of energy that would be enough to create a second Sun. We may suggest only one thing: we are on the way to a huge discovery that can change our understanding of the world, reveal all the secrets, it is not for nothing that scientists and inventors have been trying to "tame" this "radiant matter" for half a century.

References:

1. Langmuir, Irving (1928). PNAS August 1, 1928 14 (8). Pp. 627-637.
2. Langmuir, Irving (1919). "The Arrangement of Electrons in Atoms and Molecules". Journal of the American Chemical Society. 41 (6): Pp.868–934.
3. Coffey, Patrick (2008). Cathedrals of Science: The Personalities and Rivalries That Made Modern Chemistry. Oxford University Press. pp. 134–146.
4. Taylor, H. (1958). "Irving Langmuir 1881-1957". Biographical Memoirs of Fellows of the Royal Society. 4: Pp.167–184.
5. Some Criteria for a Power Producing Thermonuclear Reactor // Proceedings of Physical Society 1957 Vol. 70, pt. 1, no. 445, B. Pp. 6-10.
6. Арцимович Л. А. и др. Экспериментальные исследования на установках Токамак (CN-24/B-1) // Plasma Physics and Controlled Nuclear Fusion Research. Proceedings of the Third International Conference on Plasma Physics and Controlled Nuclear Fusion Research Held by the International Atomic Energy Agency at Novosibirsk, 1-7 August 1968. — Vienna: International Atomic Energy Agency, 1969. — Vol. 1. — P. 157—173.

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DEVELOPMENT OF AN OPTICAL SYSTEM TO FORM A LASER BEAM WITH UNIFORM INTENSITY

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Language advisor: E.Yu. Lapteva, Assistant Professor
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The work is devoted to studying the possibility of correcting the intensity distribution of laser radiation using Galileo's dual-lens optical system consisting of spherical components. Patent search and comparison with the system, where aspherical surfaces are used, was carried out. Uniform intensity distribution is necessary to increase the efficiency of technological processes in the field of materials processing with high-power lasers. In the system being developed, the first lens introduces spherical aberration and the second lens returns homocentricity to the radiation stream.

This work is a continuation of the previously published research report [1], which describes the method of calculation of the laser beam correction system using spherical lenses. In Gaussian intensity distribution, the laser beam is used rather irrationally for tasks related to material processing technology:

- the center of the Gauss function, where the intensity exceeds the working level;
- edges of the Gauss function, where the intensity is insufficient for the technological process, most often causes the formation of the oxidation zone of the surface and the zone of thermal influence[2].

Converting the initial Gaussian shape of the profile into a uniform one would help to use laser energy efficiently and technologically, where uniform intensity is preferable. The most promising method involves the use of Pi-Shaper, where the system is built on the Galileo scheme. Schematically, the process of beam redistribution is shown in the following figure (Fig. 1.):

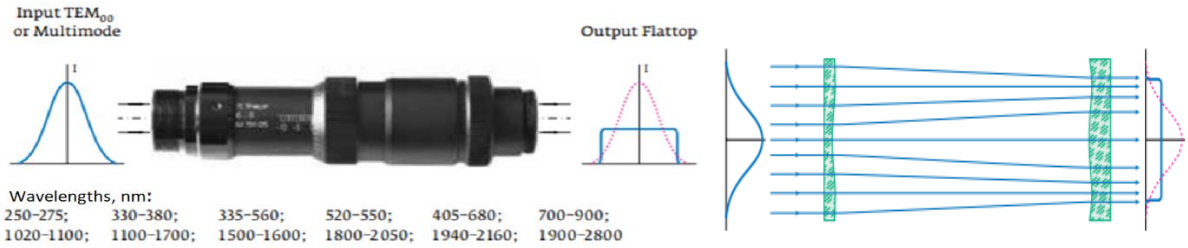

Fig. 1 Principle of pi-Shaper operation

A patent search was carried out and a patent [3] was found, which describes the technology of calculation of aspherical components of the optical system of laser beam reformation. The patent under study describes a labor-intensive, geometric method of finding components. It uses Galileo system with aspherical surfaces to correct the profile.

In this method, the shape of the surfaces is determined by integral equations, which consider changes in the thickness of the lens at a different distance from the center of the lens, due to which the redistribution of the beam is the most effective way. In the figure, it is noticeable that at the edges the radiation practically does not change, but in the center it is redistributed closer to the edges, due to which the corrected beam is obtained [4].

Using the method described in the patent[3], let us calculate the optical system.

$$r_2(r_1) = \sqrt{\frac{1-e^{-\left(\frac{r_1}{a}\right)^2}}{1-e^{-\left(\frac{R}{a}\right)^2}} R^2}\,, \tag{1}$$

$$r_1(r_2) = a\sqrt{\ln\left(1-\left(\frac{r_2}{R}\right)^2\left(1-e^{-\left(\frac{R}{a}\right)^2}\right)\right)}\,, \tag{2}$$

where r_1, r_2- lens surfaces, R - lens diameter, a – constant.

Then, using the formula (1) for the first lens, and (2) for the second lens, determine the thickness on the optical axis, depending on the distance from the center of the lens, with equal pitch.

$$z_1(r)\int_0^r\left((n^2-1)+\left(\frac{(n-1)s}{r_2(r_1)-r_1}\right)^2\right)^{\frac{-1}{2}}dr_1\,, \tag{3}$$

$$z_2(r)\int_0^r\left((n^2-1)+\left(\frac{(n-1)s}{r_2-r_1(r_2)}\right)^2\right)^{\frac{-1}{2}}dr_2\,, \tag{4}$$

where r – distance from the optical axis, n – refractive index of the glass, s – distance between the system lenses.

As a result, we get the dependence of z_1 parameter on r and F1 on r and the dependence of z_2 parameter on r and F2 on r. Let's plot the obtained dependencies (Fig. 2).

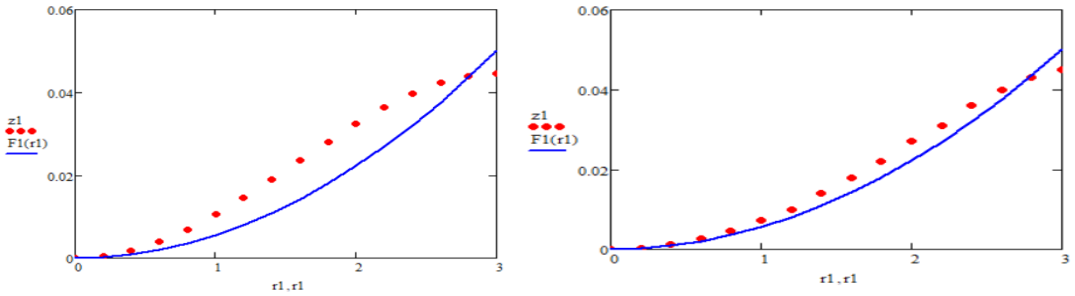

Fig. 2. Dependencies charts, left - z_1 on r and $F1$ on r, right - z_2 on r and $F2$ oon r

Calculation

At development of a variant of system for formation of a laser beam of uniform intensity the following initial data were used: the laser beam diameter is 6 mm, radiation wavelength 1.06 μm.

When investigating the variants, the relative hole is selected as 1:8.

The shape of the lens is selected by graphing the dependence of spherical aberration on the

shape of the lens, and the parameters are selected by fitting (Fig. 3).

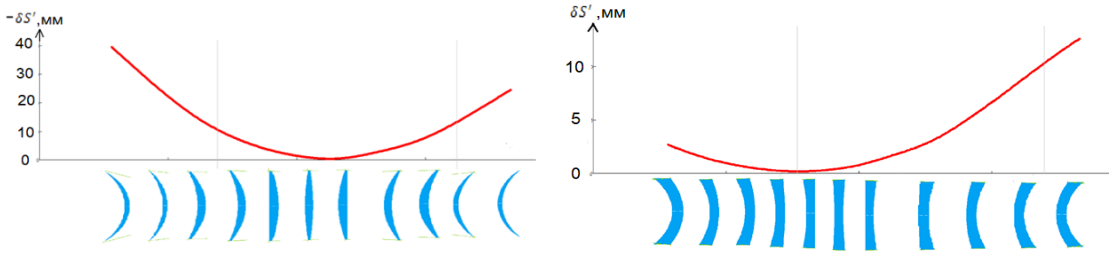

Fig. 3. Dependence of spherical aberration on lens shape, positive on the left, negative on the right.

We receive the focal length of the first component is 48mm. A series of calculations in Opal have been carried out, which showed that the close distance between lenses is not enough to redistribute the intensity of laser radiation. The possibility of redistribution of radiation appears when the focal length of the second component is more than 34mm.

Let us calculate the parameters of the optical system, based on the the method described in [1].

Table 1

Spherical system parameters (Zemax)

Radius (mm)	Thickness (mm)	Brand of Glass
-13,3786		
-10	0.5	TF10
8.381	17.7	
6	0.5	TF10

Calculated by the method described in the patent [3]:

Table 2

Aspherical system parameters (Zemax)

R (mm)	Thick. (mm)	Glass	k	a^4	a^6	a^8
0						
43.861	0.5	TF10	-442.014	-2.896E-4	-2.395E-5	1.647E-6
66.956	30		-2.38E3	7.34E-4	-1.279E-4	5.991E-6
0	0.5	TF10				

As opposed to spherical lenses, aspherical lenses have more than one curvature radius. The local radius of curvature changes from the center of a part to its edge. This means that the local radius of curvature can change its variable sign from convex to concave at different points on the surface. All this complicates production of optical components and leads to their rise in price, up to hundreds of thousands of rubles.

Simulate optical systems (Fig. 4-5).

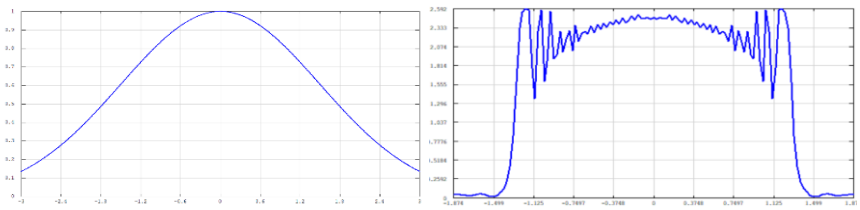

Fig. 4 Results of modeling a spherical system in a physical optics unit. On the left - before passing the corrective system, on the right - after passing the corrective system.

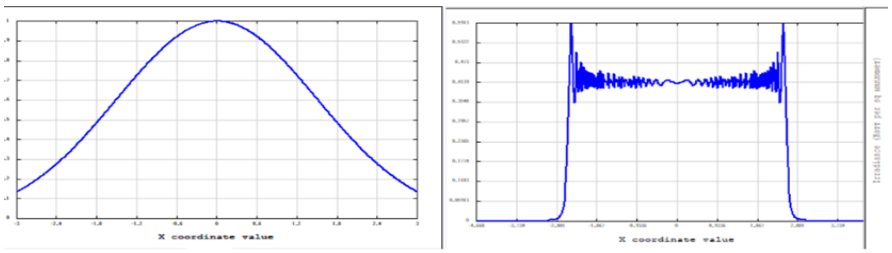

Fig. 5 Results of aspherical system modeling in physical optics block. On the left - before passing the corrective system, on the right - after passing the corrective system.

Conclusion

Two variants of the system of radiation reshaping were studied: one with spherical surfaces, and the other with aspherical ones, according to the patent method [3]. The principles of modeling the block of physical optics and CAD OpticalStudio Zemax are considered.

A solution that uses spherical lenses can be useful in material processing (laser welding, etching, marking, engraving, hardening), which will greatly reduce the cost of the final product and facilitate the process.

References:

1. Чеплаков А.Н. Optical Scheme of Laser Beam Intensity Redistribution / Английский язык в сфере профессиональной коммуникации: V Всероссийская молодежная научная конференция, 29 ноября 2019 г.: Материалы конференции. Сборник тезисов докладов. – Казань: изд-во ИП Сагиева А.Р., 2019. 209-210 с.

2. A. V. Laskin, V. B. Romashova, S. A. Bolt, N. V. Burov. Laser beam intensity profile shapers. // Photonics Magazine Issue Vol. 12, - 2018, P. 178-190.

3. J. Kreuzer, "Coherent light optical system yielding an output beam of desired intensity distribution at a desired equiphase surface". US Patent US3476463, 4 November 1969.

4. A. Möhl, S. Wickenhagen, U. Fuchs Gauss to Top-Hat Beam Shaping with Aspheres // SPIE 9741, High-Power Laser Materials Processing: Lasers, Beam Delivery, Diagnostics, and Applications V, 18 March 2016.

УДК 621.56/.59

DESIGN OF A TURBOCOOLING UNIT BASED ON A CENTRIFUGAL COPMRESSOR

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The use of turbochargers in refrigeration technology is characterized by a noticeable increase in the energy efficiency of the refrigeration cycle. By itself, the compression process in the turbocharger is becoming more efficient. The dimensions and weight of the compressor, and therefore the dimensions and weight of the rotating elements are also lower, which also leads to a reduction in power consumption.

The design features of these types of compressors are: high specific energy indicators, reliability, high degree of aggregation and automation, which minimizes installation costs and ensures the operation of machines without the constant presence of maintenance personnel. The use of a magnetic suspension system (SAMP) of the rotor, which are electromagnetic plain bearings, have a lower stiffness, which is adjustable and selected to specific design and operating conditions, by selecting settings for electronic control circuits of the system[4]. A distinctive feature of the

SAMP requires a preliminary analysis of the characteristics of bending vibrations both in the design of the compressor rotor and in the design of the electromagnetic bearings themselves [5].

Currently, a large company engaged in manufacturing of turbochargers is "Turbocor". Turbochargers of this manufacturer are equipped with refrigerating machines with a cooling capacity of at least 300 kW. The advantages of these compressors compared to the screw compressors used in this power range include:

Compactness. The size of the turbocharger is 2-3 times smaller than screw compressors of similar capacity. The mass of a turbocharger is also lower than the mass of a compressor of the same power of any other type.

Energy efficiency. Energy consumption is reduced by an average of 7%, and the cooling coefficient, which takes into account only the compressor power consumption, exceeds 5.1.

Reduced noise level. While the overall sound pressure level of chillers is about 77-79db, and the sound power level is 95-97dB, for chillers with turbochargers, these indicators are 67-73db and 85-92db, respectively.

The advantages of turbochargers include the absence of danger from liquid refrigerant entering the compression cavity.

The lack of oil. Turbocor compressors do not require the use of oil, which means simplifying refueling operations, increasing the efficiency of heat exchangers, as oil worsens the boiling and condensation processes, and creates a thin film, being an additional barrier to heat exchange. Moreover, since turbochargers can replace the compressors of existing refrigerating machines, the manuals provide the procedure for freeing the cooling circuit from the oil it has.

Turbocor compressors are equipped with their own control and regulation system that allows them to receive control signals from external automation and transmit operating parameters to it.

The purpose of this study was to design an analogue of a 10THMV-2000 type turbo-refrigeration machine, which differs in reduced dimensions of the flow path, smaller dimensions and noise level, which, in turn, leads to an increase in the cooling capacity and economic indicators of the turbocharger. In our study, we calculated the flow path of the compressor, and also did the calculation and construction of the refrigeration cycle and verification calculation of heat exchangers, which were a condenser and an evaporator. For the calculation and construction of the refrigeration cycle, we used the Coolpack program, and for critical rotor frequencies we used the C004 program developed at Turbocompressor Research Institute. It uses the method of initial parameters, which, according to the parameters used and the fulfillment of the boundary conditions, are classified as full-time methods.

During the research the following tasks were set and completed:

1. A compressor design has been developed.

2. Compressor drawings have been developed: turbocharger assembly, longitudinal section of the compressor, compressor flow path, compressor impeller cover disk, gas-hydraulic circuit, and evaporator drawing.

3. The following calculations have been performed: thermal gas-dynamic calculation, calculation of the critical frequencies of the rotor, strength calculations, calculation of bearings and seals. Calculations confirm the performance and reliability of the compressor.

4. Sections of automation, economy, industrial and environmental safety have been worked out.

Thus, a refrigerating machine based on a centrifugal compressor has been designed and developed. These compressors are widely used for gas compression in the chemical, oil, gas, and machine-building industries. They are of great importance in new promising areas of engineering and technology development, in particular, space exploration, and the production of artificial fuel.

References:

1. Основы проектирования холодильных турбоагрегатов: Учеб. пособ/ А.А.Мифтахов, А.А.Никтин; Казан. гос. технол. ун-т. Казань, 1993. 64 с.

2. Щербин В.А., Гринберг Я.И. Холодильные станции и установки, -М,: Химия, 1979 г-376 с.

3. Данилова Г.Н., Богданов С.М., Иванов О.П. и др. Теплообменные аппараты холодильных установок, Л.: Машиностроение, 1973.-328 с.

4. Тепловые и конструктивные расчеты холодильных машин/ Под ред. Н.Н.Кошкина, Л.: Машиностроение, 1976.-464 с.

5. Хисамеев И.Г., В.А.Максимов, Г.С.Баткис, Я.З.Гузельбаев Проектирование и эксплуатация промышленных центробежных компрессоров- Казань; Изд-во «Фэн». 2010-671 с.

УДК 616-72

USING A GREEN LIGHT SOURCE IN BLOOD OXYGENATION MEASURING DEVICES

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Introduction

In the modern world, medicine plays a fundamental role in the life of society. The level and life expectancy of individuals, and in some cases (for example, the situation with the COVID-19 pandemic), of all humanity depends on its quality. And the most acute is the question of creating advanced devices for measuring the main indicators of the vitality of the human body. One of these indicators is the degree of blood oxygen saturation - oxygenation. Every cell in our body needs oxygen for growth, life, existence and development, especially the command center of the whole body - our brain. The hardware complex for its diagnosis in blood is not very diverse due to the complexity of the implementation of most of its methods, however, two methods are still widely used.

In modern medicine, oxygenation can be measured by the lumen of the vessel with two waves of different lengths and registration of the light transmitted through the blood. This method is called transmission and is the most widespread, but it also has its drawbacks, since oxygenation can be measured only in those parts of the body where the vessels are located closest to the skin surface, and there is also a need to position the light source and receiver on both sides of the tissue being measured. This method of measuring oxygenation is not possible on large parts of the body or in internal organs, which severely limits the capabilities of the device created with its [method] use. In order to solve this problem, a second method was proposed, which is gaining more and more popularity in modern medical society - the transcutaneous method for measuring blood oxygen saturation. The essence of the method lies in the fact that a piece of tissue is also illuminated by two light sources of different wavelengths (usually red and infrared), but it is not the light passing through the tissue that is recorded, but reflected from the hemoglobin cells. This method eliminates the need to "hug" the investigated area of tissue or human body with sensors, but at the same time, for its implementation, a much more sensitive photodetector is needed, since the reflected light is several orders of magnitude smaller than the transmitted through the tissue. This is due to the fact that the light is attenuated twice, scattering when it leaves the source and re-scattering when reflected from hemoglobin cells. As a result, only a small part of it [the light] falls on the photodetector [1]. Nevertheless, this method makes it possible to solve the issues of measuring blood oxygenation in transplantation, making it possible to check the tissue engraftment in a particular organism or place of the body, including in internal organs. The need to improve this device cannot be

questioned, today there are many areas, such as improving accuracy, reliability, reducing the price and size, increasing the ease of use, which would make life much easier for ordinary doctors working with the device. Also, to add pulse measurement to the functionality of the oximeter (such devices are called pulse oximeters), it is reasonable to replace the red light source with a green one. This approach can be accompanied by a sharp decrease in the measurement accuracy, however, for everyday use by unskilled persons, simplifying the design (and, as a result, reducing the price) has a higher priority [2].

Application of the pulse oximetry method in medicine

Pulse oximetry is a non-invasive photometric technique that provides information on arterial oxygen saturation (SpO2) and heart rate and has wide clinical applications. This is accomplished with peripheral pulse oximetry probes, mostly attached to the toes, or earlobe. Direct application of pulse oximetry to an organ such as the esophagus, liver, intestine, stomach, or free flap can provide an indication of how well the organ or free flap is illuminated. In addition, placement in oximetry of the probing pulse at a more central node, such as the esophagus, may be more reliable when conventional peripheral pulse oximetry fails [3].

The most commonly used areas of blood oxygen saturation information include the areas shown in Figure 1.

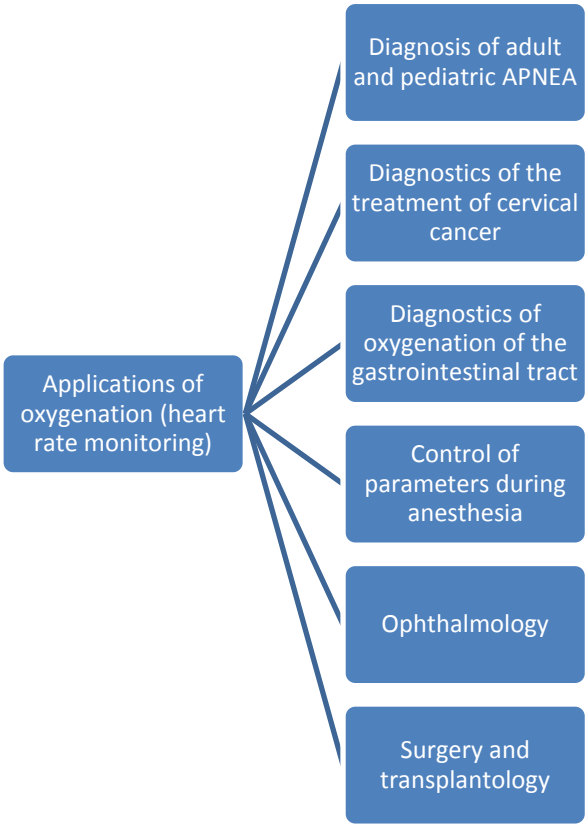

Figure 1. Application of the pulse oximetry method in various fields of medicine

The most relevant area, for the current period of time, is the measurement of blood oxygenation in the diagnosis of lung diseases. In particular, having received the status of a pandemic, the COVID-19 virus has a damaging effect on the respiratory system and one of its symptoms is a drop in the level of oxygen saturation of the blood to 82-86%, which is 8-12% below normal (blood cannot be 100% oxygenated) a number of physiological features of blood supply).

Also indications for the use of pulse oximetry in the field of diagnostics of the respiratory system are:

- respiratory diseases with respiratory failure;
- bronchial blockage;
- operations using an endotracheal tube;
- use of drugs that depress the respiratory center, muscle relaxants;
- apnea (stopping breathing during sleep);
- pneumonia;
- collapse of the lungs;
- thromboembolism of pulmonary vessels;
- pulmonary edema;
- or anomalies in the structure of blood vessels with mixing of blood;
- premature babies;
- condition after operations on blood vessels, heart, lungs or prolonged anesthesia;
- shock or coma of any origin [4].

The main indicator for determining oxygenation is saturation. Oxygen saturation is a measure of the oxygen saturation of the blood. Oxygen transfer is carried out by hemoglobin. Each of its cells is capable of taking 4 oxygen molecules. When all cells carry 4 molecules, the blood is considered 100% saturated. The closer the value is to 100%, the more gas cells receive, their viability and the rate of metabolic reactions increase. At full saturation:

- the color of arterial blood is bright scarlet;
- the skin has a natural shade;
- tongue and lips are pink;
- respiratory and pulse rate are normal.

The first indicator of a lack of oxygen is the pallor of the skin, and as the deficit increases, they become bluish, cyanotic. The pulse rate increases and the blood pressure decreases. The depth of breathing increases, if a person is conscious, then he feels shortness of breath - even with excessive breathing efforts, there is not enough air.

Methodology

The pulse oximetry method is widely used in many fields of medicine. Basic examples of pulse oximetry are shown in Figure 1.

To saturate the blood with oxygen, both invasive methods of oxygenation of the blood and non-invasive measuring devices - pulse oximeters are used. In turn, pulse oximeters are divided according to the method of their work into two types - using methods of reflection and using methods of wave transmission through. It is preferable to use non-invasive methods. In the first case, a sample is taken using a puncture of the ulnar or femoral artery. This manipulation is performed only by a doctor in a mini-operating room.

Pulse oximetry is convenient because it does not require blood sampling and laboratory testing. This is especially important when the patient is in serious condition and there is a need to get a quick result. The method allows you to evaluate the effectiveness of the therapy or resuscitation. Let’s study the latter.

The idea of a transmission method is as follows:

With transmission pulse oximetry, the light flux penetrates the tissues, therefore, to obtain the saturation effect, the emitter and the receiving sensor must be placed on opposite sides, with a tissue between them. For the convenience of research, the sensors are applied to small areas of the body - finger, nose, auricle. In the transmission method, measurements are made using a special sensor. In this case, the passage of light through the tissue is provided, therefore, it is necessary to position the wave source and the detector exactly opposite to each other. If there is a displacement, then the result will be unreliable. Such sensors look like a clothespin and they clamp a finger or a toe, an outer ear. Saturation is calculated as the ratio of the amount of HgbO2 to the total the amount of hemoglobin, expressed as a percentage. Saturation correlates with partial tension of oxygen in the

blood (norm PaO2 = 80-100 mm rt. Art.). When PaO2 is 80-100 mm Hg. Art. SPO2 is within 95-100%, at 60 mm Hg. Art. SPO2 about 90%, and at 40 mm Hg. SPO2 is about 75%.

Transcutaneous pulse oximetry involves the registration of light waves that are not absorbed by oxygenated hemoglobin and are reflected from the tissue. This method is convenient for use on various parts of the body, where it is technically impossible to locate the sensors opposite each other or the distance between them is too great to register light fluxes - stomach, face, shoulder, forearm. The choice of the place of the study gives a great advantage of reflected pulse oximetry, while the accuracy and information content of the methods are approximately the same. Such devices are tuned to perceive light waves that are reflected from tissues. Their accuracy is not inferior to transmission ones, and the possibilities for research are wider. The sensors for this purpose are provided with adhesive strips, they are removable and designed for one-time use.

Hemoglobin, which has attached the maximum number of oxygen molecules (oxygenated), absorbs the infrared light flux, and the unsaturated one absorbs the red one.

The operation of the device is based on this - it emits red and infrared light, and then captures the reflected one. With the help of special software, these data are processed, and the saturation value is indicated on the monitor.

With the transcutaneous method, it is customary to use light of the red and infrared ranges, since this combination has the lowest permeability in the tissue and the best reflection from them. The plot of absorption versus wavelength is shown in Figure 2 [5].

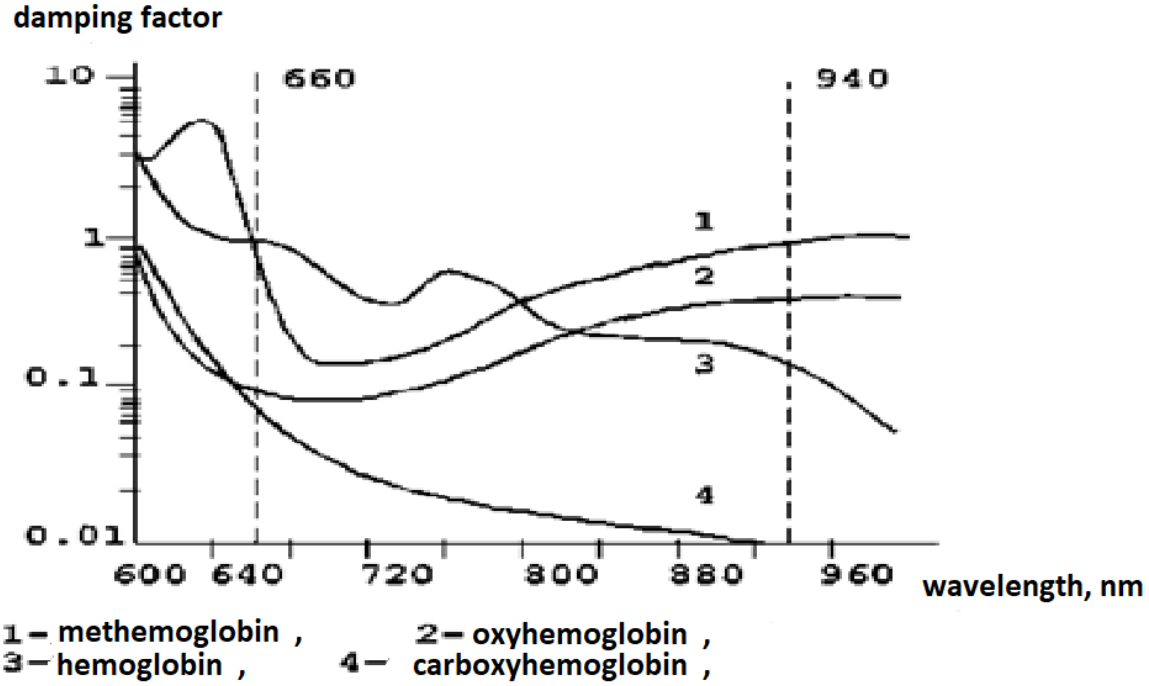

Figure 2. Dependence of light absorption by different types of hemoglobin depending on the wavelength

But recently, green light has also become more and more widespread, as a separate element for measuring the pulse, or as a replacement for a red radiation source. This is due to the fact that green light is best absorbed by the blood, therefore, the less green light returns to the receiver, the more blood is in the vessel. The converse statement is also derived from this, that is - the more light returns back, the weaker is the flow. (The maximum value corresponds to systole, and the minimum corresponds to diastole. As the attenuation coefficient for red and green light has adjacent values, the measurement error is considered to be the smallest possible [2].

References:

1. Orlov A.S. Determination of the degree of saturation of circulating blood with oxygen by the amplitude of the pulse wave. Medical equipment. - 1992, No. 5, p. 16 and 17.

2. Lushina A.V. Pulse registration by photosensitive elements using light waves / Lushina A.V. - 2004. – 3p. [Electronic resource] URL: https://cyberleninka.ru
3. Gynecological blood oxygenation meter (patent for utility model No. 121721) A61B5 / 145 Authors of the patent: Berdnikov Alexey Vladi-mirovich (RU), Novikov Maxim Yurievich (RU) and others. 2012.
4. Shurygin IA, Respiration monitoring: pulse oximetry, capnography, oxymetry. // - SPb .: "Nevsky Dialect"; - M .: "Publishing house BINOM", 2000. - 301 p .: ill.
5. Kalakutsky L. I., Manelis. E. S., Equipment and methods of clinical monitoring // - M. - "High school". - 2004 .- 156 p.

УДК 621.074

UTILIZATION OF BROKEN CERAMIC CASINGS OF STEEL AND ALUMINIUM CASTINGS IN A MANUFACTURING PROCESS

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Keywords: ceramic shell mold, investment casting, quartz, tridymite, cristobalite, polymorphic transformation, recycling, resource saving, ceramic mold breaking.

As it is known, investment casting (LMC), being one of the special methods of castings production, along with such advantages as high accuracy of the dimensions of castings, is distinguished by high resource intensity [1 - 5]. First of all, this is the duration of the production cycle, high energy consumption for a number of technological operations (for example, drying and calcining of body molds) and the high cost of materials for casting molds and models. For this reason, only mass and large-scale production of castings by this method can be considered as economically justified. Until now, ceramics based on silicon dioxide (silica) is widely used as a material for body casting molds at domestic enterprises engaged in the production of castings from steel and aluminum alloys using the LVM method. The limiting factor is the tendency of quartz ceramics to polymorphic transformations under conditions of temperature loads, which in practice leads to cracking and even destruction of individual layers of the shell wall or the mold as a whole.

Being present in the composition of the molding material (suspension, refractory dusting) and when calcined in a filler, quartz undergoes polymorphic transformations when heated with a change in volume, which results in the occurrence of stresses and cracks in the RP.

The use of quartz in its low-temperature modification for irrigation creates additional risks in the manufacturing of molds in terms of their reduced fracture toughness due to polymorphic transformations and in practice often leads to cracking and even destruction of individual layers of the shell wall or mold in general. Pre-calcining of the packaging material, which is practiced at many foundries, makes it possible to reduce the negative consequences of dangerous polymorphic transformations of quartz; however, all of them are quite expensive and do not meet modern challenges and requirements of resource conservation in foundry and metallurgical industries. In this regard, attention is drawn to the ceramic destruction of steel and aluminum castings for investment casting based on silica.

At present, the breakage of used ceramic body molds for investment casting is not used for recycling. This waste material is utilized or it is used as a support filler for flasks. The component-chemical and phase analysis carried out on the material showed that in the composition of the destruction of ceramic shells formed after taking out steel and aluminum castings from molds, in addition to quartz it contains up to 5-10% iron and scale and, respectively, 3-5% aluminum and its oxides. Residual iron, aluminum and their oxides help to improve the workability of the mold.

Experimental tests of the proposed recycling option under the conditions of existing production have confirmed their effectiveness.

The most significant for the thermally stressed state of the mold is the rapid transformation at 573 ° C, when the linear size increases by 1.4% upon heating. This is one of the reasons for the formation of cracks in shells and blockages in castings. Conversions at 870 ° C are extremely slow and not important for casting practice. In addition, the preliminary firing of packaging material, which is practiced in many foundries, can reduce the negative effects of dangerous polymorphic transformations of quartz. Smooth heating of molds in order to reduce the possibility of their cracking, which is carried out in the support filler, contributes to an increase in the duration of the technological process and additional energy consumption. One of the options for reducing the possibility of OP cracking during their calcination is replacing the pulverized quartz sand as a filler with dispersed quartz sand of a polyfractional composition.

It is proposed to use pulverized aluminosilicate, which does not undergo polymorphic transformations in the operating temperature range of the ceramic mold. Due to the low coefficient of thermal expansion, the casting molds obtained on the pulverized aluminosilicate have high strength at high temperatures. In addition, the cost of pulverized aluminosilicate is much lower than that of distensillimanite powders. Fused quartz is a promising material for replacing quartz sand. As a result, the number of RP layers, the drying time and the consumption of auxiliary materials are reduced. The use of fused silica (trademark Ecosil-Melur) also improves the quality of the cladding due to the low heat coefficient.

Thus, a technological version of the utilization of broken ceramic casings of steel and aluminum castings using lost wax patterns has been developed and tested in production conditions, which involves the use of the material, after the necessary preparation, as spraying of multilayer casting molds.

The use of ceramic broken shells as a packing material excludes the re-occurrence of polymorphic transformations of quartz during the calcination and casting of molds that determine the change in volume, density and change in the types of crystal lattices of the material.

References:

1. Leushin I.O., Leushina L.I., Grachev A.N., Ulyanov V.A. Investment casting: technical solutions for saving resources // Metallurgical Review of the CIS. 2013. No. 1.P. 6 - 8.

2. Leushin I.O., Leushina L.I., Koshelev O.S. Innovative technology for the manufacture of ceramic body molds for the manufacture of castings with removable models // Ferrous metals. 2018. No. 5.P. 25 - 28.

3. Zhao H. Analysis of recycle and composition of molding shell waste during investment casting // Special casting and non-ferrous alloys. 2005. Vol. 25. Issue 1.P. 52 - 54.

4. Mahrabi Kh.A., Jolly MR, Salonitis K. Methods of reducing material waste and saving energy in investment casting // Annual meeting of TMS. 6th International Molding Symposium - TMS 2016: 145th Annual Meeting and Exhibition; United States. 2016.Vol. 2016. S. 69 - 76.

5. Borisov V.A., Varentsov V.V., Zhukov A.A., Pochkarev Yu.A. Regeneration of materials used in the manufacture of ceramic molds // Foundry production. 2001. Issue 11.P.18 - 20.

УДК 617.7-073.178

CONTACTLESS DEVICE FOR MEASURING INTRAOCULAR PRESSURE

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The vision of all mankind is catastrophically reducing. The number of ophthalmologist patients is growing steadily. The cause of the disease is the pathology of the endocrine system, uncontrolled

intake of drugs, genetic predisposition, poor nutrition. Measurement of intraocular pressure (IOP) is an obligatory stage of the examination in case of suspicion of various pathologies. The study allows to make a preliminary diagnosis and control the course of treatment [1].

The whole variety of existing tonometers includes 2 groups: contact and non-contact. Distinctive features and advantages of non-contact tonometers are: elimination of errors in reading and scatter of readings; improving accuracy through the use of digital processing, control of the measurement process and through the presentation of information in digital form; ensuring invariance to the state of the cornea; creation of patients database and the possibility of conducting statistical studies; elimination of the risk of eye infection.

The measurement of ophthalmotonus is based on obtaining deformation of the eyeball under the influence of external influences. In this case, they proceed from the assumption that the values of deformation (λ), acting force (F) and intraocular pressure (p_t) in the first approximation are related to each other by the following functional dependence:

$$p_t = f(F / \lambda) \quad (1)$$

In ophthalmotonometry, it is not the IOP that is practically measured, but the degree of compliance (rigidity) of the sclera or its ability to change the internal volume under the influence of the volume of the incompressible aqueous humour that is additionally thrown into the eye (i.e., the cornea or sclera displaced backword) [2].

The main trend in the development of IOP measurement methods, as the analysis presented in [1] shows, is the improvement of non-contact measurement methods based on the use of a combination of signal sources (sensors) that provide information on IOP by algorithmic processing of these signals.

In a number of domestic and foreign developments of contactless IOP tonometers, to obtain information about IOP, a scheme of reflection of light rays from the surface of the deformed cornea is used (Fig. 1).

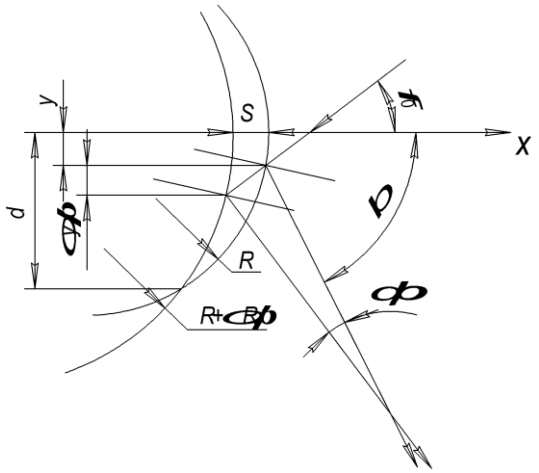

Fig. 1. Scheme of reflection of light rays from the surface of the deformed cornea

Δp_a – the amount of pressure change as a result of the pneumatic pulse; σ - surface tension coefficient; y - coordinate of the point of incidence of the ray; φ_0 – the angle of incidence of the light beam on the cornea; d - the radius of the cornea; p - IOP value

Analysis of the optical scheme to derive the following dependence:

$$\Delta\beta \approx -\frac{\Delta p_a}{\sigma}\left[y - \frac{\varphi_0(d^2-y^2)}{4\sigma}p\right] \quad (2)$$

All the variety of options for the structural design of contactless IOP meters [3] can be reduced to the following structural diagram (Fig. 2).

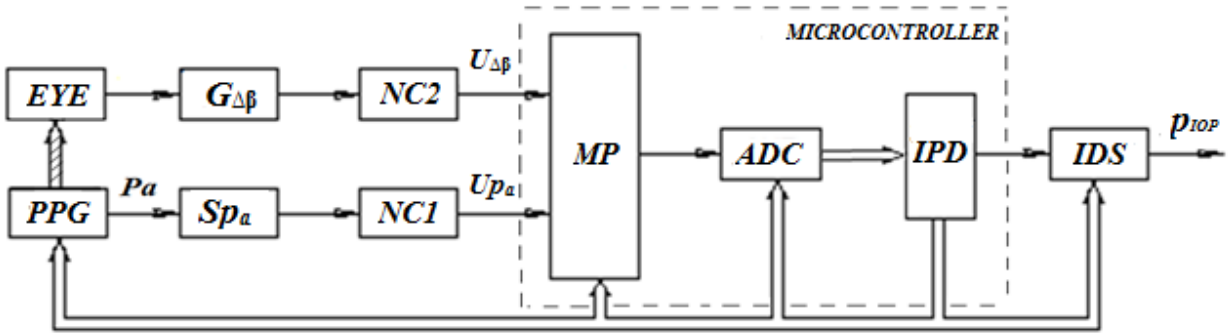

Fig.2. Block diagram of a contactless device for measuring IOP

PPG - pneumatic pulse generator; Sp_a - pressure sensor; $G_{\Delta\beta}$ - strain gauge; NC - normalizing converter; MP – multiplexer; ADC - analog-to-digital converter; IPD - information processing device; IDS - information display system

The diagram shows a two-channel parallel-serial device that includes two parallel measurement channels: an optical channel and a pressure channel. The output signals from the channel sensors, after matching and normalizing, are reduced to the same type, and then sequentially or according to the algorithm through the multiplexer MP are connected to the common ADC and then through the digital communication channel are entered into the information processing device, where signals are processed in accordance with the dependencies:

$$U_0 = \eta k L \Delta\beta_0 \quad (2)$$

$$U_{Pa} = Q \cdot p_a, \quad (3)$$

where η - the sensitivity of the photodetector; k - coefficient depending on the position of the slit diaphragm; L - the distance from the surface of the cornea to the photodetector; Δβ0 - the amplitude of angular oscillations of light reflected from the cornea; Q - pressure sensor sensitivity.

To determine the requirements for the main functional elements of the channels of the device for measuring IOP, a metrological synthesis of each of the channels is carried out, the essence of which is the distribution of the accuracy requirements between the functional elements entering the pressure channel or the optical channel, respectively. The computational and analytical substantiation of the requirements for the parameters of the functional elements included in the digital part of the IOP meter is based on the results of metrological synthesis, namely, on the magnitude of the error dispersion of the ADC, IPD and IDS. In accordance with the values of these errors, a parametric synthesis was carried out and requirements for the functional elements were determined: ADC, IPD, IDS (Table 1).

Requirements for ADC, IPD, IDS — Table 1

Parameters	Pressure channel	Optical channel
ADC		
- sampling frequency - number of digits -conversion time	101 Гц 8 0,0099 с	1,05 Гц 8 0,95 с
IPD	8	2
- length of the discharge grid		
IDS	7	7
- number of digits		

In accordance with the terms of reference, a non-contact device for measuring intraocular pressure was developed. This design option significantly reduces hardware costs and simplifies management.

References:

1.Lyubimov G.A. Development history and biomechanical content of intraocular pressure measurement by the Maklakov method. // Glaucoma, 2006, No. 1

2.Iomdina E.N. Biomechanics of the scleral membrane of the eye in myopia: diagnosis of disorders and their experimental correction. Diss. doct. biol. sciences. - M. 2000 - 316 p.

3.Koshits I.N., Svetlova O.V., Kotlyar K.E., Makarov F.N., Smolnikov B.A. Biomechanical analysis of traditional and modern concepts of the pathogenesis of open-angle glaucoma. // Bulletin of Ophthalmology, 2002, No. 2.

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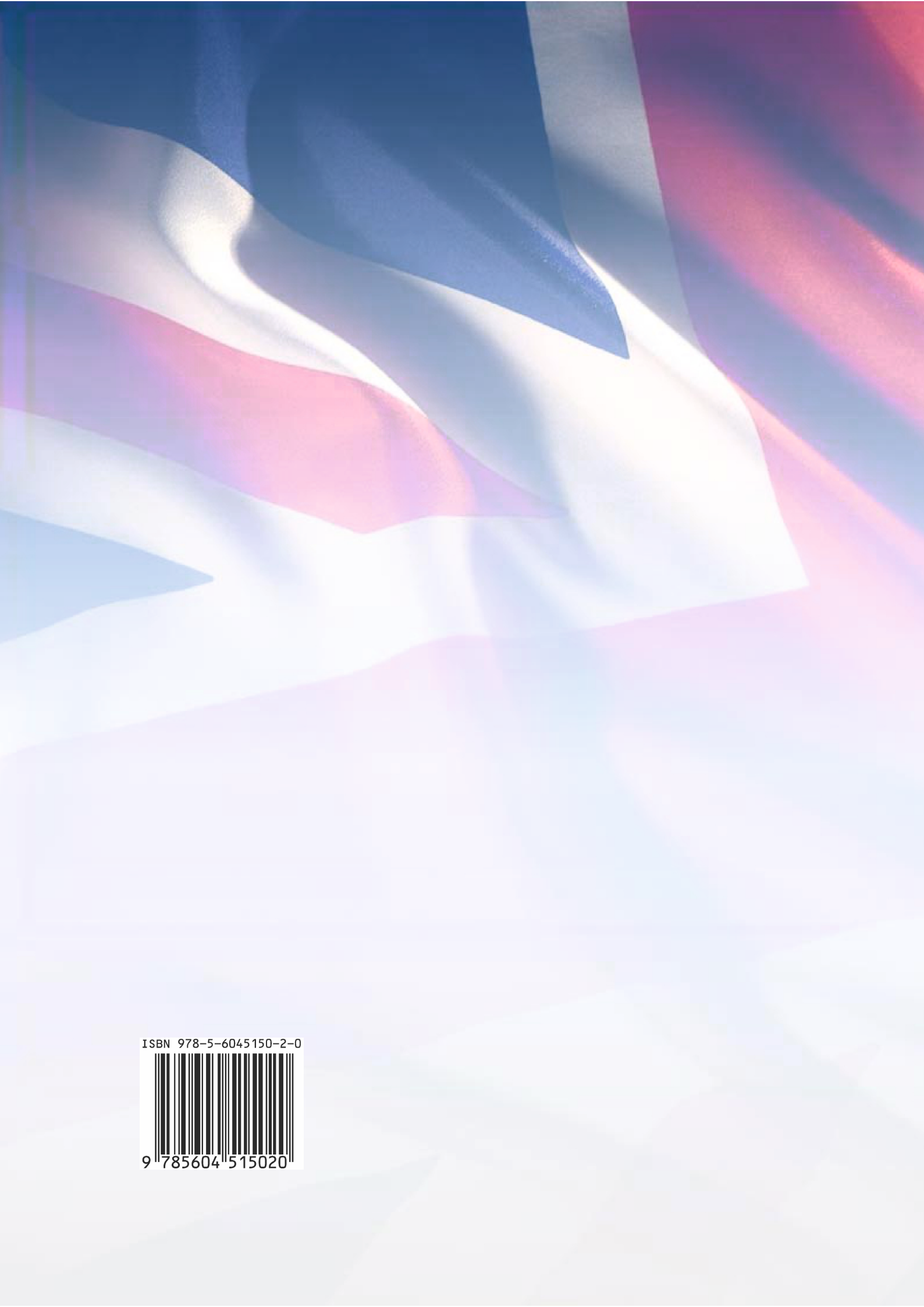

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