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STRUCTURE, FUNCTIONS AND POLITICAL IMPORTANCE OF THE «SOCIAL FORM» OF TRANSPORT

Abstract: *The structure, functions, specificity of the systemic status of the social form of manifestation of transport in the historical context and as a factor of politics are considered. The author's understanding of social transport differs from the existing one, but it is not an alternative. The analysis of social transport was carried out as an attempt to solve the ideological and methodological problems associated with the fact that the officially recognized definition of transport is one-sided, both theoretically - logically and methodologically. It reflects the level of general ideas in the process of cognition and cannot be correctly built into the system approach, which, in turn, reduces the productivity of knowledge in its practical - political application. The use, along with the term "social", the terms "human", "artificial", "Public" does not mean their substantive identity, just in the existing epistemological situation these differences are not significant, therefore, within the solution of the main task - to overcome the one-sidedness of the interpretation of transport as a carrier and to expand the functional purpose of transport in the organization, it is necessary - sufficient conditions of social construction can be neglected for now ... The methodological and theoretical aspects of the study of social transport, where appropriate and justified, are brought to practical conclusions. Verbal analysis is accompanied by a conical one - there are 3 schemes in the text. Particular attention is paid to the management of the organization of social transport, in particular, the possibilities of multi-transport complexes, as ways of efficient construction of space - time as conditions for the realization of free human life and the implementation of social progress in general. If the general goal of social progress is to increase human well-being with the full development of the freedom of his activities, then the strategy of social construction should be focused on the systemic importance of the development of social transport, as a carrier and as a constructor of conditions for freedom of all social subjects.*

Key words: *transport, social transport, social space and time, social construction, management of the organization of space and time, the history of social transport.*

Language: *English*

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Introduction

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Transport, being a universal tool in organizing the movement of matter, has a unitary nature, which, depending on the form of movement, appears in a specific way, creating the impression of the autonomy of its individual expressions. There are no different types of transport, there is a variety of ways of its manifestation, revealing the qualitative specifics of movement. Spiral; twisting transport history, common to all varieties, but within the development of transport, each of them has its own historical spiral, characterized by the peculiarity of patterns that complete the single essence of transport. The differentiation of transport shows its participation in the formation of new levels of movement, the diversification of transport functions reflects the need for new actions in connection with the development of the organization of matter.

The general theory of transport allows you to maintain the course orientation in the study of its varieties, their relations, but the general theory and methodology are especially significant for determining the political value of transport in the process of social construction and preserving the natural conditions of social movement. The social movement turns natural conditions into factors that ensure social progress, therefore political correction is required. The factors of natural support of social progress should not be factors of crises of natural development itself. And here an understanding of transport adequate to its actual status is necessary as a measure of both social and natural movement. The management of the interaction of the movement of the natural environment of society is based on transport policy, in which the interests of man and the laws of the natural system must be coordinated.

The history of mankind does not allow you to smile, reading the phrase: transport policy is the core of the system-forming factor in the organization of interaction between society and the natural environment of its movement. "National" and "universal" (global) ideas, designed to consolidate social advancement, must rely on the socially dominant attitude in politics towards transport construction. In the meantime, the utilitarian-local idea of transport as a means of ensuring the movement of people and cargo will dominate in the public consciousness, neither national nor global problems can be rationally solved. It seems that the military was the first to approach this truth. In any case, armed competition is already built on the achievement of an advantage in traffic control, more precisely, transport, as an instrument of movement. There are encouraging examples of awareness in civil practice: China has raised railway traffic in the Himalayas, Japan is energetically investing in the development of high-speed rail traffic, Russia is seriously engaged in transport support for the Arctic, more and more countries are rushing into Space, striving for its practical use, the EU is trying to be among the leaders development of "green" transport. The complex nature of transport has been improved in the process of its evolution. By the time transport climbed to the next round of the spiral of its development, became a "human" transport, it was already clear that the spiral of transport ascent has a specific design. The spiral of the historical transformation of transport is twofold. It is similar to the spiral of organization of the DNA of living matter. The double helix is a sign of perfection and significance of the status of a phenomenon.

The privilege of transport is due to the peculiarity of its place in the movement of matter. The very immanence and universality of the presence of matter in motion is sufficient to recognize the special purpose of the phenomenon, and transport, moreover, as we have shown in previous publications, plays a key role - it serves as an instrument of movement. In this connection, it is advisable to clarify one essential detail in the understanding of movement.

Taken in general, that is, as the totality of all forms and types, movement is most often interpreted through the method of its manifestation. In Russia, as a rule, they refer to the definition of movement by F. Engels, reducing the author's text to the basic concept - “to change”.

F. Engels really emphasized the key meaning of change in movement, but, firstly, he did not reduce movement to change, and secondly, it is important how he interpreted the change, attracting specifically for this a historical sketch of the progressive progress of natural science. And already without question from the text it is clear that changes in the form of movement are extremely significant, but they are the simplest manifestation of movement. F. Engels wrote: "Motion, considered in the most general sense of the word, that is, understood as a way of existence of matter, as an attribute inherent in matter, embraces all

changes and processes occurring in the universe, from simple movement to thinking."

Main part

The interpretation of transport, which is an instrument of movement in its aggregate understanding, should not be limited to a statement of changes in space - time. Transport takes a different part in all the changes taking place in the movement, including in the reconstruction of the existing reality and in the construction of a new reality. We have already noted that, in our opinion, the construction function of transport is mainly focused on the creation of necessary - sufficient conditions for construction. In this, transport, apparently, differs from construction as such, that is, we are not talking about displacing construction from the structure of movement by transport. They complement each other. Unlike construction, which is always construction, transport is always an instrument for organizing the conditions of the construction process in space - time, temporary support space for construction. His work is more like a preparatory process for the main part of the construction. Transport prepares and accompanies the construction part of the movement. The building function of transport can be expanded on the example of its human form of development.

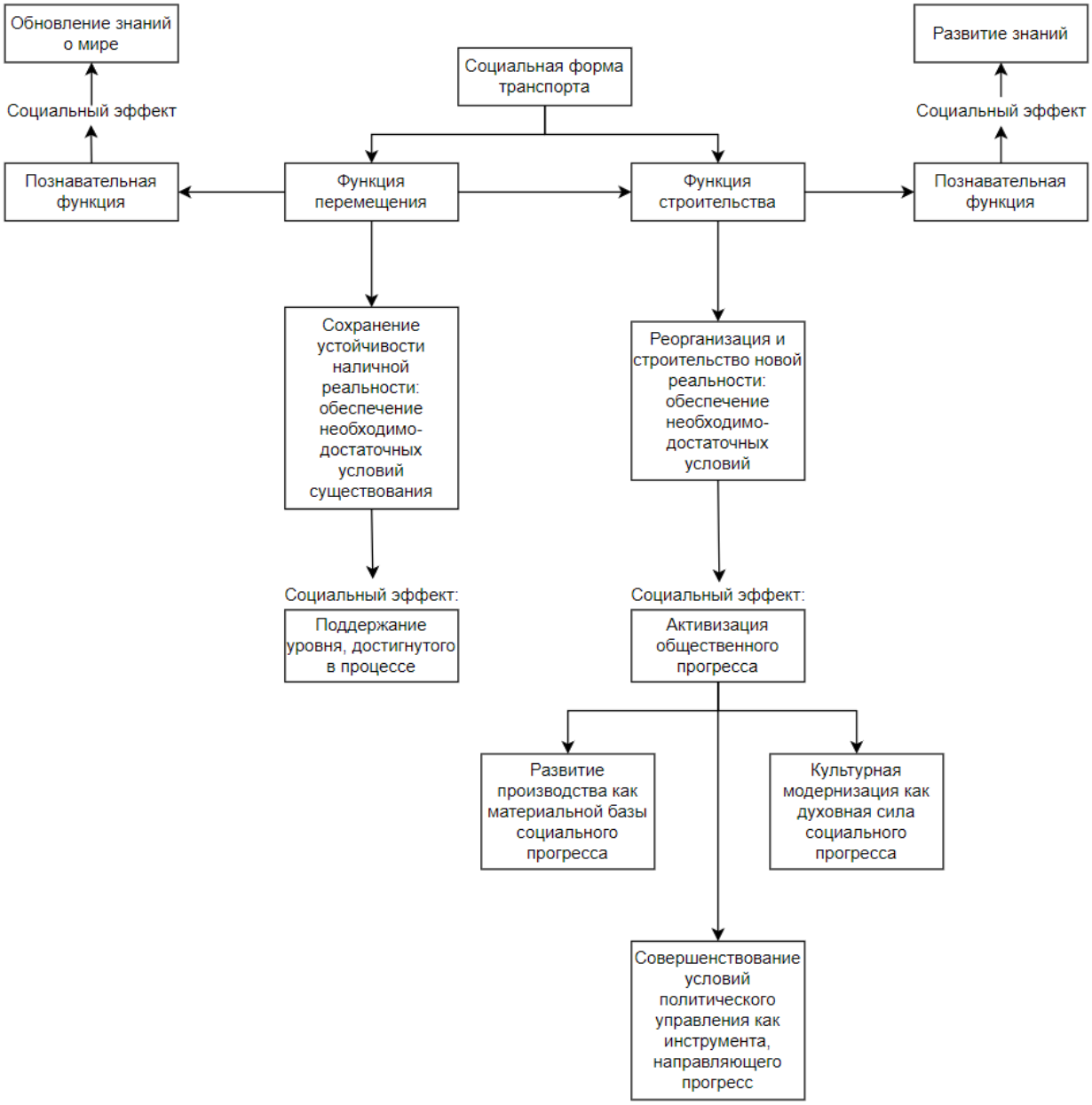

Figure 1. Functions and social effects of the functioning of the social form of transport.

Cognitive activity is inherently connected with the development of human transport. Participation in the process of cognition, as well as the very process of the formation of cognition, starting from its history in the animal world, is indicative for understanding the development inherent in transport. This function, in contrast to the first two - to serve as an instrument of movement and to provide necessary - sufficient conditions for construction, does not have universality and therefore does not belong to the fundamental tasks of the existence of transport, however, it is of paramount importance for the actualization of the transport business in society. It was the basis for the "conquest" of the world by man and the provision of the growth of freedom of activity of the individual.

Transport was originally the only tool for man to move from the known part of the world to the unknown; expansion and deepening of the outlook and world outlook of a person. In addition, new knowledge was usually accompanied by regular territorial acquisitions (Figure 1).

A simple list of social effects from the implementation of the functions of transport support for social progress makes it possible to assess the importance of transport in the history of mankind, first of all, in improving material production and conditions for personal freedom. The definition of social transport as a branch of production reflects only the external manifestation of transport and that, unfortunately, is not proportional in relation to the actual role of transport.

Transport has long become a product of labor, moreover, it forced a person to develop a special branch of transport production. In the same cases, when the construction of vehicles was carried out in places located on waterways significant for life, the transport specialization of production became the leading industry.

There are enough confirmations of this: T. Heyerdahl, planning the passage across the Pacific Ocean, used the experience of building rafts, which had developed over centuries of practice among the local population - Indian tribes. The plan of the famous Norwegian researcher turned out to be correct, his calculations and expectations came true. The journey from Peru to the Tuamotu archipelago undertaken under the leadership of T. Heyerdahl first showed and then confirmed the possibility of settling Polynesia by the inhabitants of the eastern coast of South America. In 1953, T. Heyerdahl discovered the remains of pre-Inca settlements on the Galapagos Islands. Three years later, the researcher of the Indian resettlement route, conducting archaeological excavations on the Easter, Rapa - Iti and Marquesas islands, specified the time of their settlement by mainland migrants (IV century AD). Convinced of the validity of his version of resettlement of people with the help of home-made vehicles from natural material available for primitive production, T. Heyerdahl in the 1970s organized transfers on papyrus boats "Ra" and "Ra-2" from the coast of Morocco to the shores of America. His last expedition along the route Iran - the mouth of the Indus - Djibouti was also carried out on papyrus ships. Some African tribes were considered masters of making boats from papyrus. Domestic northern Slavs - Pomors, who lived on the shores of the White Sea, developing the experience of building large boats for coastal coastal sailing in order to catch fish and prey sea animals, by the 11th century they constructed a sailing rowing fishing vessel "koch", flat-bottomed, single-deck with raised edges and low draft. Koch was equipped with a mast, sail and outboard rudder. The length of the vehicle did not exceed 20 m, the carrying capacity reached 30 tons. Kochi were built without the use of metal. In the Middle Ages, kochi were actively used for the development of the Urals, Trans-Urals and Western Siberia. It was impossible to settle new lands without kochi, or it was extremely difficult in practice, it would take much more time, which significantly limited the pace of social development

Representatives of the Scandinavian peoples were called "Varangians" in the ancient Russian chronicles, without distinguishing them by nationality. The Varangians played a significant role in the formation of statehood in Russia. Before the accession to the throne of the Romanovs, power belonged to the Rurikovichs, descended from the representatives of the Scandinavian leaders called to rule. In the domestic mass historical consciousness, the mention of the Varangians is usually associated with a mercenary armed force, which constituted a significant part of the Russian army under the princes.

In reality, Scandinavian mercenaries were only part of the Scandinavian presence in Russian history. The Varangians actively developed merchant shipping along the famous medieval highway “From the Varangians to the Greeks”, that is, from the shores of the Baltic to the Black Sea, where the settlements created by the Greeks remained, mainly in the Crimea. Transport not only connected the South of Eastern Europe with the North, but also made an important contribution to the social development of that territory, which was subsequently united under their rule by the great Russian princes. The transport main, like an electric line, created around itself fields of attraction for the population - the organization of construction, trade, production, cultural life. Along the river systems used during the transition "from the Varangians to the Greeks"

The above-described dependence of social progress on the development of transport is a natural phenomenon. It was typical for Antiquity, when most of the known states were formed on the shores of the Mediterranean Sea and in the basin of rivers flowing into it. The same was the case in the northern part of Europe, adjacent to the Baltic Sea. The magnetic force of transport is inherent in its ability to move, however,

apparently, the main factor is not the fact of movement itself, but a sign of stability, repeatability, the ability to control the movement of transport. Due to its ability to act with a given constancy of repetition, transport becomes not only a means of movement, it becomes a way of communicating people, opens them up the prospect of communication and activity.

In Russia, the departments responsible for transportation were officially called departments, corps, ministries of communication. The last state institution with a name that contained a combination of "means of communication" was abolished in the 1990s. It was the Ministry of Railways, which controlled the railroad transport of the USSR. History does not forgive haste in making political decisions on a national scale. It was during this decade that, for the first time since 1837, the increase in railway tracks decreased by 1200 km. The reformers of the 1990s tried to simplify the cost of transport by abolishing its function as a means of communication to the population of the state, which could lead to the disintegration of the integrity of the state.

It is also impossible to imagine the highest socio - economic achievements of the USSR, as well as its main successor, the Russian Federation, without the development of railway transport, as the progress of the United States without improving the road network and automobile production. Already at the beginning of the reign of Alexander II, who replaced Nicholas I, individual railways were united into a network (1857), a ministerial form of government was formed (Ministry of Railways - 1865). As a result, over the rest of the 19th century, the length of public railways increased from 680 km (1851) to 70260 km (1917). Railways, which were fiercely opposed by domestic conservatives, believing that they could undermine the autocratic power and its social support - the serfdom of the peasants, the class gradation of the population, depriving a significant part of civil rights, who claimed that the climate and relief of Russia will make railroad communication impossible or wasteful for the treasury, have become a national mode of transport. The founder of the national railway construction P. P. Melnikov stated: “The railways are extremely necessary for Russia, they are, one might say, invented for it more than for any other European country ..., the climate of Russia and its spaces make them especially precious for our fatherland "(Figure 2).

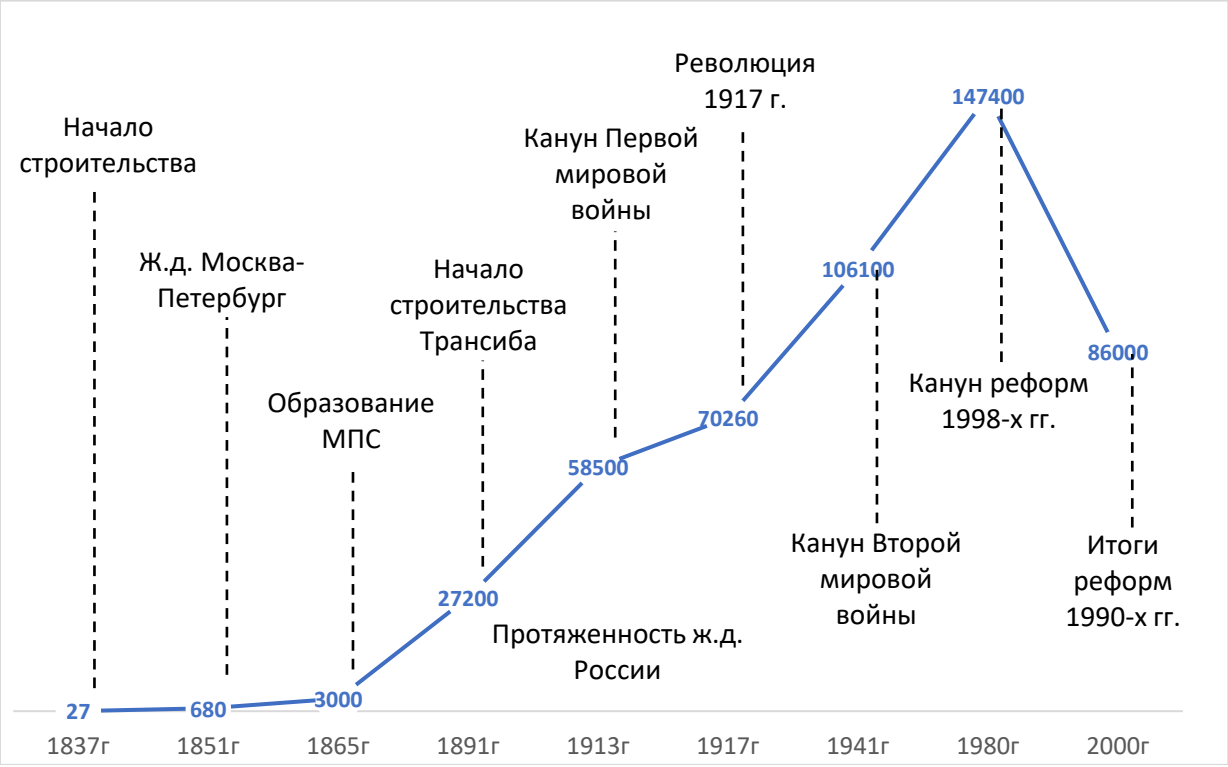

Figure 2. Change in the total length of railways in Russia, the USSR and the Russian Federation

Railway communication has a number of essential features: it is the most material and energy-intensive, requires a developed construction industry, a high level of scientific and technical support and the art of management. The history of Russian railways is an excellent encyclopedia of what should and should not be done and how to do it, having such a large-scale and nationally significant object under management. The political events that became the content of two decades after the abolition of the USSR showed not only the significance of great national achievements in the development of transport, but also high risks. To

undermine the economic foundations of the state, whose history since Peter the Great was based on transport construction, it is not necessary to destroy the entire national economy. It is necessary to break down the transport system and a complete economic collapse will occur.

The reforms of the end of the twentieth century deprived Russia of river and sea transport, as well as famous shipyards, automobile production stalled, and aircraft construction stopped. The entire burden of transport responsibility fell on the shoulders of the railways. And the systematic way of organizing them coped with its task, although not without losses. The reform initiative, which is always distinguished by energetic pressure, is very often dequalified by historical illiteracy and poor knowledge of international experience, in particular Great Britain, France, Spain. The history of railway transport, and not only it, testifies to the need to adapt the requirements of cost accounting and the combination of private ownership with state ownership to the specificity of production activities.

We have no reason to doubt the good intentions of either ours or all other reformers. Politics is a complicated matter, therefore, besides the desires of the noblest, politicians are obliged to build their plans in the system of objectively determined coordinates of social movement in space - to measure by the size of social space and the time of implementation of the plan, but most importantly, they must be aware that reforms in society are something , akin to the organization of transport. Every movement needs its own locomotive. Reforms run the risk of becoming "good intentions" paving the way into the social abyss if they are not provided theoretically and the reformers have not decided on the "locomotive" that can be trusted to move towards the desired future.

The social structure and the logic of its change, in a formalized form, look very simple: society is a system of people, their activities and relations conditioned by the activity. The activity creates the economy, culture and the need to manage the social complex. The social contradictions of a developed society are not capable of collapsing on their own. The state comes to the rescue, it is also a product of people's activities in their own interests.

Ideally, the state should be equidistant and equally concerned with all of its citizens. Formally, a democratic government looks like this, but real contradictions are much richer than the formal responsibilities of the state. The forces in society are shaking the social movement "to the right", "to the left", "back", "forward", like sea waves and ship currents. On ships, they maintain a course with the help of a compass and instruments that guide the heavenly bodies; in politics, the course should pave the scientific understanding of the movement of social progress.

In reality, politics is capable of disregarding the laws of development. Social laws have a statistical form, they are expressed in the dynamics of phenomena that are themselves mobile and can therefore be "moved" by politics. Phenomena gain social strength over time, and the shrinking force field of space gives the force a vector of action. The law in society that a perfect ship at sea will take its toll and straighten its movement, but time will be wasted, and the social space will not be properly equipped.

All subsystems of society have a "human face", are created and move by people, economic policy should not steer the movement of society. Its destiny is to ensure the exchange rate movement of the development of production. Social policy is called upon to steer. All political decisions require humanitarian expertise, a check on how they correspond to the interests of those who have done everything that politicians control.

Economic policy, due to its status - to move the production base of human life, create material wealth, is significant and responsible. However, it is a component of the system of society, and it is not supposed to measure its quality by its own criteria. Not economic, but social and humanitarian criteria determine the quality of any policy.

"Profitability" is a purely economic indicator, and it is indisputably significant in determining the economic organization of a business, within the framework of the localization of the production process. The spread of profitability as a universal measure contradicts the systemic construction of society and its orientation towards improving human life as a social, not an economic entity.

The economization of the management of social progress introduces a dangerous tilt into the social movement, and during the "shock" reforms this tilt becomes critical. Even when it is possible to neutralize the risks, their delayed effects do not allow society to calm down for a long time to return to the normal course of movement and stability. Let's repeat: the movement of a "social ship" is formally the same as that of an ocean-going ship.

Private railways appeared in the Russian Empire at the end of the reign of Nicholas I. In 1868, part of the state railways were sold. Thirteen years later, the government realized the shortcomings of the commercialization of railways and began to buy out private roads. After that, the development of the road network and the quality of construction work became noticeably more active. Economic development in general has become more intensive. Nevertheless, the Russian rulers of the House of Romanov were unable to extract and correctly use the advantages of building railroads.

In the third quarter of the 19th century, transport in the USA and economically mobile countries of Western Europe was recognized as a locomotive of social and economic development. Russian monarchs

and most of their courtiers continued to plan transport construction with an eye on the possibility of undesirable changes for the autocracy system. They were afraid that in the domestic economy, even before the opening of the first "real" railway St. Petersburg - Moscow, characteristic signs of market economy appeared, which, according to European history, was followed by bourgeois - democratic restructuring in the socio - political sphere.

During the transition to steam traction in railway transport, the number of workers in Russia increased to 505.1 thousand people, an increase in comparison with 1804 by 6 times. Almost 90% of the workers were already civilians. The number of industrial enterprises has exceeded 15 thousand, and a third of them have been built over the past 25 years.

The government of Nicholas I by some decrees opened up the prospect of railway construction, while others slowed down the progress of the economy. The industrial revolution created the scientific and technical conditions for organizing mass production, mass production presupposed the need for transportation with modern technical means. The enlargement of production was required; you could not bring a railroad to every village or small urban settlement.

The desire to make the first railroad as efficient as possible left even large cities aside from the main route. At the same time, with the knowledge of the emperor, the organization of centralized production was in every possible way restrained: the construction of new factories and plants, technical modernization were prohibited. In the Vladimir province, factories in the 1840s had 18 thousand machine tools, and in private village houses - 80 thousand. Handicraft production was encouraged. They did not see it as a serious danger to the existing political system; moreover, handicraftsmen paid a quitrent to their landowners.

The Minister of Finance Count E.F. Kankrin is a person known for conservative autocratic views. Meanwhile, the surname of the count is often used by historians of our time in an innovative context, as well as P.A. Stolypin, who, on the contrary, sought to actively load the railways with immigrants to the eastern regions of Russia in order to reduce the density of the rural population in the central part and relieve the growing political tension.

The peasants practically did not participate in the revolution of 1905-1907, which was one of the main reasons for the defeat of the revolutionary forces. The possibility of a new mass peasant protest this time seriously frightened the authorities. More consistent bourgeois reforms were developed by Count S.Yu. Witte, who enjoyed authority in Western Europe, who worked consecutively as Minister of Railways, Minister of Finance, and Prime Minister. Nicholas I considered his ideas overly liberal and replaced Witte with Stolypin, who was reputed to be an exemplary conservative.

During the time when S. Yu. Witte was in power, the growth of railways almost doubled, he actively contributed to the construction of the Trans-Siberian Railway. The reform of the monetary system of Russia on the basis of gold monometallism, carried out by S. Yu. Witte, saved the country from default, he was a co-author of the Manifesto of October 17, 1905 on the granting of "unshakable foundations of civil freedom", consistently cooperating with large domestic and European industrial circles, financiers, enjoyed a steady authority with them. A number of the provisions of the Stolypin reform were developed by Witte, but he was not a supporter of Stolypin's harsh repressive methods. The diplomatic talent and international authority of S. Yu. Witte helped Russia achieve a worthy result in the signing of the Portsmouth Peace Treaty with Japan. Biographical details from the personal history of S. Yu. Witte are directly related to the topic of our study of social transport. Before graduating from the South Russian University in Odessa, Witte planned his life in a completely different way from the way it eventually turned out. After completing his mathematical education at the university, Witte, the graduate, published part of his graduate studies in the works of the Sorbonne, which he himself learned much later. As the best among the worthy, he was invited to work at the department of his native university and was preparing for a professor's career. So, perhaps it would have happened, if not for the case. Father S. Yu. Witte met his comrade, who by that time held the post of Minister of Railways, told about his son. The minister was very interested in what he heard and said that the department lacks specialists with abilities inherent in mathematically organized thinking, and invited his son to go to work at the Railway Administration. In his memoirs, S. Yu. Witte said: I decided that I would need to take another professional course at a specialized transport institute in St. Petersburg, but the minister explained: there is no need to do this, we have enough railroad engineers, we need specialists, able to look at the peculiarity of railway transport as if from the outside. And in order to avoid "superficiality", you will have to go through all the key positions in an accelerated mode to deepen your acquaintance with the case. And so it was afterwards. By the way, S. Yu. Witte warned about the inevitability of the imperial train disaster on the section of the track where it happened. The railway officials did not dare to amend the movement along the route.

S. Yu. Witte managed to leave a noticeable mark on the state, financial and transport policy of the difficult historical period of the Russian Empire. He passed a significant part of his journey under the sign of transport construction and improvement of the work of transport, together with the development of domestic railways.

The emperor, unable to withstand the pressure of the reactionary wing of politicians, obviously at the wrong time "turned the arrow" of S. Yu. Witte's political path to a dead end. It is possible that it was then that he directed his movement to the terminal station.

Transport manifests itself everywhere as a significant socio-political factor. The scale of tasks for transport is not an obstacle. Transport participates in the formation of an individual fate, the fate of the family, political movements, and the politics of states.

In the history of the Industrial Revolution, the indisputable achievements of scientific and technical creativity stand out, among them the development of a steam engine for mass use, the connection of a steam engine with the movement of a platform on rails and on water, - the birth of a steam locomotive and a steamer.

Famous personalities are behind each of these outstanding acquisitions of social progress. The logic of historical development is as simple as an elementary algorithm. At the beginning, a ripening social need for the implementation of a technical project is necessary, for example, the working part of technical tools - machine tools, machines was brought to a high level of perfection, even before the creation of a steam engine, however, the development of production stalled - there was no energy source of constant action. Certain system-minded, technically prepared, persistently acting individuals find a technical solution to an urgent production problem. Manufacturing brings the invention to the feasibility of mass use. Technically busy production requires a large number of professionally trained workers. Handicraft is giving way to industrialization. Industrial development no longer requires shop secrets and loyalty to the traditions of making a product; it forces society to engage in improving the organization of education and culture.

The construction business in Russia before the development of railway production was based on a handicraft method of implementation. The researchers reported: "The construction equipment of the first half of the 19th century was just as exactly different from the construction equipment of the second half of the 19th - early 20th century, as the manufacturing period of production in pre-reform Russia from the machine production of Russia after the reform."

Machine production equips human labor technically and, at the same time, forces him to change his attitude both to work and to life in general. The palace conservatives were partly right in fearing that the democratic ideals of Western Europe would be promoted by rail to Russia. They only primitively represented the very mechanism of the spread of humanistic ideology. This, of course, was not about the transportation of books, newspapers, proclamations and other literature. Democratization was carried out through the deep laws of progress due to the development of mass industrial production, which in the literal sense of the word dragged the locomotives of the Russian railways. The transformation of the talent of individual prominent personalities into a mass social movement began in 19th century Russia, indeed, with railway construction.

Historians of the first wave of Russian emigration often associated the decline of autocracy in Russia with the weakness of the personalities of the Romanovs, who turned out to be incapable of a strong-willed policy in the face of the tension of political forces in the country and in the world. They are right to some extent, the subjective factor of the representatives of the ruling dynasty of the early twentieth century was really inadequate to the situation, but the true explanation must be sought not in Nicholas II and his closest circle.

The autocracy previously coped with both liberals and revolutionaries not because Nicholas I was a more active politician than Nicholas II or Alexander II and Alexander III were fundamentally different from the last monarch as autocrats. The predecessors of Nicholas II dealt with the formation of capitalism in the country, it was easier for them to restrain bourgeois restructuring in the economy. No one could stop her. History left the Romanovs the only chance to retain power - to join the process on the side of creating the bourgeois foundations of social development, as their relatives in Great Britain, Denmark, Germany and other European states did, but instead they had to abandon the specifics of the Russian autocracy. Under Nicholas II, it became absolutely clear that politics became an excessive brake on the country's development.

Nicholas II brought Russia to a historical crisis and the history of the Romanovs to a political end. In 1917, the country was left with a choice exclusively between liberal democracy outside the monarchs and the revolutionary restructuring of society according to the program of the Social Democrats, who from the very beginning of their history fought with the autocracy as the main enemy.

Domestic autocracy defeated capitalism, the movement towards which opened railway construction. The paradox is that the autocracy, which tried to slow down the bourgeois development of the country, deliberately drove itself into a historical impasse, demonstrating what the lack of flexibility leads to in politics. Foreign relatives of the domestic Romanovs turned out to be politically more far-sighted and retained their form of power. If Peter I were in the place of Alexander II, Alexander III, it is quite possible that the Romanovs ruled in Russia even now. Pyotr Alekseevich had an excellent political flair for scientific and technological progress in the economy. His active nature was fully consistent with the beginning of the Industrial Revolution and the importance of the economically proactive behavior of

the head of state for the timely sale of its products. Peter the Great with special love, was known to be different to transport. Steamers and steam locomotives would be his personal concern and he would never miss the opportunity to benefit from the progress of transportation.

To compare the economic policy of the late Romanovs with the similar results of Europeans and the United States, let us turn to the statistics of Professor I.Kh. Ozerov - one of the authors of the five-volume "Three Centuries", released for the 300th anniversary of the reign of the Romanovs (1913). There were 155.5 km of railways per 1000 km2 of the territory of Belgium, 114.8 km in Great Britain, 102.1 km in Germany, 20.3 km in Japan, and only 9.3 km in Russia. There are many navigable bodies of water in Russia - lakes, rivers, canals. At the beginning of the twentieth century, 3,600 steamers and 25,000 non-steam vessels with a total tonnage of 800,000 poods were sailing on them. In terms of its capacity, the Russian river fleet raised more than the entire fleet of Great Britain and ranked first in the world. The domestic fleet was almost three times the capacity of the entire rolling stock of Russian railways.

Despite this, for the entire second half of the 19th century, the government allocated only 80 million rubles for the modernization of the river fleet. A similar situation was with the development of institutions and communication networks: mail, telegraph. In 1905, there were 8.33 mail per 10,000 US residents, in Germany - 6.48, in the UK - 5.37, in Russia - 0.96. From his analysis I.Kh. Ozerov concluded: "And without means of communication, with insufficient equipment of the country with mail and telegraph, it is impossible to conquer space." Adding something not at all complementary to the Romanovs' jubilee: “With its riches, Russia needs a different economic policy, statesmen with a broad outlook, with an understanding of the great tasks and the great role that Russia is destined to play ... Economic policy, which was carried out in Russia did not set itself the task of the lasting development of the country's productive forces; here they were chasing more for the effect, they thought to create an industry without creating a solid foundation on which it could develop. "

At the time when I.Kh. Ozerov was writing his article, the authorities did not allow direct criticism of the economic policy of the autocracy, so the author deliberately did not prove his idea, believing that critical reflection of consciousness is capable of going through the left part of the path itself. I. Kh. Ozerov meant by "solid foundation" the transformation of social relations, including relations of production. In addition, like all thinking domestic scientists, he did not miss the opportunity to emphasize the special role of modern transport in the social progress. He was well aware of the position of S.Yu. Witte, who believed that for the successful development of Russia, its space must first be "pulled together" by transport, primarily through railroad construction. One line of the transport route was clearly not enough.

Nowadays Switzerland is not going to wait for vehicles to become massively environmentally friendly and switch to hydrogen and electric energy. The ruling circles of this important state for Europe want to develop the capacity of electric railway communication in every possible way. In this connection, it is curious to recall that N.G. Garin - Mikhailovsky - an engineer - tracker, in the first years of the last century proposed a project for the construction of a railway along the eastern coast of the Crimea on electric traction, and thirty years later Soviet engineers - enthusiasts Yu.V. Kondratyuk and N.V. Nikitin won a competition initiated by G.K. Ordzhonikidze for the development of a powerful wind farm on Mount Ai - Petri in Crimea.

Crimea has long been an object of environmentally friendly technical development. N.V. Nikitin, who subsequently developed the project of the Ostankino TV tower in Moscow, recalled with great warmth his work with Yu.V. Kondratyuk in the Crimea: the station resembled, he wrote, a twin-engine aircraft, the engines of which were located vertically. “It was very difficult to give the dynamics, (Yu.V. Kondratyuk, one of the first enthusiasts of space design) considered it absolutely necessary to consider the dynamic effect of the wind load. He perfectly felt that gusts of wind can cause forces that are completely different from those under the static action of the wind ... Yu. V. Kondratyuk liked the design of the bogie train for the bracing, which I invented. "

History convinces even the most staunch skeptics that the development of transport plays a critical role in creating an economy that can be a reliable foundation for accelerating social progress. In political competition, the victory is celebrated by those states that previously realized this historical pattern. Logically, everything is frank and obvious here: movement, in principle, is self-movement to a certain state, after which external factors are needed in the macrocosm - nature, production. They become a kind of locomotives of further movement until the ascent to the next round of the spiral of development. Then a new cycle begins, again due to self-movement.

Let us recall the political history of the Ancient Mediterranean period. It began on the Middle Eastern shores of the Mediterranean - in Babylonia and Egypt. What made the strongest impression on travelers in these places? The scope of construction work that required a large-scale work of transport moving huge masses of building materials in the horizontal and vertical directions. In the encyclopedic dictionary of F.A. Brockhaus and I.A. Efron's "Ancient Civilizations" describes the building structures of the capital of Babylonia, built during the reign of Novohudonosser (after 567 BC). They formed a giant regular square, each side of which was 21 miles long.

The city was surrounded by two concentric walls with a hundred bronze gates. Archaeologist Rawlinson calculated that the outer wall was up to 200 feet high and 50 feet wide, so that chariots drawn by four horses could freely ride along it. This required 18,765,000,000 bricks of the largest size.

The history of the heyday and decay of another state - a giant born in the fertile expanses of the Mediterranean - is indicative. Transport connected the Roman Empire, breathed stability of life into it, but was powerless when the state lost its internal sources of vitality. Transport strengthens the position of the state, but it lacks the potential that is designed to save the state. Reliance on transport - facilitates climbing due to the fact that with the help of transport it gets a unique opportunity to expand its boundaries and tighten the space to manageable dimensions. The spatial chaos that accompanies the intervention must be given the form of a certain order, without which it is unrealistic to exercise power in the acquired territories. The Roman rulers realized this need for transportation and launched road construction on a scale comparable to the size of the empire itself. They built roads by combining durability with comfort.

"Already in the era of the Republic, the Romans began to build magnificent paved roads, gradually covering not only Italy, but also numerous provinces." The most famous of the roads built in the Roman Empire is the Appian road, which connected Rome with the cities of southern Italy. One of the Roman poets called her "the queen of the roads along the way." Near Rome, the road was lined with large slabs of tuff, while the main part was covered with blocks of volcanic lava. The width of the canvas ranged from 4.3 to 6 meters. Without excellent roads paved everywhere, which made it possible to quickly move between cities, it was impossible to reliably control the outskirts of the country from the center, and the provinces could not communicate with the capital. A. Yu. Nizovsky, referring to specialists - builders, archaeologists, states: “The total length of Roman roads, calculated from ancient remains, was several thousand kilometers. The roads were laid on a solid stone foundation and everywhere had a standard width of 6 meters, the roadway laid with tiles and small stones ended in rounded bevels. For centuries, such a road did not require repair, and troops and vehicles could quickly move along it. The pavement of some strategically or economically important roads consisted of a series of successive layers of stone and rubble, bonded with lime mortar.

Roads were carefully built in western Syria. In a specially prepared bed, stone slabs were laid, on which a layer of crushed stone was poured on a lime mortar. From above, the entire structure was covered with large stone slabs. Such roads had vertically placed slabs on the sides for strengthening. The most important roads were built in North Africa. The road connecting Carthage with Leptis Magna was 800 kilometers long, and the road from Carthage to Lanbesis was 275 kilometers long. The Via Egnatia road crossed the entire Balkan Peninsula, starting at the modern Albanian city of Durres (the ancient name is Dyrrachium) and ending at the Greek port of Thessaloniki. Emperor Tiberius ordered the installation of milestones along all the roads - milliaries indicating the distance between the nearest cities. Roman builders learned how to build reliable arched bridges.

European roads in our time remain exemplary for organizing high-speed and safe road traffic, for which the grateful drivers and passengers of the current founders usually thank, forgetting about those who left the Europeans of the New and Modern times an exceptionally rich legacy in terms of experience. Of course, from the Roman roads that crossed the European continent far and wide, little has survived and then modernized, but the main thing in the inheritance is the culture of construction, which should be symmetrical to the special importance of road construction for the development and functioning of transport.

Marine shipbuilding and the timely realization of all the advantages of being the mistress of the sea, - in fact, to be able to manage affairs in the sea space and keep the coastline, which is a promising bridgehead for an offensive inland, in subordination, owes the highest segment of the history of Spain's development. The era of great geographical discoveries was a triumph for ship transport. Until that time, sea-going ships generally moved along the coast. There was no necessary knowledge for orientation on the high seas and the design of the ships itself did not meet the requirements of sea storm tests.

This can be confirmed by the history of the Vikings. They advanced far south on their ships, colonizing Sicily and part of southern Italy. While their routes passed near the coast, the losses of the fleet were negligible. When they tried to sail to the invisible West to the shores of America, the situation changed radically. At the end of the 10th century, out of 25 ships with 500 people: men, women and children, only 15 reached the shores of Greenland.

When science convinced the navigators that the Earth is not a disk, but a ball, therefore there are no edges, but there is confidence that after a certain time, it is possible to return to its initial position, the shipbuilders began to create ships that are reliable for long-term navigation. Spain preempted all competitors and managed to attract famous sailors to the service, ready to take risks in new circumstances. H. Columbus, while in the Spanish service, discovered the New World and thereby laid the foundation for the colonization of rich lands.

Under King Charles I (1519-1556) Spain became a world power. Its power mainly rested on the navy, which was used both to suppress resistance and to carry out expansion and economic activity. It became

clear to many opponents of the political ascent of Spain that "a wedge can only be knocked out with a wedge," that is, by uniting and creating a stronger fleet. In 1588, the Spanish "Invincible Armada" was crushed in a battle with the British fleet. Having lost its leadership in the navy, Spain also lost its political weight, the era of decline of its European significance began.

England is becoming the European leader. During the reign of Elizabeth I (1558 - 1603), the country is experiencing a "golden age", turning into a "mistress of the seas", confirming the historical truth, according to which the fleet, having clear advantages in movement and traffic control, in comparison with land means, provides the necessary foundations to be the mover of the political destinies of states on the planet, the surface of which is 70% covered with water.

The expression: “time measures the living space of a person” is the best fit to characterize active Englishmen. They did not waste time and as a result, with their energetic transport policy, forced half the world to serve the British crown, including not only huge parts of the Asian and American continents, but also the whole continent - Australia and New Zealand.

All British acquisitions have been made due to their modern attitude to life. They were among the first to understand the advantages inherent in scientific knowledge, studied well, and most importantly, comprehensively, that is, not only achievements, but also failures, experience in building seaworthy ships and the art of ship management. Having defeated the Spanish "invincible armada", the British convinced everyone of their political and military strength, capturing and consolidating their dominance at sea.

The fleet was built in England, sparing no expense, knowing full well that only with its help it is possible to keep everything conquered as a single whole and a common cause. In the Great Illustrated Encyclopedia, only one listing of the composition of the British Empire took up a page in type 8.

A flexible policy regarding the status of belonging to the British Empire - to be a colony, protectorate, etc., opened up the prospect of reducing transport costs. For three centuries the British government ruled over this collection of dependent countries. Political history made it necessary to correct the original name "British Empire". It was replaced by the "British Commonwealth of Nations" replaced later by the "Commonwealth of Nations".

Political history changed naturally, but one invariant conclusion from history remained: without active involvement in the historical process of transport, the described history of Great Britain would not have happened. Politicians needed the means to carry out their economic and political plans. British politics would have remained on the coast if the coast had not been developed as a seaport. The crown was served even by those with whom it had to deal with as enemies - pirates.

It should be noted two patterns opened by the transport policy of the British rulers - the importance of transport expansion in strengthening political dominance and the need to develop a systemic organization of transport to ensure a successful policy. British leaders were firmly committed to the idea of combining vehicles to drive in different environments. In order to subjugate someone - to make them serve the interests of the victors - a strong navy may be enough, it alone is clearly not enough to pull together the empire and provide it with a special history in history. For this, firstly, a diverse fleet will be required, and secondly, the creation of local transport networks.

It is no coincidence that Great Britain was the birthplace of the Industrial Revolution. The progress of science, technical creativity in the country was due to the intensity of the development of production, that is, the objectively prevailing circumstances put them on a solid socio - economic foundation. This made scientific knowledge and the technical pursuit of excellence sustainable. They turned into the policy of the state, an illustration of which is the state status of the genius of British and all European science, I. Newton. The principle of combining "external" and "internal" transport was consistently embodied in politics. With the help of the first, the territory of the empire was incremented, the second ensured the management of new territories.

Despite the fact that Britain was an island state and nature itself suggested which mode of transport was most natural for the country, politicians actively stimulated the development of land transport. Until the land transport had a steam power plant, its capabilities were largely limited, nevertheless, the muscular energy of the animals turned out to be quite sufficient to represent the prospect of progress on the usual converted roads.

For the uninitiated, water transport looks, although dangerous, but cheaper in organizing traffic. Professionals know how much time, spent lives and finances it took for rivers, lakes, seas, oceans to become accessible and relatively safe for mass shipping. Only in the second half of the nineteenth century, thanks to the unique research of the outstanding Russian scientist - mechanic A. N. Krylov, who calculated the formulas for the onboard and pitching qualities, shipbuilding was put on a strictly scientific basis. It is curious, but natural, that the first to appreciate the discoveries of Academician A. N. Krylov were in England, where he reported the results of scientific searches for solutions to the problems of ship control.

In 1680, D. Papen designed and built a steam boiler capable of performing work. T. Newkamen in 1717. Implemented the project of a steam-atmospheric engine. In 1763, II Polzunov proposed a

project for the world's first two-cylinder engine combining the work of the cylinders on one shaft. It was a universal, continuous engine. The work was interrupted due to another project - the first steam power plant introduced in Russia with a capacity of 32 hp.

As a result, the face-to-face competition of scientific and technical thought won the project of the universal steam engine by J. Watt. The designer worked on it for 10 years (from 1774 to 1784). “The appearance of P.M. (steam engine) and its spread became one of the main factors in the rapid pace of development of industry and transport, first in England, then in other countries. "

To this conclusion, it should be added: initially, the steam engine had limited use. It was actively used in mining as a lifting device, including for transporting water from mines, which was very important. The steam engine became a mass industrial tool only after it was placed on a trolley and thus turned into a truly universal mechanism. As a lifting vehicle, the steam engine had a limited production demand, not all production needed a lifting mechanism. When the steam engine became the driving force of the cart, then immense prospects opened up in front of such a machine. It was then that the transport industry was born, which turned a lot in human life.

The history of the steam engine can be seen as a watershed moment in the history of man-made transport. The path from the invention, brought by D. Watt to a model acceptable in production, and then to a real steam locomotive and the construction of railways according to the rules of the "road map" consisted of several "steps". The first step is to connect the steam engine to a trolley capable of moving. The second is the development of a technical mechanism for controlling a moving cart. The third is the transformation of a moving bogie into a carriage and specialization of the carriage for a specific function. Fourth, the construction of the track, including the laying of rails that provide and guide the movement. Fifth, the organization of traffic in accordance with the rules that guarantee the safety and uninterrupted traffic. Sixth, the creation of the necessary infrastructure. Seventh, - a turn of public consciousness towards the social and personal usefulness of the railway. The last step was especially significant. History knows many examples when the political and public reaction turned out to be inadequate to the event.

The first trains showed the reality of railway traffic as early as 1804 and 1808 (R. Trevithik). Continuation of the experience gained were the flights of M. Murray trains, made up of 6 and 8 cars, each of which contained 3.5 tons of coal. In addition, the train carried almost 50 curious people. In principle, the train could move up to 27 wagons with a total load of over 90 tons at a speed of 5.5 km per hour. M. Murray's trains have served for about 20 years. In 1813, the future Emperor of Russia Nicholas I also came to see the work of the road.

Until the early 1820s, politicians looked closely at the railway, but were in no hurry to make a decision. There was no public opinion about rail transportation either. The situation changed under the pressure of industrial progress, which required steady and increasing freight traffic in a shorter time. The industrial revolution gave life to the railway, and it also decided its further fate in social progress.

The first public railway is the one between Stockgon and Darlington. Its length is 35.8 km. The movement opened on September 27, 1825. The date was later designated as World Railroad Day on Public Roads.

In the context of our study of the social value of transport, the dynamics of decision-making on the construction of the Stockgon-Darlington road is very interesting. The owner of the mines E. Pierce proposed to build the road at his own expense back in 1817. The parliament, in spite of the obvious attractiveness of the project, "thought" for more than 4 years. Politicians were clearly in no hurry to support the industrial use of the achievements of science and engineers as a means of sociocultural progress. On the other hand, politicians could be justified. Public opinion was formed in a contradictory way: the peasants were afraid that the iron "monster" moving with great noise would not frighten and suppress the animals belonging to them, which would negatively affect economic activity; the church was determined for a long time, - the priests considered the movement of the steam engine too similar to the manifestation of the devil; the townspeople were frightened by the noise of the trains; shipowners and port workers feared the railway as a direct competitor.

There was no solidarity in the political circles themselves. Queen Victoria, even at the beginning of her reign, was delighted by traveling by rail: “Yesterday, she wrote in her diary, we arrived by rail from Windsor. It was a charming walk for half an hour without dust, heat and cramped conditions. " It was about a trip on the newly built railway from London to Bristol (1842). Queen Victoria stayed true to first impressions and actively promoted railroad entrepreneurship for the rest of her long tenure. The Duke of Wellington, who was the Prime Minister of Great Britain in those years, did not share the Queen's assessment, saying: "I see no reason to believe that such a machine could be useful." It is known that Napoleon also failed to appreciate the steam engine.

Among those who saw the perspective of railways was G. Heine. One of the geniuses of European literature wrote: “Railways have become a defining event that gives mankind new opportunities, changing the image and colors of his life. A new period in world history is coming, and our generation should be proud to live in such a time. Even the basic concepts of space and time are shaken. Railways

conquered space. Now there is only time left ... Our ancestors must have experienced the same when America was discovered, when the invention of gunpowder announced itself with the first shots, when typography told the world the first title pages of the divine word. " As an illustration of the prophecy of H. Heine, one can consider a friendly caricature of those years. On it, the artist placed a locomotive with the name "Time", in the cabin of which the "god of time" was located as a driver. Thanks to the "railway", on August 28, 1850, numerous admirers of R. Wagner's work were able to reach Weimar, where the premiere of the opera "Lohengrin" took place, ensuring its resounding European success. A young Englishman, Thomas Cook, organized a trip of 500 abstainers from Leicester to Lauborough to protest the abuse of alcohol (July 5, 1841). This is how the famous travel agency appeared, and Russian cultural historians considered this event to be the beginning of the history of tourism. It is a mistake, because educational tourism was organized much earlier as Crands tours of the British and Scots across continental Europe. The history of cinema began with the show of the train arriving at the station. The Lumière brothers in 1895 had a wide choice, but they preferred the railway,

Transport, by definition, as a tool for the movement of matter in all its manifestations, could not help but actively participate in the successful implementation of human evolution. His active participation is easy to find at all stages of human history.

In addition, the current level of development of Homo sapiens is illogical to consider the result of this story. It is perceived as such when a person's abilities are assessed within the localization of his reality. Man has historically manifested itself physically - "walking upright"; an active attitude to the conditions of existence - "doing"; mental potential - "rationality". Its evolutionary "road map" is rightly perceived to have been built with sufficient reasoning. But there is one serious objection to the desire to make homo sapiens the final link. So to speak, the Olympus of the development of humanity.

For the absolutization of modern human rationality, it is not enough to study evolution within a separately taken developing system. In our case, it is the progress of human reality. The evolution of man and his way of life took place in the natural environment and were the product of the systemic interaction of natural factors that allow a person to develop, and the person himself. Natural competition took place, in which two subjects of the relationship took part.

The natural environment until a certain moment was an object - normally functioning conditions, but, as the position of a person became stronger, it was forced to transform into a counterparty. Competition is a competition of subjects connected by the struggle for existence in a common space - time.

Human evolution was accompanied by significant changes in the natural environment caused by human activity. The action of forces that disrupted natural connections and relationships grew. The natural environment more and more from the initial relationship between the object and the subject turned into a subject of interaction. Within the limits of its systemic potential, nature is capable of "taking a blow", when natural reserves are depleted, it itself starts active offensive actions. Then it is the person's turn to "reflect the blow."

At the same time, both nature and man rely on transport. Each has his own, but they are united by their functional fundamentality and the universality of manifestation in their localization.

Social transport not only made a decisive contribution to the creation of conditions for human evolution, the history of everything that distinguishes the social arrangement of human life is also associated with it. The last "creation of transport" is the organization of conditions for the development of civilization. Unfortunately, the development of civilization itself, which conditioned the process of the natural environment becoming a subject of relations with humanity, along with a positive charge, contained negative consequences. In principle, nature should not be a subject. It is universal and remains as an objectively existing reality that changes according to its own laws. Any human intervention in the natural world is infinitely small and in this context the natural system is unchanged. Another thing is the natural environment as a part of nature, with which there is a practical interaction of human activity.

The natural environment is a component of it localized within nature. Whatever its scale, the natural environment, in relation to the infinity and boundlessness of Nature, remains negligible. Its deformation is assimilated by Nature and will heal like a wound on the body of a healthy organism. The very same natural environment, forced to compete with humans, defending the consistency of its organization, is very vulnerable. In this connection, science has posed as an urgent problem the formation of the noosphere as the most rational direction of competition.

The reality of the noosphere turns out to be dependent on the quality of the rationality of homo sapiens, and it is excessively unstable, balancing between rationalism and empiricism, going to extremes, activating subconscious and mystical thinking, leaving the most important moral and aesthetic guidelines for movement on the periphery. In our publications, we have to increasingly raise the question that the creation of the noosphere will require the continuation of the evolution of "Homo sapiens" into "Homo sapiens", sufficiently equipped morally and aesthetically to solve systemic problems in relation to nature.

Homo sapiens, already within the limits of the existing quality of rationality, has to overcome the egoism of thinking and become aware of the natural environment as his home, rebuild on the perception of it as a subject of cooperation, without attention to which, without solidarity with which, his path will naturally end in a dead end.

The relationship between man and the natural environment has been systemic from the very beginning. The system-forming factor was their general dependence on action within Nature as a platform of relations, what F. Engels called a natural component of the historical process. The relationship between a person and the environment should be approached dialectically, that is, they should be considered not only mutually binding, but also developing.

The "phenomenon - conditions" system is evolving. “Conditions” turn into a “factor”, being built directly into the change in the phenomenon. The human body does not perceive normal temperature and atmospheric pressure, because they fully meet its requirements for existence. It reacts quite differently to significant deviations from normal conditions. The body includes protective - compensatory mechanisms, rebuilds under these new circumstances. The very same circumstances (conditions) become factors of the changing state of the organism.

Under certain changes, environmental factors are able to evolve further, up to the transformation of the environment from an object opposing the phenomenon as a subject of interaction, into a subject of interaction, bringing the system to new horizons of development.

Of course, in the systemic relations of the subjects, the specificity of their natural basis is preserved. Natural factors, having become the subject of relations, will remain “conditional subjects”. The originality of the status of conditions that have formed into the subject of systemic relations with a phenomenon is determined by the specificity of their function. The phenomenon is born in the specificity of conditions. The natural origin of conditions ensures their stable recurrence, which causes a contradiction with the order of changes in the phenomenon, the quality of which is different from the conditions. Conditions are capable of testing phenomena for the strength of normal development, but such challenges to phenomena are random, they are qualified as force majeure. The regularity and orderliness in changing the conditions of movement of the phenomenon restrains the excessive activity of the phenomenon, which forms the system for itself.

All these metamorphoses are carried out with the help of transport, from which it is easy to conclude that the formation of transport systems in subjects and intersubjective interactions should serve as a criterion for the formation of systemic relations. The ability of local systems to integrate into intersystem formations, up to macro and mega-systems, depends on the degree of perfection of the system construction. Systemic defects are also more visible at the level of more general systemic formations.

Social egoism grew out of the balanced development of relationships with the ecosystem as the increasing presence of human action was included. Competitive struggle within the developing society was carried out not only and not so much by eliminating a direct rival, but by violating systemic "obligations" with respect to the natural conditions of development. Since the time of the Industrial Revolution, mankind has perceived the natural environment not as a place and condition for its development, but as its natural reserve for all cases of its own systemic calculations and miscalculations. Today we already live at the expense of future generations, and this form of egoism will continue until the importance of competition in social progress is made absolute, or until environmental tension breaks down, bypassing the crisis, into a catastrophe.

In the 21st century, it is necessary to decide on the main question: under what sign to live? Continue the fight for political leadership, or build solidarity. I. Kant was right when he spoke about the perfection of the celestial order of the stars and the need to subordinate all vital activity to the moral law. Again, the economy is just the basis of a person's social and personal life. It is a great delusion to make it the goal of social progress. It will first lead to the death of hundreds of millions, mostly sinless people, and then to the degeneration of homo sapiens, as unable to evolve into a "prudent man."

What is the role of transport in modern human history? She remained the same. Transport is devoid of its own rationality, it is not able to set goals and objectives for itself, to determine its own "roadmap". It is built into the objective reality of movement, and within these limits of its natural position, a person must show his rationality. The intelligence of homo sapiens, as well as its bearer itself, is in the process of movement. The reason for human stupidity, since the stage of movement is defined as the acquisition of rationality, must be sought in the underdevelopment of the rationality of thinking, which, in our opinion, based on the history of philosophical searches for truth, consists in the imperfection of the systemic rationality of human thinking, - the imbalance of rational and empirical, utilitarianism with responsibility to moral and aesthetic maxims.

Humanity is overly satisfied with development here and now. It continues to expand the living space, however, without showing due concern for the rationality of its arrangement. Something similar happened during the intensive construction of railways, when attention to quality was disproportionate to the scale of the increment.

Road bed, rail track. Reasonableness realizes itself only when the rationality of a person changes the

egoistic vector and spreads to the reasonable organization of the arrangement of the entire living space, everything will become reasonable. A truly new reality of the noosphere will be formed. Human transport does not build the noosphere. He provides the organization of the necessary - sufficient conditions for this construction. It is in this status that transport manifests itself as a real builder of the rationality of human history.

The resettlement of the Indians of the west coast of South America across the Pacific Islands using primitive vehicles is not an illustrative example. More interesting is the history of the capture of the Eastern shores of North America by the Vikings. Their transport was more adapted, but they could not or did not want to gain a foothold in the new lands. As a result, the brave sailors returned to their homeland. The Vikings wrote a significant chapter in the annals of transport history, but this is also a private history. Really indicative is the history of the transformation by means of transport of entire continents. The population of the USA and Canada, Australia and New Zealand, Antarctica is mainly composed of ethnic Europeans, descendants of immigrants from Africa and Asia. Great migrations saved humanity and opened up new perspectives for it.

The subsequent resettlement in new places was no less significant. Their arrangement - economic, sociocultural, is obliged, again, to transport. It is no exaggeration to say that it was transport that made modern political geography possible. Of course, in the light of instrumental support. Transport could not be a sufficient condition for the successful outcome of mass migration, it fulfills the function of the primary necessary factor. Great migrations in the history of mankind stimulated the development of transport, the emergence and improvement of new vehicles.

The history of transport of modern civilization has a rich heritage, and the main thing is a person's awareness of the importance of transport for life. The classic of Russian poetry F. I. Tyutchev, using the Leipzig-Dresden railway, compared it to magic back in 1841: "Thanks to the railways, he wrote, some of which have already been completed, all these cities approached each other as if by magic." ...

The pace of railway construction was also magical. In the United States, the first mainline railway appeared in 1829. It connected Baltimore with Ellicott Mills and was only 24 km long. Forty years later, only private companies in the United States put into operation 85,000 km of the equipped railroad track. By 1916, the US rail network was 409,000 kilometers. In the 1930s, 63,300 steam locomotives, 54,800 passenger cars and 2.4 million freight cars operated on railways in the United States.

In the second half of the 19th century, an average of 20,000 km of railways were built in the world annually. By the early 1910s, the total length of railways in the world exceeded 1 million km. In 1879, at the Berlin Industrial Exhibition, E. Siemens demonstrated a working model of an electric railway, and in 1881, an electric city railway with a length of 3 km appeared in Berlin. The era of trams and metro has begun.

However, it has long been known that social progress is a contradictory process, combining all manifestations of movement from ups in development to recessions and crises. The development of social transport, as it should be, was accompanied by diversification and competition. Rail transport has replaced land transport, and in countries where rivers, lakes, canals and seas freeze over for a long period, also water transport, mainly domestic. The invention of the internal combustion engine gave land transport a chance to compete successfully with rail transport, but rail transport remained an important advantage in all-weather and greater safety.

The technical equipment of the transport required an increase and technical training of those who manage or serve the traffic. The qualifications of drivers and technical personnel in railway transport are continuously and professionally monitored by the state inspectorate, the control is systemic in nature, it is self-certified. The statistics also testify in favor of the higher safety of railway traffic. There are a lot of trains in the world today, but even so, their number is very small in comparison with the number of vehicles, the speeds of which are comparable to trains. It is hardly feasible to train qualified drivers for such a mass of cars. This is the logic behind comparing rail and road transport. Air transport is highly professional, but its infrastructure is extremely complex and expensive.

Crisis symptoms for railroad transport began to mount after World War II. In the 1960s and 1970s, both Europe and the United States fell in both passenger and freight traffic. Transportation at short and medium distances was particularly affected by the increase in personal and commercial vehicles. Many travelers have opted for airplanes. The railways were able to get out of the crisis towards the end of the twentieth century, creating a new generation of high-speed trains, providing comfortable and affordable movement to the destination.

The attitude to travel by train has also changed among tourism enthusiasts. The tourists realized that from the plane's window little interesting could be seen during a long flight. A completely different impression is created by the opportunity to observe what is happening outside the carriage window. Fascinating routes have appeared along the Trans-Siberian Railway, along the Indian Pasific line across Australia, along the Coastal Starlight road in the American Wild West. Projects of hovercraft trains are being developed in France, in Germany and the Russian Federation - on magnetic suspension, design and model work is underway to improve the classic "wheel-rail" scheme (TGV in France, ICE in

Germany). They are successfully working on improving high-speed and high-speed traffic in Japan, Korea, China.

In the historical process, the logic of the dialectical development of transport, which we have noted, has again manifested itself. All changes are carried out through the relationship of opposites, the competition of internal and external forces. Already Heraclitus realized that the struggle is universal. But its absoluteness is relative. The struggle of opposites, that is, that which excludes each other by definition, is productive within the limits of their unity and strives to achieve optimal interaction. The particular is reasonable, acting within the general, as a component of it.

Struggle, in our case, competition, within social transport is important as a force for improving its types, but the struggle always remains only a means of obtaining a result different from the struggle. Moreover, the result of the struggle must be the opposite of it.

Transport diversifies in the course of its development, multiplies in the concreteness of manifestation, within the limits of its integrity. The quality of transport is determined by its essence, and the essence consists of the invariance of the functional purpose of the transport. Essence is specifically concrete and unitary, which is understandable, because only so different in the manifestations of the essence can be placed under a common "roof", presented as a single, conventionally dividing. Transport is essentially unitary. Its natural and social differences are autonomous exclusively as phenomena of a single essence. The mode of transport is conditional, absolute essence.

At the turn of the second and third millenniums, multi-transport centers developed, linking the work of various types and specializations of public transport into a node. The synergistic effect of such centers steadily manifests itself in general and in particular. All types of transport have received accelerated development, and consumers have experienced increased comfort. Multi transport centers more effectively reveal the functions and direction of work of social transport.

Understanding why turning to transport construction saves humanity during systemic crises is not easy. In addition, the awareness so significant for social history has not yet received an adequate global resonance. If the task of the all-round development of social transport united modern mankind, then there would be fewer conflicts and the threat to peaceful coexistence would lose its current relevance. People are separated by space, transport is the only tool that can really remove the "social flaw" of space and make it clear that we are all "of the same blood."

The relationship of a person to space and time evolved in different ways, depending on the understanding of their significance for the organization of life. There was a test of fear of the scale of the elements and their own impotence. With the development of the means by which it was possible to steadily move in space and save the time of action, space and time were revealed in a new light as structured realities available for activity - commercial, military, cognitive, and missionary. Humanity gradually realized its ability to “conquer” space and rationally orient itself in time.

The history of transport was presented in the context of social progress. Social development can be formalized by reducing it to the rational organization of activity in space and time of being. Saving time of activity by optimizing the structure of space, humanity unfolds and organizes space - the time of its own life.

We reduced the functions of social (public, human) transport into a diagram, trying to distribute them by directions and determine the main final product where the specificity of the schematic expression allows it (Figure 3).

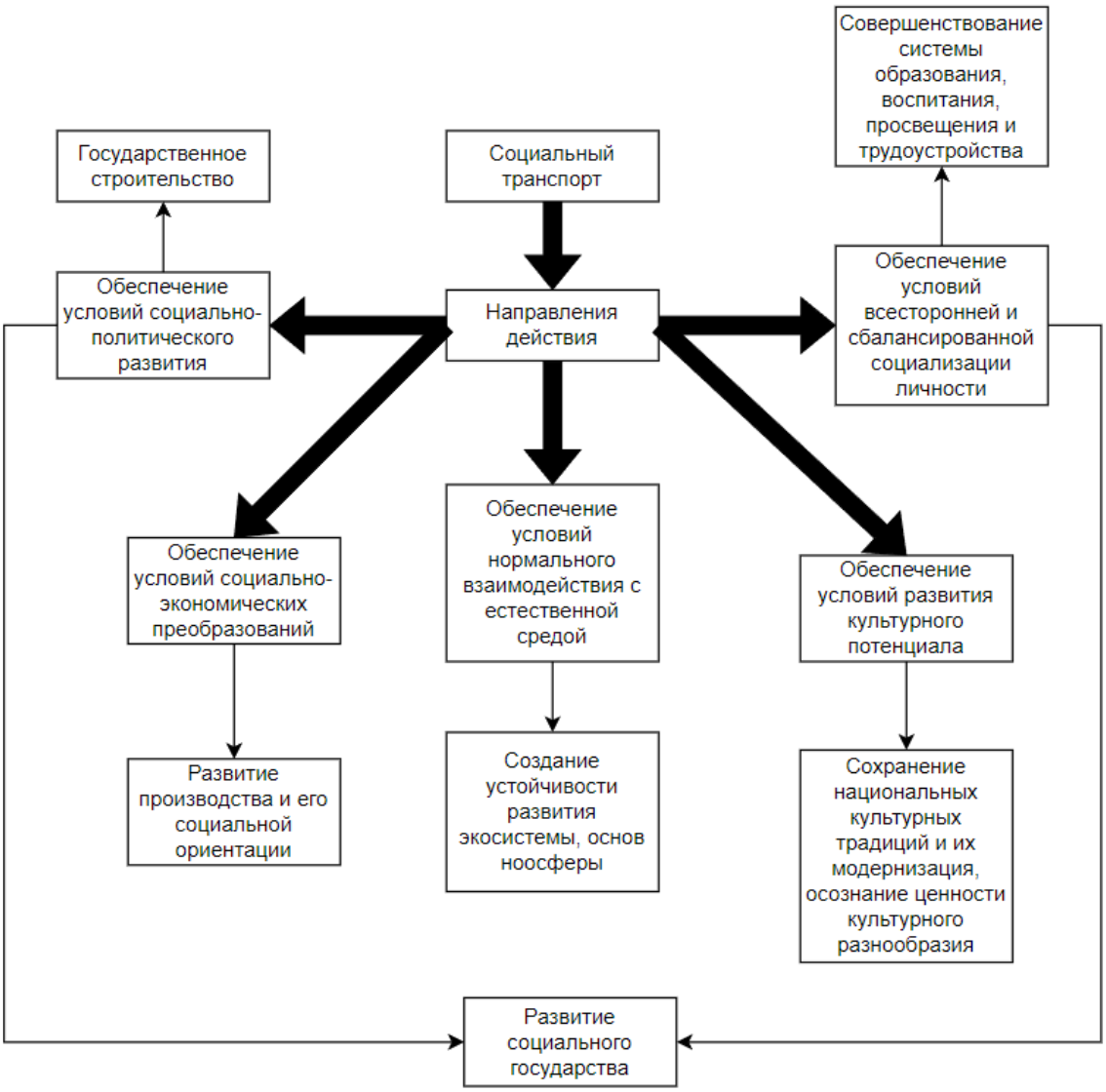

Figure 3. The main directions and products of the action of social transport.

In the scheme, we again want to draw attention to the specifics of the mechanism of action of transport in social construction: transport participates in social development by providing necessary - sufficient conditions for the action of social reorganization, that is, indirectly. The specificity of the mechanism of action of social transport is determined by the place of transport in the movement of matter, a part of which is the practical activity of a person. Transport is an instrument of movement. Work is done by traffic, transport prepares and provides traffic conditions.

It has already been noted that an individual fact lacks an argument function. Facts taken separately are incapable of either refuting or proving. But based on facts, you can build a concept. And in this case, when it is possible to obtain predicted facts in sufficient quantity and variety from its consequences, both the concept itself and the facts will acquire true meaning.

Russia was preceded by Russia. It is believed that Russia became Russia, becoming an empire under Peter I. Peter was recognized as the Great for the scale and quality of transformations in society. From the very beginning, Peter the Great connected the reorganization of the fatherland with the development of transport. He had little choice - to find a rational balance between water and land means. The emperor saw advantages in water, especially in sea transport. With its help, it was possible to increase trade, causing an increase in the production of goods, and to expand the borders of the state, and when necessary, to protect it. The strengthening of Rus took place with the growth of cities, all the historical cities of Rus and Russia grew on the banks of rivers and seas. The land movement unfolded after the water movement. Steam and electric traction was also first tested on water.

Civilization undoubtedly found its manifestation in transport creativity, but the progressiveness of

social progress depended even more on transport construction. All Russian cities with a population of a million or more have clung to both the Urals and beyond the Urals in the vastness of Siberia, to the banks of great rivers and their tributaries. They became millionaires thanks to the development of railways.

The history of Novosibirsk, the most famous city in the world from Siberia, is connected with the Great Siberian Railway. Until Novosibirsk, Chicago was considered the fastest growing city in the world. Novosibirsk as a city in 2022 will be 119 years old. On January 21, 1904, the Tomsk governor received a notification that the Emperor on the 28th day of December last year, according to the regulations of the committee of ministers, "He deigned to command the highest: the settlement of Novo - Nikolaevskoye of the Tomsk districts and provinces to be raised to the level of a bezudesk city of the same name."

The history of the settlement of Novo - Nikolaevsky itself turned out to be fleeting, it was less than 10 years old. In 1893, there was a taiga in its place.

NG Garin - Mikhailovsky, who was carrying out with his exploration party the commission to present options for the construction of a railway bridge across the Ob River, wrote: “Here Ermak, with superhuman efforts, paved his way to glory. Centuries have passed, and now we have come to finish a great work. By building the road, we will make these vast lands a real property of the Russian land. "

On the eve of the transformation of Novo - Nikolaevsk from a village to a city, Tomsk Governor Major General AA Lomachevsky reported to the Council of Ministers: “As your Excellency knows, the village of Novo - Nikolaevsky owes its origin to the Sredne - Siberian railway. At the beginning of the construction of bridge structures across the Ob River and the equipment of workshops, a mass of workers and employees in various branches of railway administrations and construction appeared, and at the same time, to meet the needs of the above persons, a mass of commercial and industrial people also poured into Novo - Nikolaevsk for sale their works and trading operations. Now the number of residents continues to grow progressively, the trade and industry of the inhabitants of the village is diversifying, due to its especially advantageous position on the banks of the Ob. Such a privileged position p. Novo - Nikolaevskogo gives the capitalists a full opportunity to develop their commercial enterprises here, and therefore now the main traders in bread - the Kolyvan merchants have moved their operations to Novo - Nikolaevsk, and the Tomsk industrialists have opened their offices here and operate on millions of rubles; all these circumstances did not remain without influence on the development of the life of the inhabitants ”.

100 years later, in the city of Novosibirsk, which was born in the taiga forests on the banks of the majestic Ob, there were already one and a half million inhabitants, its area is 506.67 km2. Novosibirsk, recognized as the cultural, scientific and social capital of Siberia, is the largest multitransport center beyond the Urals with a huge railway station, a modern international airport named after A.I. Pokryshkin, and a network of highways. The successes of Novosibirsk scientists, creative theatrical and musical groups are world famous. There are over twenty universities in the city that train specialists in various fields, the SB RAS.

The history of Novosibirsk not only confirms the conceptuality of the statement about the growing role of transport in social progress, but also demonstrates another significant idea: the optimization of transport construction accelerates social development. The latter conclusion is clearly underestimated. Modernization of national development is always associated with important changes, some of which are not considered by the country's population to be inevitable costs of social progress. These include, in particular, the undeserved fate of many settlements of different formats and ages, which have become a small homeland for people. Here are their roots and they do not want to turn into tumbleweeds. Megacities with their specific lifestyle are not suitable for everyone. There is a growing tendency to return to places where nature and man are in a natural, not a “driven” state.

The supercities policy is the simplest solution, driven by economic profitability and statistics that do not reflect the essence of resettlement. Such simplicity also simplifies a person to a “person - unit”. The conditions for personality development in the modern understanding of socialization are one-sidedly reduced to the intensity of the external manifestation of communication.

Education is less and less manifested itself as a tool that forms the student's interest in the rationality of individual thinking, replacing the work of the subject's consciousness by acquiring psychological skills - the dynamism of changing attention, memorization, orientation towards consumption and the possibilities of technical means of support.

The danger of empiricism and standardization in thinking, the dependence of consciousness on technical equipment is not so obvious “here and now”. It has a delayed effect of action, which has already manifested itself more than once in modern times, forcing the great humanists and real teachers to return to the educational ideas. For harmonious development into a personality, a person must realize his main potential in the process of formation, inherent in his dual nature. We are able to abstract from nature in knowledge, but we can never live and enjoy life outside of nature. Nature is capable of developing without us, it is limitless and eternal. The man is faced

with the Hamlet question: "To be or not to be"? The wealth of the past is not a guarantee of the future.

In multi transport centers, there is a real opportunity to optimize the transport potential for the harmonious development of the social structure, to minimize the cataclysms of irrational urban planning policy. Such centers are ready for the organization of systematic work of various transport from mainline and interregional to local, combine the general concept of road transport, water, rail and aviation. With a professional approach, free from the commercialization of social projects, there is always a way out that will be approved by all parties involved in solving problems.

The economy, like society, whose progress is based on economic activity, develops naturally. Economic booms and crises are caused not so much by objective factors as by insufficient professionalism of management. The aforementioned S. Yu. Witte was dealing with an empty treasury and growing debts, nevertheless, in a hopeless situation, he found a way out and successfully reformed finances. After the Revolution and the Civil War, the Bolsheviks also coped with the task of stabilizing the financial market in conditions of socio - economic chaos and wild inflation.

The Russian reformers of the 1990s, with the active assistance of Western consultants, led Russia to the 1998 default. When there was a change in the ruling persons and the politically and socioeconomic course was balanced, society quickly managed to cope with the consequences of "shock therapy". The economy should not be anything other than the one whose purpose is to ensure human well-being.

The desire to measure the well-being of the population by the number of goods is partly fair, but it is, as a rule, conditional, because it deals with consumption statistics, which are concretized at the regional level at best. It is so convenient for the authorities, however, in such calculations, as a rule, there is no face of really real citizens, separated by physical space even within the boundaries of a district, region, territory, republic.

Statistics are something like a mirror, sufficient for the authorities to see themselves and, in general, the socio-economic mosaic. Real life, however, predominantly takes place in the "looking glass". This life is very different, as well as the attitude of those living towards it. Dissatisfied with life were always and everywhere, even among those enjoying life. There are many of them, but they do not form the majority.

The bulk of the population is patiently waiting in the wings, steadfastly hoping for the professionalism of politicians. She needs a job with decent wages, the arrangement of the socio-cultural support of life. Most of all, they need satisfaction with the systemically organized and accessible work of transport, so as not to oppress the feeling of "abandonment". A citizen of any country educated on traditions feels his responsibility to the state and order in proportion to the care that he himself feels.

Conclusion

The state has three distinctive signs: the flag, the coat of arms and the anthem, but there are two more important signs of statehood - the territory and its socio-cultural arrangement, the space within which all citizens should have the secured right to move freely to solve their own and generally significant problems. Only a rational organization of the work of transport is able to ensure the consistency of national communication and activities, to be an instrument for creating a feeling of a convenient national space for life and confidence that time is always under control.

Politicians are always looking for valuable pragmatic ideas from theorists. Successful politicians owe their achievements to a special attitude to knowledge that differs from the utilitarian-minded pragmatists. They honor the way in which, at the dawn of modern times, supporters of empiricism critically subdivided experimental results. Knowledge cannot be ranked in a common row by assessing its content. Knowledge will have to be divided in relation to its practical significance into "fruitful" and "luminous". The first, like recipes, describe all the required actions, placing them on the "shelves". They really like their practicality. However, they are rigidly dependent, so they can improve on their own within the limits of their location. They are not able to develop and compete in development.

The workshop production was based on such knowledge - recipes, seeing the only danger - the leakage of secrets and their spread throughout the world.

The development of reality presupposes the need to have knowledge, developing experience, aimed at the future. They look impractical here and now, but they contain thoughts that refresh and guide the progress of practice. A change in knowledge about transport is a change in existing fertile ideas for luminous concepts. It will not give practical results either today or tomorrow. This is not about increasing the experience gained, but about changing the course of a practically oriented policy. Philosophical analysis will require political science concretization and social rethinking of what transport really is.

It should be borne in mind that the authors of the study do not encroach on the achieved knowledge about transport, they seek to give it a systemic position, to explain where the "shelves" came from, along which transport is distributed in its modern understanding. First of all, social transport fell under the “section”, since modern concepts reduced the understanding of transport and its purpose to it. At the same time, from a change in the definition of transport, it is social transport that will "benefit" in the first place, because its development turned out to be

the most intensive, revealing the functional values of transport. It is the history of social transport that confirms the poly functionality of transport, its creative role.

Even in its modern form, social transport shows its strategic potential, its ability to:

- to be a tool for the structural organization of the space of human life, to expand the horizons of its implementation;
- rationally use time, increasing its intensity as a factor in improving human life;
- serve as a means of scientific knowledge of the world and its philosophical, religious understanding;
- solve large-scale problems in the entire range of human life from his interaction with natural conditions of production to socio-cultural reality. We are talking about individual freedoms - freedom of creativity, choice of residence, employment, movement;
- make a more optimistic outlook for the planet and life on earth, which are finite. Only the development of transport in its social form is able to remove the problem of the finiteness of the concrete reality of being.

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STRUCTURAL-SEMANTIC PECULIARITIES OF MASS MEDIA TERMS IN ENGLISH AND KARAKALPAK LANGUAGES

Abstract: *The collected materials were analyzed using comparative-historical, structural, paradigmatic and syntagmatic, diachronic and synchronic, descriptive, analytical, cognitive, component and statistical and interpretive methods widely used in modern linguistics. Systematic and general conceptual approaches also play an important role in the article. This article is devoted to the linguistic and cultural analysis of political terms used in international relations, their history, structure and significance through in-depth scientific and theoretical analysis of special lexicon in the field of media in English and Karakalpak languages from the linguistic point of view, advanced disciplines such as linguoculturology.*

Key words: *term, lexicon, linguistics, structure, syntax, semantic, lexical-syntactic, structural-semantic.*

Language: *English*

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Introduction

In today's integration process, the common position of Uzbekistan and the peoples of the world, or the study of the peoples of the world, is of particular importance. These studies serve to enrich linguistics and other areas with new evidence. The first President of the Republic of Uzbekistan I.A. Karimov pays special attention to the study of the language, emphasizing that one of the important tasks is to study the cultural and spiritual heritage of the people, the historical and modern development of literature and folklore . In addition, speaking about education, they note that interest in English is growing along with all languages studied in Uzbekistan . "Language is important as a leader in the scientific study of culture," Sapir wrote .

The basis of the dictionary composition of the Karakalpak language can not be established without different regional terminological systems. The fact that a lot of doctoral and candidate discussions, monographs, collections and brochures and a number of scientific and popular articles have been published, various conferences have been held in linguistics, in particular terminology, is a vivid evidence of the above views.

If we look at the history of translation studies, in the scientific work carried out from the past centuries to the present day, experts have thought about the lexical, grammatical, stylistic and many other current problems of the Karakalpak language. The main purpose of studying the terms is to replace and translate words from foreign languages into words that correspond exactly to our native language.

It is important to translate into Uzbek the terms of foreign policy in the field of international relations and to find alternatives to the Karakalpak language that are used in the translation process. Many political terms are derived from Karakalpak from Russian, and Russian from Latin, Greek, English, French, and several other languages. The study of such terms is one of the most important issues not only in terminology but also in linguistics.

In all spheres of linguistics, steps are being taken to study theoretical issues deeper and deeper, a number of practical works are being carried out. The publication of different types, that is, one-language, two-or more-language, general-philological or

terminological dictionaries, is also able to demonstrate the achievements of our linguists.

In order to get acquainted with another language and its terminology, its role in the culture of language, the field of terminology is in a high place. Through terminology, we have structure, semantics, cognitive and conceptual analysis of English, Russian and Uzbek terms. The peculiarity of the intertwining of terms with the culture of language is that the existing terms can serve not only in their own sense, but also be used in a portable sense in the influence of culture, in addition, they provide an opportunity to observe their etymologically inseparable syllable. Therefore, today many of our scientists are conducting various studies on this topic.

Terminology is the study of specific vocabulary, including the origin, form, meaning, function, and use of terms. Terminology is one of the most important areas of modern linguistic research. At present, the growth of the problem of terminology is considered, on the one hand, due to the dynamic development of science and the proliferation of new concepts, on the other hand, due to insufficient study of issues such as the process of formation, development and function of terms explained.

Terminology is a very large part of the vocabulary of any language. It's not for nothing that it develops so fast, because it allows you to create new words. The terminology of a language consists of a system of many terms. A word or phrase in a particular field of knowledge, industry, or culture is called a term. The meaning of a word that a term refers to is interpreted by interpreting it in a relevant literature. Z. Harris and I.F. Frisians are proponents of descriptive linguistics, who define word expression as a term: "A word expression is any human speech that can be expressed before or after silence." Each department or school of science develops specific terminology according to its nature and methods. This special terminology is an important part of scientific research and is very important. Because it contributes a lot to development.

Terminology is one of the channels of intellectual communication, expressing a certain system of understanding reality. According to Vinogradov, "There are two sides to the creation and definition of terms, two points of view: the structure of language and comprehension, the development of a semantic conditional system of understanding in science ."

The change of terms in linguistics and the emergence of new terms are inextricably linked with the development of science and technology. Linguist L.I. Bojno states: “Under the influence of technical progress, terminology changes on the basis of two interrelated laws, first, the laws of scientific and technological progress, and secondly, the general laws of language developmen ”. The fact that technical skills are now beyond the narrow confines of the masses and that experts in various fields make extensive use of scientific and technical advances in their day-to-day work needs to bridge the gap between the high demand for terminology and its current status. Because the more important the development of science and technology in life, the more important the terms are to acquire, manage and develop it. In this regard, the regulation of terms is of great scientific and social importance.

One of the methods of word formation in modern English is word-formation by adding words together. Some literatures use the word "morphological-syntactic word-formation", "grammatical word-formation", while others use the term "lexical-syntactic word-formation". In Karakalpak linguistics, the creation of a new term by this method is called "syntactic term creation".

Creating a new term by changing the meaning of simple words can increase the vocabulary of many languages in the international arena. A large number of international terms have been enriched by changing the meanings of common language words and terms derived from social and economic fields.

This method of constructing terms differs from others in that in other cases, if a new form is created again to represent a new concept (that is, a word in which the elements are combined in a new way), a new content is placed here in the old form (that is, a ready-made word that existed before is obtained).

The peculiarity of creating a term by changing its meaning is that the object being terminated (i.e., the subject or event to be named) always has something in common with the subject or event whose name is used as a term. will be. This commonality may be reflected in the similarity between their appearance or the function they perform, and so on. The name of an existing subject can be changed to a new one only if the concepts of these subjects are clear and have a common denominator that connects them, otherwise it cannot be done. Therefore, when creating terms, it is necessary to pay attention to their meaning and structure.

International terms that are structurally and spiritually analyzed are also abbreviated. It should be noted that in the analysis of international terms, abbreviations cannot be semantically analyzed. Therefore, in order to get their full meaning, it is necessary to analyze the words.

Semantic-syntactic term formation is more widely used in the social and economic spheres than in other fields. The main reason for this can be explained by the fact that the terms of both fields originated in the past on the basis of the vernacular and have a strong connection with the spoken language. Therefore, many metographic uses specific to the vernacular, i.e., the copying of the meaning of lexemes, are relatively common in the system of terms in international fields.

Although the affixation of terms in international fields is less productive than the syntactic construction, it is important from a diachronic point of view.

There are many linguistic tools used in English terminology, especially word formation. Therefore, in order to create terms in English (prefixation, suffixation) can use several words or phrases. The following are the principles and methods of making terms in English: using prefixes, terms are formed mainly by prefixes in English (pre, inter, im, re, de, com, con, dis, ex) and a work -can indicate whether the action has been performed before or should be performed.

In conclusion, it should be noted that the regulation of terminology is an important issue not only in the scientific field, but also in social life. The development of terminology is evident in the following cases where the terms are directly used: in the correct organization of vocational education, in oral communication in industrial practice, in correspondence in scientific and production processes, in printing, foreign in translating handwritten literature. A language cannot build its terminology on its own terms. The process of language construction shows that there is no pure language in the world. There is always a process of learning a term from another language, and this process cannot be avoided. However, even when there is no need, the artificial use of foreign terms is not always justified. In such cases, it is important to make more use of one's own language and to maintain a balance between the nature of the concept and the term in which the term is to be expressed. In many cases, the terms used to describe some of the concepts are not available for consumption, and as a result, such concepts, despite being very important and significant, are deprived of the possibility of widespread use. Some of the shortcomings mentioned above are also present in the Karakalpak terminology. In particular, the use of the same term in our language for more than one concept, the naming of one concept with different terms, the existence of variability, the inability to correctly understand the conceptual meaning of Russian and European terms, there are many cases that contradict the leading trend of terminology, such as the presence of a multi-component situation that causes inconvenience, excessive use of foreign terms, diversity in the spelling of some terms. The existence of such negative aspects in the terminology of the Karakalpak language indicates that much remains to be done to regulate sectoral terms.

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ABOUT THE GRAMMAR STRUCTURE OF KARAKALPAKSTAN OIKONYMS

Abstract: *The content of the article is aimed at determining the types of oikonyms which are one of the types of toponyms depending on the grammatical structure. It mainly analyzes the structural forms, patterns of formation, root and compound types of Karakalpakstan oikonyms. They are also divided in small groups based on the requirements of the material. They are compared to the structural features of the oikonyms of Turkic languages. Word models, methods of construction were analyzed. The semantic and functional functions of word-forming affixes in oikonyms are also defined. Derivation of some affixes is described. Also they are compared with options in other languages. Also compound oikonyms are analyzed. The importance of the materials of the article for linguistics and toponymy is explained.*

Key words: *Toponym, oikonym, hydronym, structure, grammar, morphology, structure, simple, compound, root, derivative, affix, formant, topoformant, compound, combined, relative, sentence.*

Language: *English*

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Introduction

One of the manifestations of political, economic, socio-cultural changes and innovations taking place in society is reflected in the language. This is especially evident in the lexicology of the language rather than in the phonetics and grammar sections.

Toponyms that make up a certain part of the vocabulary, their origin, long or short-term use, contain, the presence of various phonetic, grammatical changes in the structure, may occur depending on linguistic or extralinguistic factors.

Toponymy is a branch of onomastics that studies the terms assigned to objects such as villages, cities, lakes, rivers, deserts, mountains, hills, cemetery, etc. Toponyms are studied in several groups depending on the type of object: hydronyms, oronyms, agroonyms, oikonyms, etc. Oikonyms include the names of villages, cities, streets, settlements, where people live. It is expedient to learn in connection with other types of onomastics (hydronyms, oronyms, necronyms, etc.) without distinguishing. This is because each proper name passes from one category to another and completes each other.

Analysis of toponyms according to their grammatical structure, methods of construction allows determining the history of the origin of the term, etymology, archaic word or affixes, and other elements of the language. This is important not only for onomastics, but also for linguistics. After all, the toponym is formed on the basis of the rules and base of the language to which it belongs.

Differences, models and types of toponyms, depending on their grammatical structure, methods of construction are mentioned in the works of many scientists. This issue has been studied in detail in the researches of A.V. Superanskaya, G.I. Donidze, G.E. Kronilov, O.T. Molchanova, A.A. Kamalov, and O.R. Khisamov. It is known from the studies that there are not always the same views on the classification of toponyms according to their grammatical structure, the definition of methods of formation, the definition of models.

The article uses the methods of systematic analysis, chronology, chronological analysis, which are widely used in toponymic research, description, comparison, genetic and etymological, statistical, as well as historical research.

Professor A.V. Superanskaya in determining the grammatical structure of toponyms of Slavic languages (including some oikonyms) took into account what elements it consists of, for example, root, affixes and the number of components. Based on this principle, toponyms are divided into "single-word toponyms" and "multi-word toponyms". Toponyms formed from one word are divided into simple (derivative and root) and compound nouns, depending on their morphemic structure. Terms formed by the combination of several components in a disjunctive or predicative relationship are included in toponyms consisting of many words. The author also spoke about the formation of toponyms: "In a certain region, only some of the various word-forming tools are used in toponymy, they can be widespread and convenient in that region" [25.88-103]. From this point of view, this classification, proposed by the types of structure of toponyms, is more characteristic of the toponymy of Slavic languages.

The grammatical features of toponyms belonging to the Turkic languages, their types depending on the structural features were first studied by G.E. Kornilov, G.I. Donidze.

G.E. Kornilov pointed out the following three groups of Turkic toponyms, depending on the composition and structure: 1. Toponyms from geographical terms; 2. Toponyms consisting of attributive syntagm; 3. Ellipse toponyms [12.121-128].

G.I. Donidze divided Turkic toponyms into one-word and multi-word toponyms depending on their grammatical structure. Terms consisting of one word are further divided into affixed and non-affixed types. The basis of non affixed toponyms is formed by noun, adjectives, noun verbs and adverbs, and this is explained by examples [7.122-126]. As it is known, this classification of G.I. Donidze is based on the methods of classification proposed by A.V. Superanskaya.

Linguistic analysis of oikonyms of the Bashkir language is widely studied in the research of F.G.Khisamatdinova. In his dissertation on the structural and formation features of the Bashkir language system of oikonyms, place names are grouped as one-based (one-rooted) and two-based (two-rooted). It is noted that most of the local oikonyms are mono-rooted terms, which are further divided into groups of terms and metonymic terms. And based (rooted) oikonyms include terms consisting of noun, adjective, numeral and oikonomic terms (village, country, wintering, etc.) [28.17-22].

Historical and geographical features, ethnolinguistic strata, structural structure and forming models of the western Trans-Kama oikonyms of Tatarstan were studied in a monograph by O.R.Khisamov. In determining the structural features of the oikonyms of this territory, the author studied the toponymic techniques based on the views of G.F. Sattarov and F.G. Garipova, as well as, depending on the requirements of the materials, divided them into the following types: 1. Ordinary oikonyms. They are again divided into root and derivative roots. 2. Oikonyms with compound structure [29.140-146].

Toponymy of Kazakhstan, its theoretical implications, a number of problems of toponyms, including grammatical structure, and ways of formation are discussed in the works of T.Zhanuzakov. In his voluminous monograph "Kazakh onormastics" a number of oikonyms are divided into simple, compound and composite, depending on the structure. He said that simple oikonyms are formed from the root, and compound and composite toponyms are formed from the combination or sequence of several words [10.283].

In Uzbek linguistics, the grammatical structure of toponyms, including hydronyms and oikonyms, and methods of their formation are the subject of a number of studies. Z. Dusimov (together with M. Tillayeva) divided the toponyms of Uzbekistan, including Khorezm region, according to their structural structure into non-affixed (root), affixed (derivative), prefixed, indicator and sentence toponyms [9.19].

Geographer S. Korayev divided the structural structure of toponyms of Uzbekistan into two groups: simple and compound [11.112-124]. Given the ratio of affixes and topoformants in the composition of simple toponyms, they are divided into root and derivative toponyms. Terms formed from the sequence or combination of two or more words are called compound toponyms.

In the toponymy of the Uzbek language, oikonyms as a type of toponyms are the object of research on its own. S. Naimov was the first to study the oikonyms of Bukhara region in a linguistic project. He divided the grammatical structure of the oikonyms of this region into simple, compound and composite [16.133]. This classification is based on the principles of pre-existing classification in Russian and Turkish toponymy.

A. Turabov grouped ethno-oikonyms of Samarkand region as ethno-oikonyms with appellate, formant and indicator [27.122]. Information on the grammatical structure of oikonyms of Fergana region can be found in the work of N. Ohunov (together with Yu. Ahmadaliev) entitled "Naming features of oikonyms of Fergana region" [21.61-62]. It teaches the grammatical structure of regional oikonyms into simple and compound. Yu. Nematova said that the oikonyms of Namangan region are different depending on the grammatical structure, in classifying them into certain groups guided by the classification

proposed by N. Ulukov (on the structure of hydronyms) and divided the collected materials into simple structured, compound structured and composite structured oikonyms[19.115].

The first ideas about the grammatical structure of toponyms of Karakalpakstan can be found in the research of K. Abdimurtov. In his article (together with T. Begzhanov) "The structure of toponyms of the Karakalpak language" [3.85-88] he studied the local toponymic materials according to the structure of the following types: 1. Ordinary toponyms: Lar, Qır - root, Kegeyli, Shaǵırlı - affixed; 2. Compound toponyms: Aqbulaq, Qızıljar - combined; Mamıydıń dalası, Aral teńizi - related; Nókis-Shımbay jolı, Barsa-kelmes kóli are a pair of toponyms.

K. Pakhratdinov (together with K. Bekniyazov) in his article on the construction of toponyms of Karakalpakstan divided the toponyms of the republic into singular, compound and combined forms according to the structural, morpheme and contain of them [22.69]. G. Mambetova refers to the most common classification in toponymy in determining the structural features of hydronyms of the northern regions of Karakalpakstan. She divided hydronyms into simple (affixed, non-affixed), compound and composite [13.19-20]. The study of regional toponyms in the toponymy of the Karakalpak language is just beginning. Among such works in the dissertation of G. Abishov on the linguistic analysis of toponyms of Shymbay district [1.19-20] toponymic materials are divided into simple and compound types. I. Khalmuratov divided the oikonyms of the southern territory of Karakalpakstan into structurally simple, compound and combined [30.13].

There are general similarities in the made classification by the grammatical structure of toponyms, as well as oikonyms. At the same time, there are differences related to the features of each region and language. A.V. Superanskaya said: "Although toponyms in close or related languages are based on the same patterns, it is clear that each language differs due to its own internal rules and resources" [25.52].

Giving a positive attitude to the views and the proposed classifications of scholars, as well as the requirements of the Karakalpak language and the collected materials, we agreed to study the grammatical structure of oikonyms into the following types: I. Simple oikonyms; II. Compound structured Oikonyms.

I. Simple structured oikonyms consist of one lexical unit. Their one-component, shortness makes them compact in use. This sign distinguishes it from compound structured oikonyms.

The decrease or increase of some sounds in the composition of oikonyms, other linguistic phenomena can affect the blurring of the meaning of the term, the displacement or merging of morphemes. With this in mind, we learn to divide simple-structured oikonyms into groups affixed and non-affixed.

I.1. Non-affixed Oikonyms. The non-affixed oikonyms are terms that have one root, do not contain grammatical forms, and have a zero index. T. Nafasov advises to pay attention to the analysis of simple toponyms of this model. This is because such terms were originally used as a structural compound, and over time the second component was dropped, and as a result, the compound term may have become a simple term [18.11].

The fact that non-affixed oikonyms are units in the appellation or onomastic lexicon requires their division into the following types:

A) Words in the appellation lexicon (noun, adjective, number, adverb) are transferred to the oikonomic lexicon without any changes by means of onomastic conversion. To it, Múlk, Qayır, Rawshan, Aral, Shege, Ferma – are nouns; Boz, Kebir, Góne, Kebir are examples of adjective terms.

B) Proper terms in onomastic lexicon pass from one category to another by transformation without any changes. The oikonyms such as ethnonym based term Túrkmen awıl, Qazaq awıl, Ayteke, Keneges, Qıyat; anthroponyms based terms Abat, Ádil, Áwez, Dúysen, Qurban can be example. Therefore, the non-affixed oikonyms are not common in the Turkic-speaking regions, including Karakalpakstan oikonyms. However, they reflect the structural differences of Turkish oikonomy.

I.2. Affixed oikonyms. In toponymy, terms that contain word-forming, word-changing affixes are called affixed toponyms or oikonyms. Z. Dusimov used the term formant toponyms for such types of terms [8.47].

The function of word-forming affixes, their use, productivity or inefficiency, and grammatical meanings are clearly reflected in the word-formation system of linguistics [2].

There are different views on the use of affixes in the system of Turkic toponyms, the function of naming. Some researchers have studied the affixes belonging to the word-formation system of the toponym as toponym-forming affixes. Z. Dusimov [8.43] in Uzbek linguistics and K. Pakhratdinov [22.69] in Karakalpak language explained in detail that the function of word-forming affixes in toponymy was finished till the toponyms, the geographical terms were formed from (ready) derivative words in the language. Therefore, affixes in toponyms should not be considered as term forming affixes. They do not create a term from the root, but before that they created a lexical unit. We will see some affixes in the composition of Karakalpakstan oikonyms

The -lı-li affix. In Turkic languages, the affix -lı-li is one of the main affixes used in the formation of the adjective. The fact that this affix is often found in oikonyms and has a wide range of distribution is mentioned in many studies. O.T. Molchanova says

that this affix (along with variants) plays a key role in the formation of the Mountainous Altai oikonomies. According to him, 343 out of 754 derivative oikonims are formed with the help of these affixes [15.125]. This affix has the following differences in the composition of oikonyms: a) the abundance of plant or animal species in this place: Baqanshaqlı, Boyanlı, Kegeyli, Gújimli, Qarabaylı; b) this place (or object) is characterized by the presence of the object described in the root: Aqbaslı, Bógetli, Shaǵırlı, etc.

J.B. Bugibayeva describes coming of the adjective forming affixes -lı / -li, -dı / -di, -tı / -ti in the Kazakh language in a part of the toponym as following: "-lı / -li, -dı / -di, -tı / -ti suffixes are the adjective forming suffixes. Since land and water names are nouns, the suffixes -lı / -li, -dı / -di, -tı / -ti are in the nominative (nominative – M.K) position. They have a substantive quality. With this in mind, these affixes can be included in the list of noun forming affixes in the sense of place, land [5.330].

-lıq / -lik / -laq affix. This affix creates new words in the word-formation system in the sense of nouns and adjectives. The abstract meanings of this affix are obvious in the composition of local simple and compound oikonyms: the names of such villages as Azatlıq, Doslıq, Shadlıq, Jaslıq, Ortalıq can be an example.

In the Karakalpak language, the affixes -shı / -shi,-kesh are used productively in the creation of professional nouns. A number of professional words have a nominative function and have been transferred to the village names: Arbashı, Arqanshı, Etikshi, Kókshi, Túyekesh and others. In addition, oikonyms such as Birinshi awıl, Ekinshi awıl, Segizinshi awıl contain word-changing affixes.

I. 3. Topoformant oikonyms. Topoformants are not as widely used in toponym creation as word-forming affixes. They were originally words that meant something, and then became topoformant. Many toponymic formants can be derived from geographical terms and their original meaning can be reconstructed through linguistic research.

In modern Turkic languages, the topoformants -abad, -kent, -kesh, -rabat, -rud, -stan which form the oikonyms in the sense of place, land, settlement, and are characteristic of the Iranian languages of origin are widely used. In the oikonomy of Karakalpakstan the topoformants abad, kent and stan occurs in the terms of populated areas such as Diyxanabad, Elabad, Xalqabad, Tashkent, Ózbekstan and others.

II. The compound structured oikonyms. The morphological structure of toponyms does not always consist of a single root or basis, sometimes are formed by combining or sequence of two or more words by semantic and formal sides. In the scientific literature the terms related to this type of toponyms such as: compound toponyms, combined toponyms, composite toponyms, indicator toponyms are used.

The fact that it is composed of two or more lexical units, built on a common unity in form and meaning, the name of an object, makes a basis to call the compound structured oikonyms. They are formed by the combination of words – composition

Most of the oikonyms of the Turkic-speaking republics, including Karakalpakstan, are the compound structured oikonyms.

The external form of compound oikonyms, the degree of unification of their components is not the same, some are formed by the complete combination of two words, and the others are consequence of them. Compound toponyms, including oikonyms, are studied in accordance with the concepts of the theory of formation of compound words in the language. In this regard, A.V.Superanskaya: "Each toponym appears in accordance with the rules of the language to which it belongs, so the study of structural types of toponyms is important not only for toponymy, but also for linguistics. The structural analysis of toponyms should be guided by linguistic principles "[26.61]. Based on this point of view and material requirements, we learn to separate compound structural oikonyms as combined oikonyms and sequential oikonyms.

II. 1. Combined oikonyms. Combined oikonyms and a number of toponyms that was basis to it, are formed by a complete combination of two or more meaningful words. They are the result of long-term constant combined use of words related to a geographical object and its features. Initially, the words used in the sequence became more and more stable over time. We studied the combined oikonyms into the following types, depending on the model of morphological structure:

1) noun + noun model. Qamısshalı, Suwenarım, Begjap, Tabankól, Dárwazaqum, Bekniyazózek, Esimózek, Birqazankól, Qutankól, Sazanjap, Arpakól, Qamısarıq, Qazaqdarya awılı (village), Qońıratkól awılı, Naimankól and other names of villages and settlements are a combination of the names of animals, plants, tribes and nouns.

2). Noun + adjective model. There are not many oikonyms of this type in the region: there are such village names as Aqımbetshúńgil, Tubay, Shımshıqoy, Moynak, Pillánoy.

3) Adjective + noun model. In the oikonyms created in this model, the adjective means any feature of the object (color, shape, properties, appearance, size, etc.). In the toponymy of Karakalpakstan in the names of Aqjay awılı, Kókdárya awılı (village), Qızıljar village, Qızılózek settlement words related to color are combined with noun and form a term. Also, in the names of this model, the adjective differs in the expression of the appearance of the object (Jalpaqjap, Maqpalkól, Terensay), the property (Góneqala, Jańabazar, Jańaqala).

In toponymy, the model of adjective + noun is widespread in the terms of land, water and place. B. Biyarov, who studied the patterns of creation of

toponyms in Kazakhstan, showed that the effective use of adjective in toponyms depends on two factors, first, the adjectives can not give full meaning in isolation, it must be conditionally followed by the next word (usually noun), secondly, the color is selected as a reverse sign in giving difference of the geographical object [4.156].

4) Numeral + noun model. The use of numberals in onomastic materials (anthroponyms, ethnonyms, toponyms) attracts the attention of scientists. Numerical combined oikonyms are also common in the region. For example, the names of the villages Úshsay, Besqudıq, Toǵıztam, Beskópir, Ontam, Qırqjay, Qırqúyli, Mıńjer are proof of this. According to B. Biyarov, in toponymy, the words qırıq, mıń (forty, thousand) do not mean the exact number of geographical objects, but "abundant, many, infinite" [4.383]. The meaning of a geographical object is also explained by the words jalǵız, taq, qos, egiz (singular, odd, double, twin). For example, Qosqala Qosjap, Qostam, Qosterek, Qostruba and others are proof of this.

5) Noun + verb model. The use and semantic differences of verbs in the system of Turkic toponyms are specifically mentioned in the research of G.I. Donidze [6.39-46], O.T.Molchanova. O.T. Molchanova said that in the toponyms of the Mountainous Altai and Turkic languages the forms of the verb -kan / -ken / -kon / -kón, -ǵan / -gen / -gón are used a lot, and their meaning is interpreted differently [[14.54].

In the oikonyms Qazanketken, Qoshqarjıqqın, Qumjıqqın, Qıyatjarǵan, Teńgeshashqan in the territory of Karakalpakstan its basis is built on the construction noun + verb.

6) Adverb + verb model. A number of toponyms are formed from the nominative function of the word, which means action and its sign. For example, Qattıaǵar is a residential area.

II. 2. The sequential oikonyms. In toponymic research, word-sequence and word-place-terms formed in various syntactic connections of two or more words are studied as compound toponyms, while sometimes they are studied under the terms of compound, composite, unbound, complex besides them. A.V. +Superenskaya called the sequence of several words, as well as terms based on predicative relations as "toponyms consisting of many words" [25.103].

S.Koraev studied toponyms in the form of complete sentence as a kind of compound toponyms, such as Joldastıń atı ushqan, Mollanıń qızı ushqan which is met in the microtoponyms of Uzbekistan [11.126]. T. Nafasov analyzed the terms of land and water as compound toponyms formed on the basis of predicative relations in the toponymy of Kashkadarya such as Sapar ushtı, Bay qondı, Shopan óldi, Xan kóshti, Mola qashtı, etc. [17.166-168].

Proper terms in any language, one type of them - toponyms (excluding those borrowed from another language) appear on the basis of the internal rules and resources of the language. A.V.Superanskaya said that all proper terms are derived from words in the common used lexicon, their meanings are secondary [23.29], V.A. Nikonov: “Geographical term is a word. Like all words, it obeys the rules of language. Toponymy does not create its own tools, but uses the existing opportunities of the language, albeit to a lesser extent.” [20.66]. Therefore, in the Karakalpak language, based on theories of compound words, we decided to call a sequence of several words, that is, terms formed on the model of a sequence of words, as sequential oikonyms. Incomplete interconnection of components is a barrier that distinguishes them from other types of terms.

The sequential oikonyms can be divided into the following types depending on the sequence of words:

1) Formed from the sequence of two nouns. Depending on the meaning of the words they contain: a) appellation words - Abat mákan, Shegara Terek, Doslıq bayraǵı, Ferma tam; b) from a sequence of human names, surnames, nicknames, tribes and other words - Allayar Dosnazarov, Tolıbay Qabulov, Bákir Kárimberdiev, Muwsa Jálil, Mamıydıń dalası; c) due to the sequence of tribe names - Ayteke Sheriwshi, Besli Ayteke, Qazayaqlı Bessarı, Kepe Sheriwshi, etc.

2) The sequence of adjective and noun forms sequential oikonyms: a) from the sequence of adjective and appellation – Qara aǵash, Qıysıq kanal, Qıysıq terek, Taza bazash; b) adjective and ethnonym - Kishi jádik, Úlken qayshılı, Úlken quyın; c) from the sequence of ethnonyms and appellations with the relative adjective - Aylanba jap, Qumlı ataw, Góne taslıjap, etc.

3) It is made of a sequence of numeral and noun: Jeti Tóle, Tórt Sharyar, Alpıs jıllıq (Nukis district, village), Eliw jıllıq.

In Turkic languages, one of them in Karakalpak language, the components of compound structural oikonyms are formed in isafety relations. We divide them into three types:

In type I of the isafety relations, the components are connected to each other without affixes by meaningful pairing. They are constructed in an attribute and identifiable model. This type of isafety relations is a phenomenon inherent in Turkic compound toponyms. Most of the Karakalpak language compound oikonyms belong to this type. For example, Qızıljar, Aqjay, Bozataw, Kókdárya, Qızılúy, Erkindárya, Kendirli oy, Maylıózek, Mırzamurat Abdullaev, Qoskópir, Úshtam, Shegara terek, Kishi jádik and other such names in the region are among them.

In type II of the isafety relations, the first attribute component is in the nomenative case, and the second identifiable component is in the 3rd person of possesive affix: Xojeli, Doslıq bayraǵı, Qorıs boyı. S.

Korayev calls such an isafet connection a morphological sign or an affixed isafet [11.124].

Both the attribute and the identifiable components of type III of isafety connection are connected by morphological indexes. The first component takes the possessive case, the second component takes the third page affix of possesive. Oikonyms such as Kóseniń jurtı (the village of Kose), Mamıydıń dalası (steppe of Mamiy) are examples of this. Over time, the affixes of possession in the noun may be dropped: such as Kóseniń jurtı (Kose's homeland) → Kóse jurt (Kose homeland) → Kósejurt (Koseland).

Types I and II of isaphetic connection are actively used in the creation of oikonyms. There are very few oikonyms with type III. They are more typical for microtoponyms.

In the oikonomy of Karakalpakstan, the names of the villages of Ayteke qızıl sáwle, Ayteke taza talap, Jaǵa boyı beksıyıq, On eki úy, Úsh tóbe qum consist of three components. In toponymy, toponyms formed from three or four components have more structural changes. According to A.V. Superanskaya, in any language there are two opposing traditions. First, the term expands by adding different words to its structure, and second, some words in the term are omitted without affecting its nominal function and shortened the long term [24.349].

Thus, it is possible to study the toponyms, including oikonyms in terms of grammatical structure, to determine their main and auxiliary morphemes, formants, to determine their functions, to get clear information about the models of oikonyms, methods of formation. This allows us to determine not only the structural types or differences of the oikonium, but also the body of the meaning of the term, its semantics.

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QR – Issue QR – Article

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STUDY OF THE PROPERTIES OF THE H13A CARBIDE PLATE (ANALOGUE VK6OM) AFTER COMPREHENSIVE PROCESSING IN CUTTING STEEL 18XGT

Abstract: *This article examines the properties of the H13A carbide plate after complex processing when cutting steel 18XGT. As already noted, wear spots on a carbide cutting tool can be located on all working surfaces. And the location of the prevailing source of wear, which develops in the place where the maximum temperature operates, determines the processing conditions. A significant part of the frictional energy of the tool is converted into heat. and high-temperature alloys have low thermal conductivity.*

Key words: *roughness, wear, deformation, cutting force, wear resistance, surface, depth, processing.*

Language: *English*

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Introduction

The state of the surface layer of the workpiece and the roughness of its surface are significantly influenced by the result of the force aftereffect of the transformation of the cut allowance into chips, as a result of which a transitional plastically deformed layer arises, which is determined by the processes of self-adapting tribocontacts, which is responsible for the formation of a stagnant zone and build-up. The process captures the chip formation zone and tribocontacts of the working surfaces of the cutter with the chips and the surface that is being processed. Deformations reach depths from several micrometers to hundredths of a millimeter. The intensity and depth of the spread of work hardening increases with an increase in cutting forces and the duration of their impact.

The magnitude of the cutting force affects the change in dimensions due to the displacement of the workpiece to be processed relative to the centers of the machine, the intensity of abrasion of the contact areas of the cutting plate, the magnitude of internal stresses, which often leads to leads and changes in the dimensions of the workpieces. The studies carried out on the wear of replaceable multi-faceted N13A plates in the turning operation of steel 18XGT showed that electron-beam alloying in combination with the coating reduces the cutting force, changes the location of the tool wear zone and affects the intensity of its wear (Fig. 1).

When cutting with a tool without machining, the characteristic place of occurrence of wear is the top of the insert (Fig. 1, a, b).

For tools with a wear-resistant coating and complex machining, blocking of the development of wear at the tip is observed, which significantly slows down the onset of the stage of catastrophic wear (Fig. 1, c-f). This can be attributed to the fact that the near-surface modified layer obtained by means of complex processing exhibits chemical passivity and reduces the adhesive interaction with the processed material. TiNb and Hf carbides form stable and strong oxides. As a result, the characteristics of contact processes change, which significantly reduces the power of the heat generation source near the cutting wedge of the tool.

It follows from Fig. 1 that, in addition to blocking the wear of the cutter at the tip, there is also a decrease in the intensity of wear along the flank surface. It is known that a gradual increase in temperature in the zone of direct contact leads to catastrophic wear along the flank surface, which

eventually reaches values at which irreversible processes begin in a hard alloy. The delayed flank wear on a multi-cut tool can be explained by the fact that the near-surface layer created under the coating has increased hardness combined with higher heat resistance and better resists microplastic deformation. This, apparently, also inhibits the softening processes at the back surface.

This is the difference in flank wear on a multi-cut tool and wear on a coated tool only. In the case of a coated tool without microalloying, after exposure of the base, the friction conditions on the flank surface are increasingly approaching those characteristics of an uncoated tool.

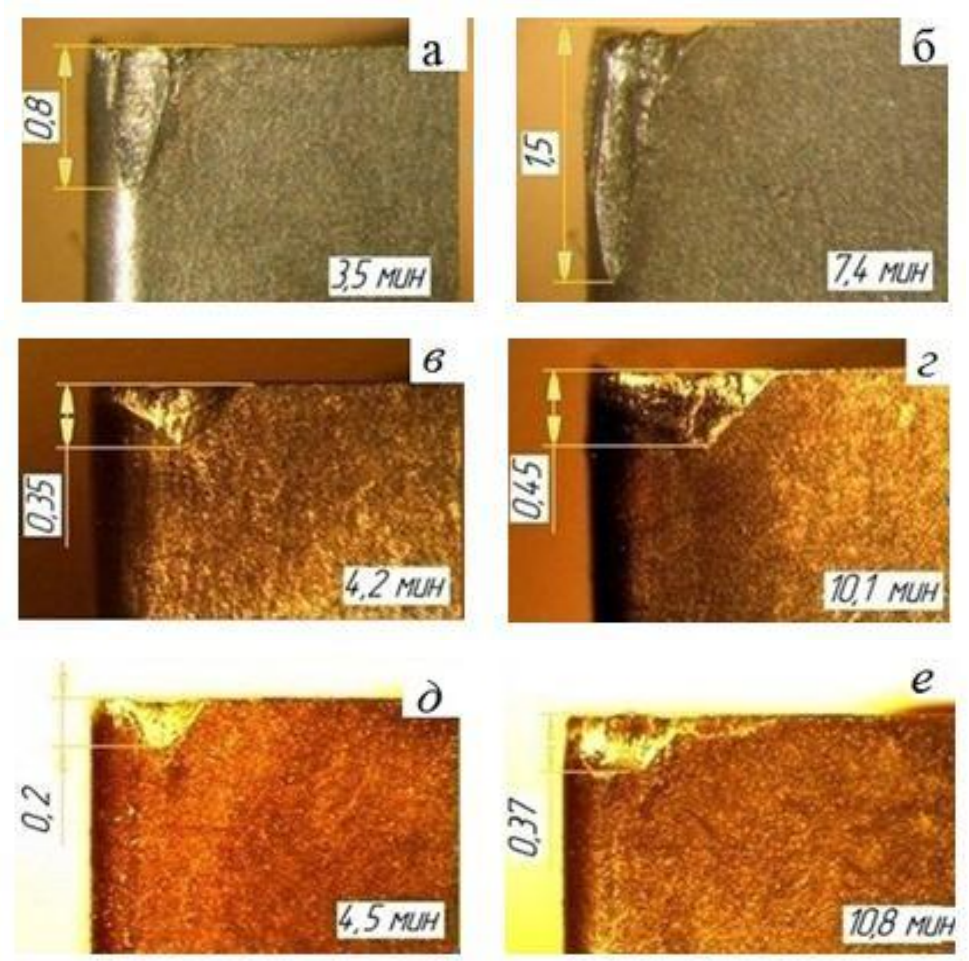


Fig. 1. Wear of cutting plates H13A during turning of heat-resistant alloy; a - b) uncoated plate; c-d) coated plate; e - f) plate after complex processing.

In a tool with complex processing, even after a breakthrough of the coating, the modified layer continues to perform its protective functions, which is reflected in the wear pattern of the tool (Fig. 1, d, f). Complex machining noticeably inhibits the formation of a wear pocket on the front surface. The wear zone on such inserts is closer to the tip of the tool than for inserts with only a wear-resistant coating, but at the same time, wear does not develop along the tip of the insert.

In practice, the durability of a metal-cutting tool is determined by the amount of wear on the flank surface (for finishing operations, it is considered critical that its value is of the order of 0.3-0.4 mm, for roughing operations - 0.4-0.8 mm). Often, this criterion is not always the most objective, since wear can be of a different nature, which is just characteristic of the case under consideration.

Therefore, as criteria for assessing the wear resistance of N13A plates when cutting a heat-resistant alloy, in addition to the amount of wear on the flank surface, the change in the resultant cutting force during processing was also considered (Fig. 2).

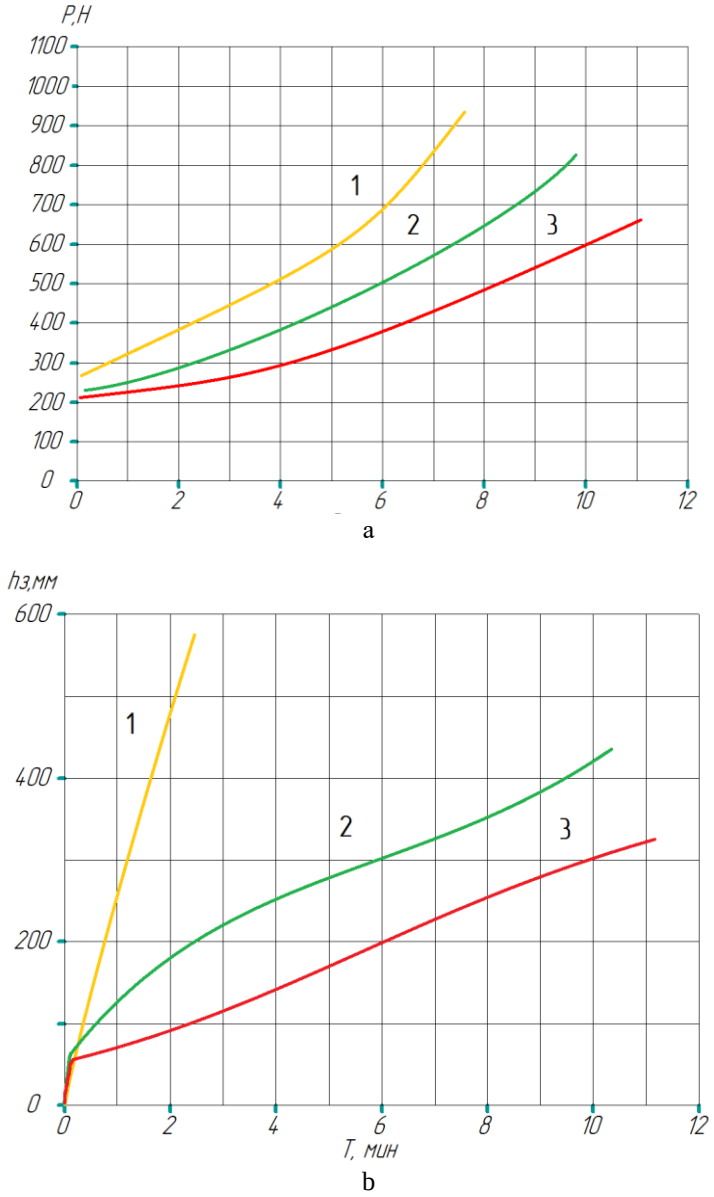


Fig. 2. a) the dependence of the magnitude of the resultant cutting force on time; b) time dependence of the wear of the cutting insert along the flank surface.

Based on the resistance tests of a removable multifaceted insert, we can conclude: The increase in the life of the insert after complex processing, including alloying with NESP and subsequent coating (TiAl) N according to the criterion of cutting forces, was up to 100% compared to inserts without treatment and up to 75% in comparison with plates only with a wear-resistant coating (Fig. 2, a). The increase in resistance according to the criterion of the amount of wear on the flank surface was about 400-500% compared to plates without treatment and up to 40% compared to plates with only a wear-resistant coating (Fig. 2, b).

In order to study in more detail, the difference in the wear of the flank of a tool with a complex treatment from tool wear only with a coating, a series of experiments was carried out on cutting 18XGT steel.

In fig. 3 and 4, a study of the process of wear of the section of the H13A plate adjacent to the active section of the cutting edge is provided using an optical 3D scanner.

Attention is drawn to the different nature of the formation of adhesions and build-up on the cutting edge, which indicates a change in the chip formation process after microalloying the tool surface. A change in the structure and phase composition of the material of the cutter leads to a shift in the adhesion zone of the processed material closer to the top of the cutter. In this case, the section of the cutting edge that is not in operation is often damaged by the coming off shavings. To avoid this phenomenon, it seems necessary to slightly change the geometry of the insert, adapting it to changing cutting conditions.

It was found that the formation of chips outside the working area does not greatly affect the roughness of the treated surface. For the given cutting conditions, the roughness was determined rather by the individual properties of the plate than by the mode of its processing. The spread of RA values from plate to plate ranged from 1.6 to 3.5 μm.

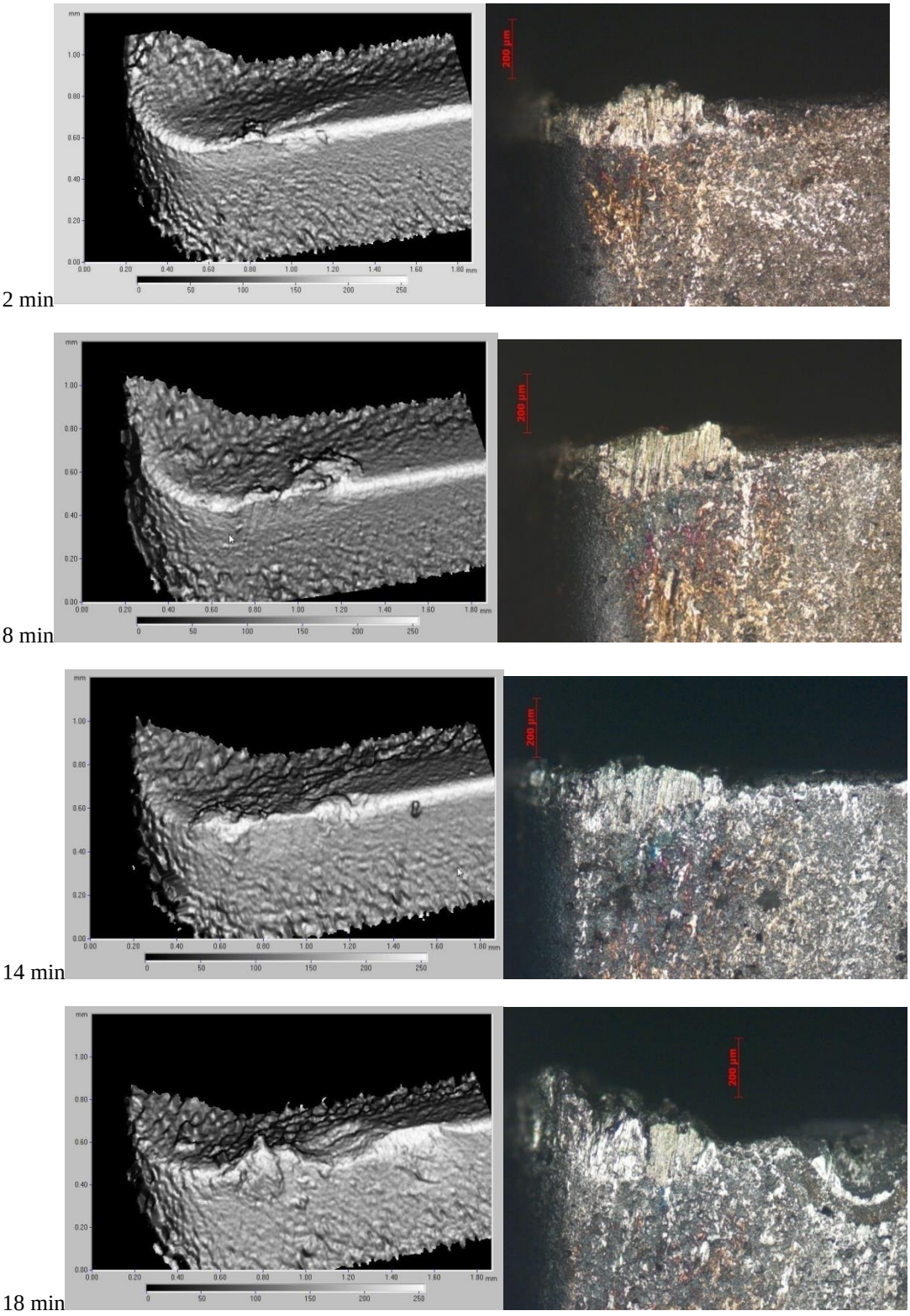


Fig. 3. 3D scans of the cutting edge area and a photo of the rear surface of worn H13A plates with (TiAl) N coating when cutting 18KhGT steel; v = 110 m / min, t = 0.25 mm, s = 0.15 mm.

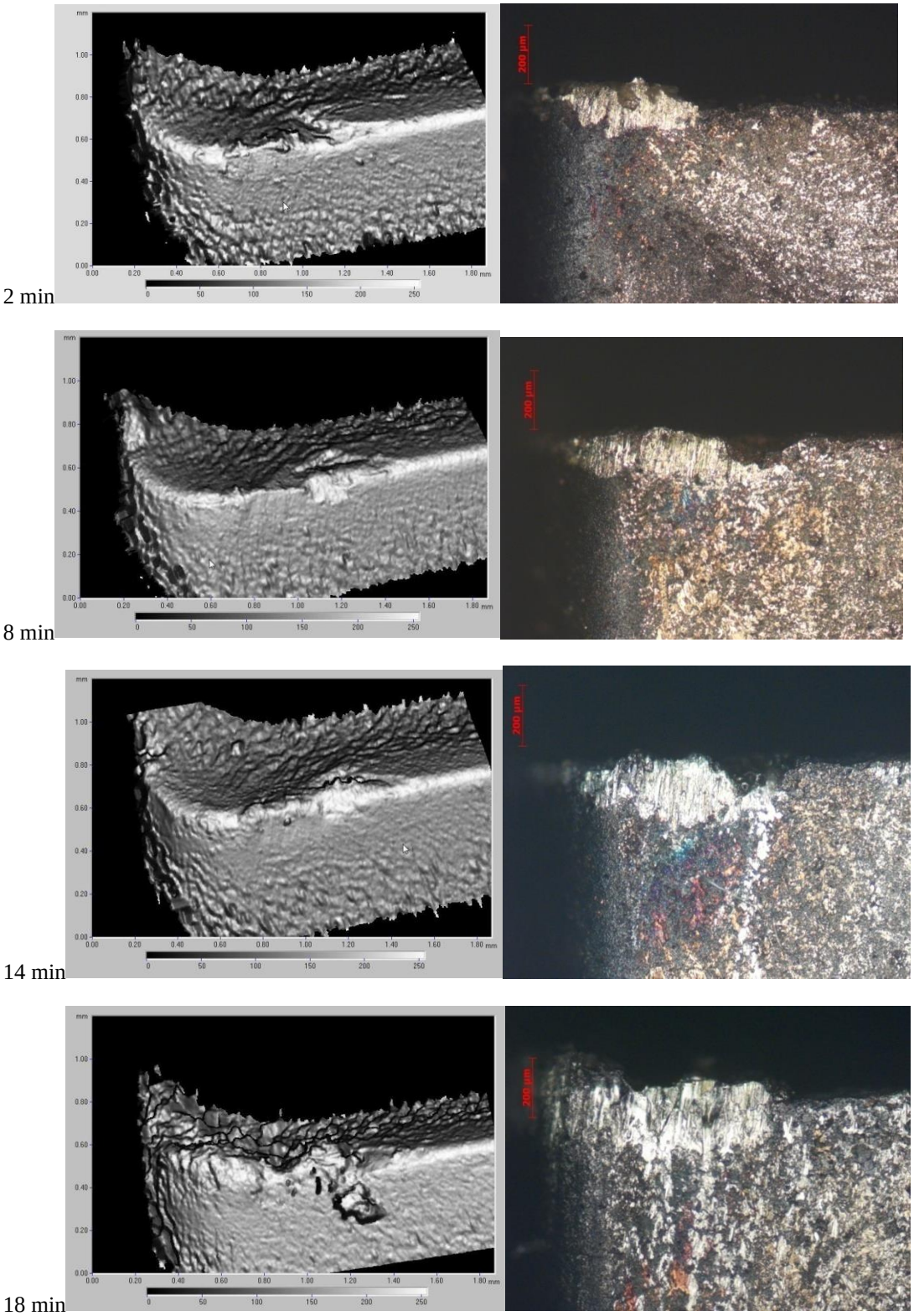


Fig. 4. 3D scans of the cutting edge area and a photo of the rear surface of worn H13A plates with microalloying with NbHfTi alloy and (TiAl) N coating when cutting 18XGT steel; v = 110 m / min, t = 0.25 mm, s = 0.15 mm.

Nevertheless, a number of features of the work of plates with a complex surface treatment can be distinguished. So, the running-in of such plates is faster, and the roughness values remain stable longer (Fig. 4).

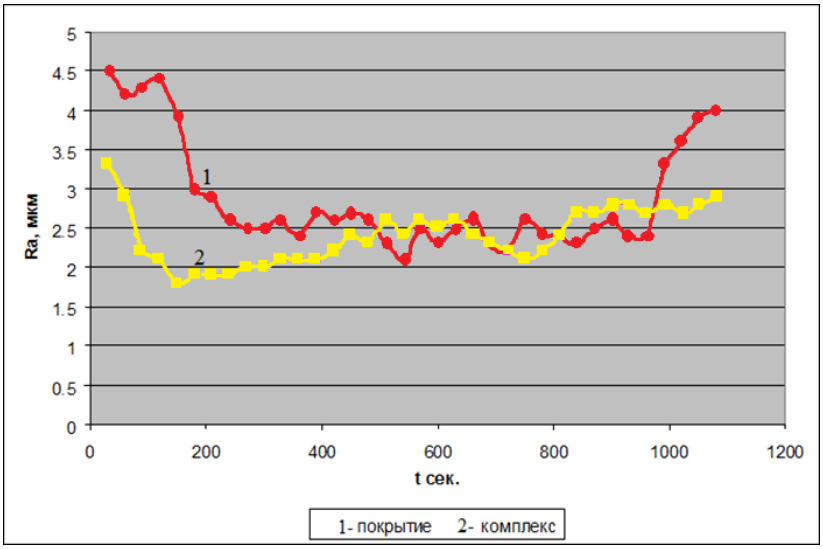
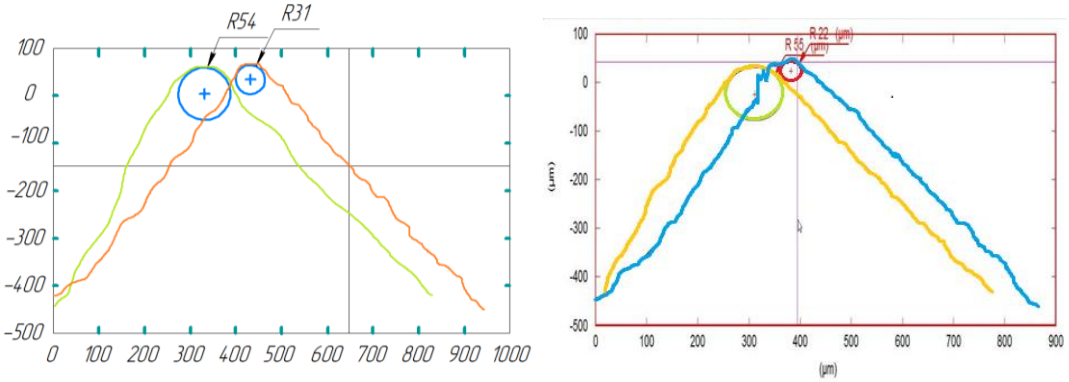


Fig. 5. Change in the surface roughness of the workpiece when cutting 18KhGT steel with N13A plates with a wear-resistant coating and with complex processing (v = 110 m / min, t = 0.25 mm, s = 0.15 mm).



a b

Fig. 6. Change in the radius of rounding of the cutting edge ρ after the insert has run in for 4 minutes. (3D scanner GFM); a) - plate with (TiAl) N coating, b) - plate with complex processing. The graphs also show the cutting-edge radius of the original insert.

Another feature of the wear of N13A plates after complex processing is a change in the place of formation of a wear hole - moving it closer to the radius of the tool. It should be noted that the radius of rounding of the cutting edge, formed during the interaction of the processed and producing surfaces, in the case of microalloying is noticeably smaller (Fig. 6). It is possible that, among other things, this is associated with a significant drop in the cutting force.

Conclusions

The durability of N13A plates with complex processing when cutting 18XGT steel after carburizing according to the criterion of cutting forces was up to 100% compared to the original plates without treatment and up to 75% compared to plates with only a wear-resistant coating. The increase in resistance according to the criterion of the amount of wear on the flank surface was about 400-500% compared to plates without processing and up to 40% compared to plates with only a wear-resistant coating. There is a shift in the wear zone and the tip of the cutter and a decrease in the radius of the cutting-edge rounding ρ after running in the cutter.

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SYNTHESIS AND RESEARCH METHODS OF SULFUR-CONTAINING SORBENTS

Abstract: *This article consists of 6 pages and includes raw materials and research methods, synthesis of sulfur-containing sorbent ligands, polymer sorbent synthesis, obtaining coordination compounds of Ni (II) and Fe (II) ions with synthesized polymer ligands. consists of. The article provides information on the method of synthesis of several sorbents containing sulfur and the sorption of metal ions.*

Key words: *EXG – epichlorohydrin, F – formaldehyde, K – urea, IQ – infrared, SAS - static exchange capacity.*
Language: *English*
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Introduction

Reagents of "t" and "kt" brands were used in the research. Solutions of reagents were prepared by dissolving their exact weights in a certain volume of solvent.

Potentiometric titration was performed on a pH-meter OP-211/1 and a universal ionomer EV-74. In this case, a decreasing portion of 0.11 N NaCl solution and an increasing portion of 0.11 N HCl solution were added to the same (0.25 g) weight of OH- and H-form ionite, bringing the volume of solution in each flask to 25.1 ml. tartar solutions were left for 8 days. Potentiometric titration of the solutions was then performed, and a potentiometric titration curve of the dependence of the pH of the equilibrium solution on the volume of acid added for titration was constructed and described.

The IR absorption spectra of the starting materials, sorbents and their coordination compounds with metals were expressed and recorded on an IRTracer-100 IK-Fure spectrometer in an area of 400-4000 cm-1.

Thermal stability of polymer ligands and their coordination compounds with metals by differential-thermal and thermogravimetric methods on Paulik-Erdey system derivatograph at a speed of 10 degrees / min, T-900, TG-200, DTA - 1/10, DTG - 1/10 galvanometer sensitivity, was studied by automatically recording the derivatogram on photographic paper. A sample of 60 to 80 mg was

placed in a 10 mm diameter platinum crucible without a lid. Aluminum oxide was used as a standard. The dynamic heating mode was carried out in atmospheric conditions.

Netzsch Simultaneous Analyzer STA 409 PG (Germany) with K-type thermocouple (Low RG Silver) and aluminum crucible was also studied on a differential scanning calorimeter at a flow rate of 50 ml / min in an inert nitrogen atmosphere (Institute of Bioorganic Chemistry, Academy of Sciences of Uzbekistan). Measurement temperature range 20-390°C, heating rate 5K / min. The sample size is 5-10 mg. The measurement system was calibrated with standard sets KNO_3, In, Bi, Sn, Zn, Mg.

The method of quantitative and qualitative radiographic analysis of compounds was carried out on a powder diffractometer XRD-6100 (Shimadzu, Japan) to determine the crystalline properties of geological deposits. CrKa was performed under the influence of radiation (b-filter, Ni, l = 1.54178Å, current and voltage in the X-ray tube 30 mA, 30 kV). The constant rotation speed of the detector was 4 degrees / min, in 0.02° steps (ō / 2th-coupling), and the scanning angle was from 4° to 80°. The samples were analyzed in a rotating chamber with a rotational speed of 30 rpm.

The morphology and element composition of polymer ligands and their coordination compounds were determined and analyzed using SEM-scanning electron microscopy at the High Technology Training and Experimental Center.

0.1 N. solutions of Ni, Fe elements “k.t.” The exact masses of the soluble salts of the brand were dissolved in distilled water and nitric acid solution was added until the pH = 1-2.1. Concentrations of the prepared solutions were standardized using a complexonometric titration method.

An aqueous solution of 4- (2-pyridylazoe) resorcinol (PAR) was used as a reagent in the photometric determination of Ni and Fe elements.

The desired medium in the solution was set using KCl-HCl [155] for pH = 1-3.1 and CH3COOH-NH4OH buffer solutions for pH = 3-11. The pH of the solutions was monitored at ± 0.05 pH using a universal ionometer EV-74 and an OP-211/1 pH meter. The solutions were stirred and tested in MM-5 type magnetic stirrers.

Concentrations of elements in the analyzed solutions were determined using optical analysis methods SF-46 spectrophotometer and KFK-2MP photometer. Ni (0.05 n, pH = 3.5-3.8), Fe (0.1 n, pH = 6.5) and sulfate solutions were used to determine the exchange capacity of ligands for metal ions. All measurements were performed under static and standard conditions. The amount of metal cations in the initial and equilibrium solutions was determined using trilonometric titration, photocolorimetry (Fe2 +, Ni2 +) and atomic absorption spectrometry (Ag +). The duration of contact time of solutions with polymer ligands was 1 day, and the pH of the solution was determined potentiometrically.

Synthesis of sulfur-containing sorbent ligands.

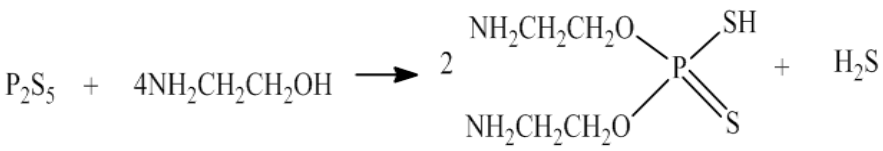
Extraction of phosphorus (V) sulfide. 1.51 g (0.05 mol) of powdered red phosphorus was mixed with 4 g (0.125 mol) of sulfur powder. This mixture was placed in a test tube made of hard liquefied glass and heated under a weak stream of dry carbon monoxide. The temperature was slowly increased until a homogeneous liquid was formed (300-3500C). The test tube was then cooled to form a yellow-green crystalline substance. The resulting substance was separated from the test tube. Product 5.38 g, reaction yield 98%.

The reaction equation is as follows.

$$2P + 5S = P_2S_5$$

i (2-aminoethyl) dithiophosphate ether synthesis. Heat to 0,11 mol or 22,2 g of phosphorus (V) sulfide with 0,2 mol or 12,2 g of monoethanolamine. The reaction is carried out in a heat-resistant vessel. When these two substances are mixed, the reaction begins rapidly. The reaction produces a thick smoke-like white gas, which is hydrogen sulfide gas with a very pungent odor, after which the gas slowly begins to separate from the vessel. After the gas is completely drained, we can see that a black viscous liquid has formed in the vessel. Heat the resulting black liquid in a water bath at a temperature of 50-600C, continue heating until the separation of the black liquid from the container is complete. Then use a glass tube to mix the substance in the container, if there is an insoluble sediment at the bottom, add 2-3 ml of monoethanolamine and continue the process, ie heating. Continue heating until the sediment and gas separation at the bottom is complete. When the sediment melts in the bottom of the pot, stop heating. Before use, the sorbent is cooled.

The reaction equation is as follows.

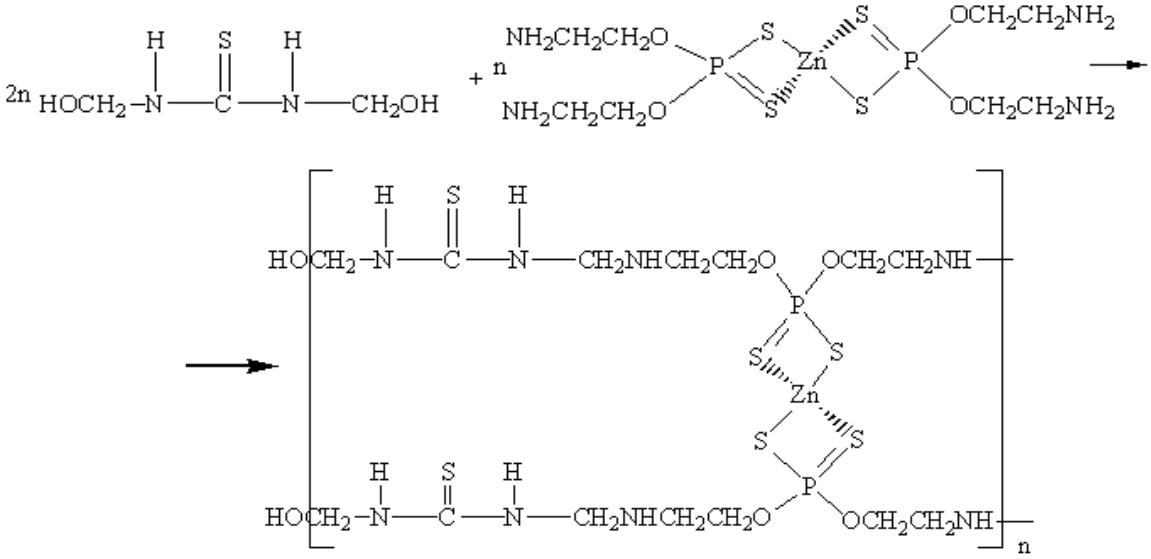


Polymer sorbent synthesis. 4 g of powder from Zn (II) O, O-di- (2-aminoethyl) dithiophosphate complex was placed in a round-bottomed flask with a return cooler, a thermometer and an automatic stirrer.

In a separate container, take 6 grams (0.2 mol) of formalin (CH2O) and 15.2 grams (0.2 mol) of thiourea CS (NH2) 2 and mix at 35-40oC until a homogeneous mixture is formed. The mixture was then added dropwise to the Zn (II) O, O-di- (2-aminoethyl) dithiophosphate product in the flask. The mixture was heated at 80-90oC for 4 hours, stirring, until a solid resinous substance was formed. The resulting solid resin mixture was poured into a porcelain bowl and dried in a drying oven at a temperature of 50-60oC for 24 hours. The dried polymer was crushed and the mixture was first washed with a 3% aqueous solution of KOH and then with distilled water and air-dried until it reacted neutrally with phenolphthalein. The resulting ionite solid white compound after drying. Air-dried ionite mass 21 grams reaction yield 83%. If the temperature is normal.

The synthesized complex sorbent is partially soluble in water, insoluble in organic solvents and does not suffocate.

The reaction equation for the production of ionite based on thiourea, formaldehyde, Zn (II) O, O-di- (2-aminoethyl) dithiophosphate is as follows



Obtaining coordination compounds of Ni (II) and Fe (II) ions with synthesized polymer ligands

Coordination compounds of Ni (II) and Fe (II) ions with the synthesized sorbent are 0.1 n of water-soluble sulfate and nitrate salts of the corresponding metals. To 55 ml of solution (Fe (II) ion is a very rare ion) add 1 g of sorbent and stir for 2 hours. The resulting black liquid forms a black precipitate with Ni (II) salts, and with Fe (II) forms a light orange precipitate, which is filtered and dried. Drying is carried out at a temperature of 500C. The results of elemental analysis of the composition of the obtained coordination compounds and some physicochemical properties are given in Table 2.1 below. A photograph of the obtained ligands and their coordination compounds was taken under a scanned electron microscope and the amount of elements in them was determined.

Table 1. Elemental analysis and some physical properties of the obtained coordination compounds

Metall	color	t_{liquid}, ^0C	Found, %			Gross formula	Calculated, %		
			C	H	Me		C	H	M
[ML^3_2]; [AgL^3]									
Ni (II)	dark black	174	32,8	5,27	8,78	$(C_{10}H_{20}N_2O_4PS_2)_2Ni$	33,44	5,61	8,85
Fe (II)	light yellow	168	32,53	5,09	8,45	$(C_{10}H_{20}N_2O_4PS_2)_2Fe$	33,36	5,6	9,08

Cd (II)	yellow	163	31,26	5,12	14,56	$(C_{10}H_{20}N_2O_4PS_2)_2Cd$	31,31	5,26	14,65
Ag (I)	black	192	27,35	4,56	23,73	$C_{10}H_{20}N_2O_4PS_2Ag$	27,6	4,63	24,78
$[ML^4_2]$; $[AgL^4]$									
Ni (II)	dark blue	165	25,92	4,04	11,15	$(C_6H_{12}N_2O_2PS_2)_2Ni$	26,59	4,46	11,72
Fe (II)	light yellow	142	25,88	4,25	11,46	$(C_6H_{12}N_2O_2PS_2)_2Fe$	26,5	4,45	12,02
Cd (II)	yellow	155	24,28	3,87	18,96	$(C_6H_{12}N_2O_2PS_2)_2Cd$	24,39	4,09	19,02
Ag (I)	black	176	20,49	3,55	30,78	$C_6H_{12}N_2O_2PS_2Ag$	20,76	3,48	31,07

CONCLUSION

The article focuses on the synthesis of starting materials and research methods, sorbents that form complex compounds with sulfur-containing metals, and describes in detail the research methods used in the analysis of starting materials and synthesized substances. Also:

1. Extraction of phosphorus (V) sulfide.
2. Synthesis of a sorbent that forms a complex from the interaction of phosphorus (V) sulfide and monoethanolamine;

Topics such as are also covered

Coordination compounds of the synthesized complex-forming sorbent ligands with Ni (II) and Fe (II) ions are obtained, and acid-base ionization constants of sorbents, stability constants of complex compounds of metal ions with sorbent ligands are given.

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REFERENCE DATA OF PRESSURE DISTRIBUTION ON THE SURFACES OF AIRFOILS HAVING THE NAMES BEGINNING WITH THE LETTER D

Abstract: *The results of the computer calculation of air flow around the airfoils having the names beginning with the letter D are presented in the article. The contours of pressure distribution on the surfaces of the airfoils at the angles of attack of 0, 15 and -15 degrees in conditions of the subsonic airplane flight speed were obtained.*

Key words: *the airfoil, the angle of attack, pressure, the surface.*

Language: *English*

Citation: Chemezov, D., et al. (2021). Reference data of pressure distribution on the surfaces of airfoils having the names beginning with the letter D. *ISJ Theoretical & Applied Science, 12 (104)*, 1244-1274.

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Introduction

Creating reference materials that determine the most accurate pressure distribution on the airfoils surfaces is an actual task of the airplane aerodynamics.

Materials and methods

The study of air flow around the airfoils was carried out in a two-dimensional formulation by means of the computer calculation in the *Comsol Multiphysics* program. The airfoils in the cross section were taken as objects of research [1-14]. In this work, the airfoils having the names beginning with the letter *D* were adopted. Air flow around the airfoils was carried out at the angles of attack (α) of 0, 15 and -15 degrees. The flight speed of the airplane in each case was subsonic. The airplane flight in the atmosphere was carried out under normal weather conditions. The geometric characteristics of the studied airfoils are presented in the Table 1. The geometric shapes of the airfoils in the cross section are presented in the Table 2.

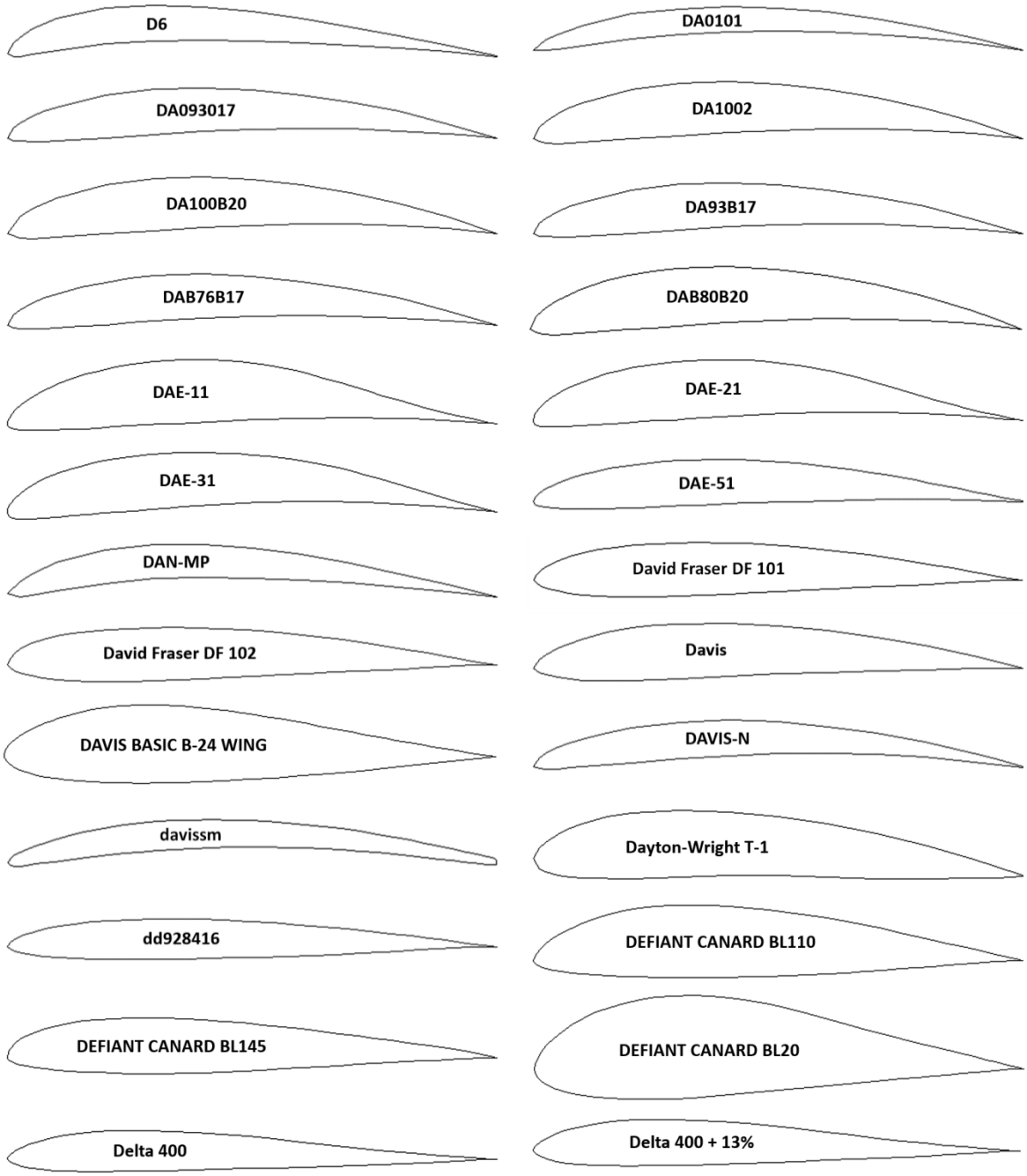
Table 1. The geometric characteristics of the airfoils.

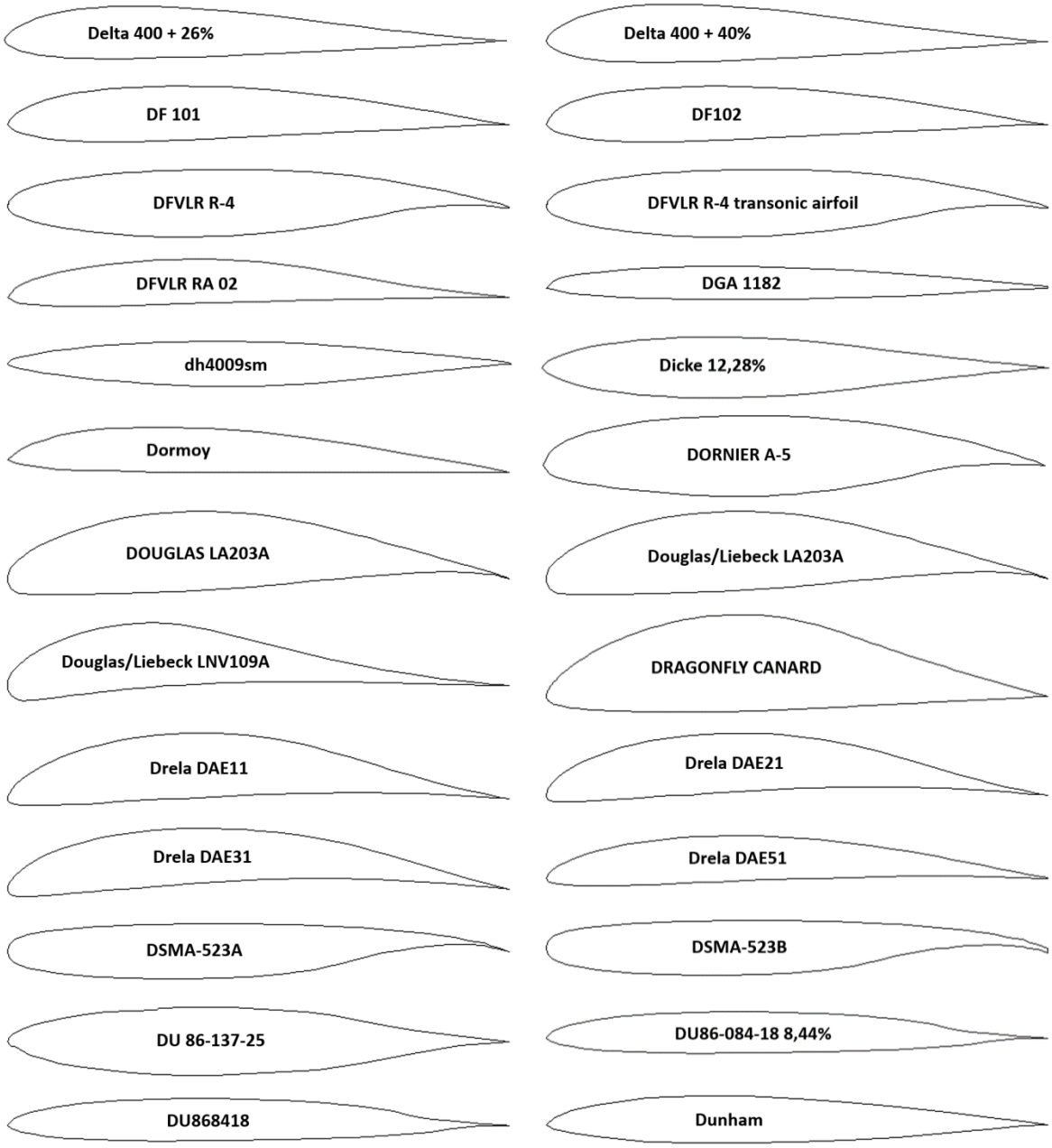
Airfoil name	Max. thickness	Max. camber	Leading edge radius	Trailing edge thickness
D6	7.4% at 20.0% of the chord	6.9% at 30.0% of the chord	0.9317%	0.2%
DA0101	5.3% at 30.0% of the chord	6.3% at 40.0% of the chord	1.2254%	0.0%
DA093017	9.2% at 30.0% of the chord	5.85% at 40.0% of the chord	0.8866%	0.0%
DA1002	10.5% at 30.0% of the chord	6.35% at 40.0% of the chord	1.0674%	0.0%
DA100B20	10.5% at 30.0% of the chord	6.35% at 40.0% of the chord	1.6056%	0.0%
DA93B17	9.2% at 30.0% of the chord	5.85% at 40.0% of the chord	0.8866%	0.0%
DAB76B17	9.17% at 30.0% of the chord	5.86% at 40.0% of the chord	0.8927%	0.0%
DAB80B20	10.46% at 30.0% of the chord	6.34% at 40.0% of the chord	1.0297%	0.0%
DAE-11	12.81% at 31.5% of the chord	6.62% at 44.4% of the chord	1.3641%	0.0%
DAE-21	11.78% at 31.8% of the chord	6.57% at 44.6% of the chord	1.8569%	0.0%
DAE-31	11.06% at 29.2% of the chord	6.75% at 45.1% of the chord	2.186%	0.0%
DAE-51	9.38% at 30.7% of the chord	4.02% at 43.3% of the chord	0.8406%	0.2%
DAN-MP	6.8% at 20.0% of the chord	7.25% at 40.0% of the chord	1.3239%	0.0%
David Fraser DF 101	10.99% at 29.8% of the chord	2.3% at 45.2% of the chord	0.874%	0.007%
David Fraser DF 102	10.99% at 29.8% of the chord	2.3% at 45.2% of the chord	0.9725%	0.007%
Davis	11.25% at 30.0% of the chord	3.69% at 40.0% of the chord	0.8876%	0.0%
DAVIS BASIC B-24 WING	15.89% at 27.9% of the chord	2.47% at 31.7% of the chord	1.9735%	0.0%
DAVIS-N	7.42% at 30.0% of the chord	5.85% at 50.0% of the chord	0.7303%	0.4%
davissm	5.87% at 30.6% of the chord	5.91% at 45.4% of the chord	0.6009%	1.178%
Dayton-Wright T-1	13.37% at 30.0% of the chord	7.06% at 40.0% of the chord	1.7369%	0.21%
dd928416	8.41% at 31.0% of the chord	1.55% at 36.0% of the chord	0.4303%	0.0%
DEFIANT CANARD BL110	14.73% at 28.6% of the chord	3.81% at 28.6% of the chord	1.0025%	0.0%
DEFIANT CANARD BL145	11.48% at 28.6% of the chord	2.38% at 28.6% of the chord	1.6191%	0.0%
DEFIANT CANARD BL20	20.92% at 28.6% of the chord	4.46% at 36.1% of the chord	3.0657%	0.0%
Delta 400	8.31% at 23.7% of the chord	1.6% at 27.9% of the chord	0.629%	0.0%
Delta 400 + 13%	9.39% at 23.7% of the chord	1.6% at 27.9% of the chord	0.7631%	0.0%
Delta 400 + 26%	10.47% at 23.7% of the chord	1.6% at 27.9% of the chord	0.9182%	0.0%
Delta 400 + 40%	11.64% at 23.7% of the chord	1.6% at 27.9% of the chord	1.1081%	0.0%
DF 101	10.99% at 29.8% of the chord	2.3% at 45.2% of the chord	0.874%	0.007%
DF102	10.99% at 29.8% of the chord	2.3% at 45.2% of the chord	0.9725%	0.007%
DFVLR R-4	13.38% at 38.1% of the chord	2.1% at 80.5% of the chord	1.205%	0.5099%
DFVLR R-4 transonic airfoil	13.38% at 38.1% of the chord	2.1% at 80.5% of the chord	1.2028%	0.51%
DFVLR RA 02	9.21% at 30.0% of the chord	3.16% at 40.0% of the chord	0.9713%	0.0%
DGA 1182	6.7% at 40.0% of the chord	1.0% at 30.0% of the chord	0.5247%	0.3%
dh4009sm	8.95% at 41.6% of the chord	0.2% at 9.6% of the chord	0.3752%	0.028%
Dicke 12,28%	12.25% at 32.4% of the chord	0.0% at 0.0% of the chord	0.7631%	0.0%
Dormoy	9.0% at 30.0% of the chord	4.54% at 20.0% of the chord	0.5718%	0.0%
DORNIER A-5	16.21% at 40.1% of the chord	2.54% at 78.0% of the chord	2.3431%	0.0%
DOUGLAS LA203A	15.73% at 34.3% of the chord	5.48% at 46.0% of the chord	3.0242%	0.0%
Douglas/Liebeck LA203A	15.73% at 34.3% of the chord	5.48% at 46.0% of the chord	3.0235%	0.0%
Douglas/Liebeck LNV109A	12.99% at 23.5% of the chord	5.97% at 31.5% of the chord	3.494%	0.0%
DRAGONFLY CANARD	19.34% at 37.4% of the chord	6.56% at 39.4% of the chord	1.399%	0.0%
Drela DAE11	12.81% at 31.5% of the chord	6.62% at 44.4% of the chord	1.3649%	0.0%
Drela DAE21	11.78% at 31.8% of the chord	6.57% at 44.6% of the chord	1.8593%	0.0%
Drela DAE31	11.06% at 29.2% of the chord	6.75% at 45.1% of the chord	2.1875%	0.0%
Drela DAE51	9.38% at 30.7% of the chord	4.02% at 43.3% of the chord	0.8408%	0.2%
DSMA-523A	11.0% at 36.0% of the chord	2.3% at 82.0% of the chord	2.4138%	-0.019%
DSMA-523B	11.0% at 36.0% of the chord	2.04% at 82.0% of the chord	2.4138%	1.0417%
DU 86-137-25	13.65% at 41.2% of the chord	0.28% at 1.4% of the chord	0.8062%	0.0%
DU86-084-18 8,44%	8.45% at 35.1% of the chord	1.12% at 44.4% of the chord	0.4786%	0.0%

DU868418	8.61% at 35.8% of the chord	1.14% at 45.2% of the chord	0.3825%	0.119%
Dunham	9.6% at 30.0% of the chord	1.0% at 30.0% of the chord	0.8799%	0.0%

Note:
David Fraser DF 101 (Low Reynolds number airfoil (Soartech 8));
David Fraser DF 102 (Low Reynolds number airfoil);
Dayton-Wright T-1 (W. Wright (USA));
DFVLR RA 02 (Germany);
DGA 1182 (Italy);
Dormoy (J. Dormoy (Great Britain));
Douglas/Liebeck LA203A, Douglas/Liebeck LNV109A (High lift airfoil);
Drela DAE11, Drela DAE21, Drela DAE31, Drela DAE51 (Low Reynolds number airfoil);
Dunham (B. Dunham (USA)).

Table 2. The geometric shapes of the airfoils in the cross section.





Results and discussion

The calculated pressure contours on the surfaces of the airfoils at the different angles of attack are presented in the Figs. 1-52.

The calculated magnitudes on the scale can be represented as the basic magnitudes when comparing the pressure drop under conditions of changing the angle of attack of the airfoils.

The presented range of the airfoils is characterized by curvature and asymmetry of the geometric shapes. There are modifications that differ by changing the size of the leading edge radius and the trailing edge thickness.

Air flows around the DF 101 airfoil in the horizontal position is accompanied by pressure of 7.22 kPa at the leading edge, which is the greatest pressure compared to the other airfoils experiencing loads under similar flight conditions. Thus, the drag on the leading edge of the DF 101 airfoil is 5-14% greater than that of the other airfoils.

The greatest difference of negative and positive pressures (18 times) between the upper and lower surfaces was determined for the DA0101 airfoil at the angle of attack of 15 degrees. This indicates the large lift of the airfoil. The smallest difference of negative and positive pressures (1.5 times) between the upper and lower surfaces was determined for the same airfoil at the angle of attack of -15 degrees.

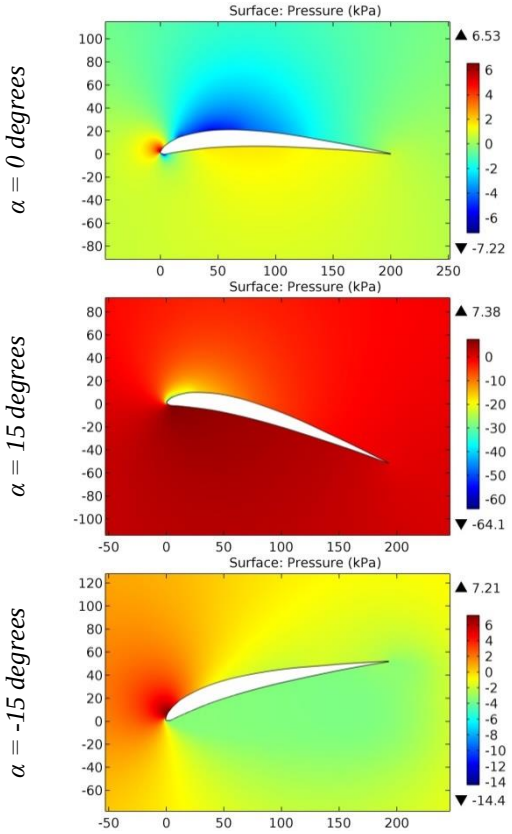


Figure 1. The pressure contours on the surfaces of the D6 airfoil.

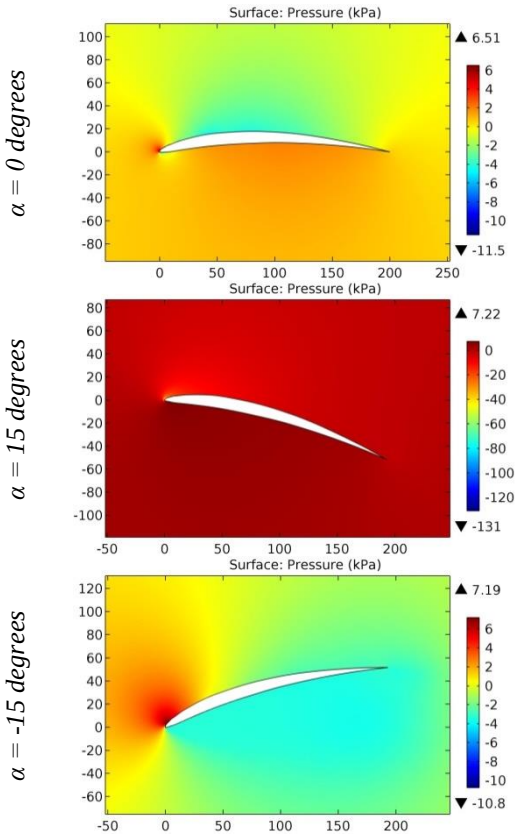


Figure 2. The pressure contours on the surfaces of the DA0101 airfoil.

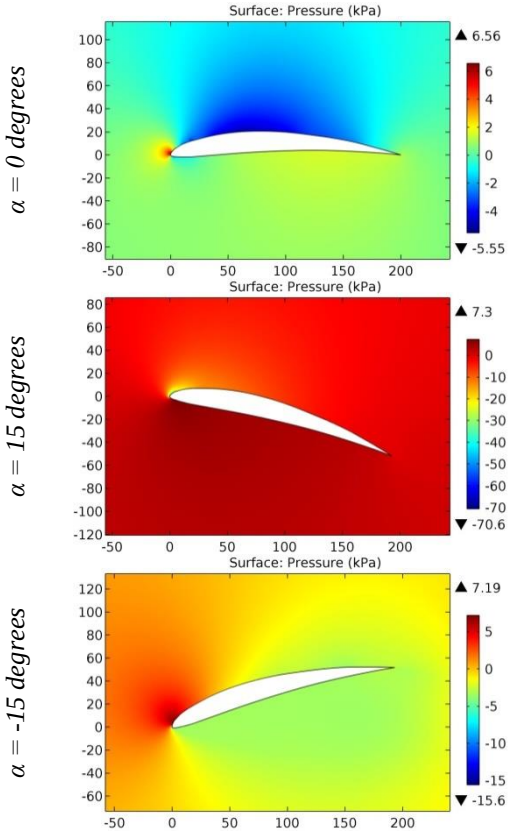


Figure 3. The pressure contours on the surfaces of the DA093017 airfoil.

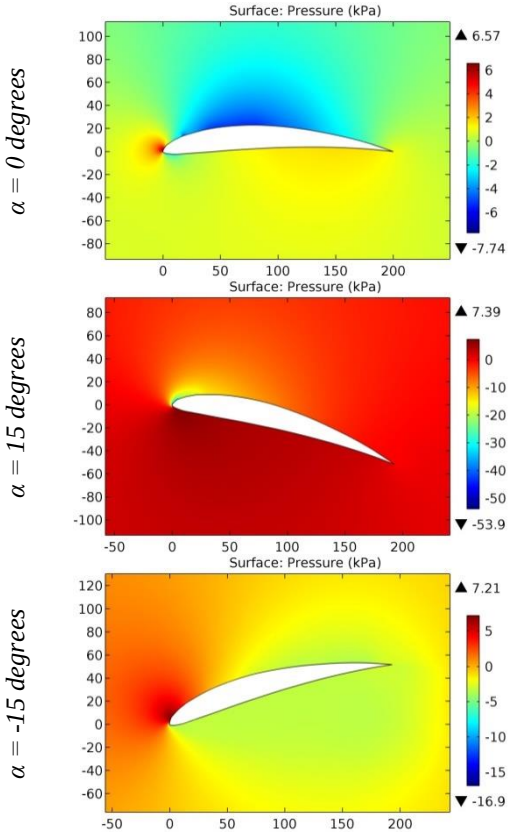


Figure 4. The pressure contours on the surfaces of the DA1002 airfoil.

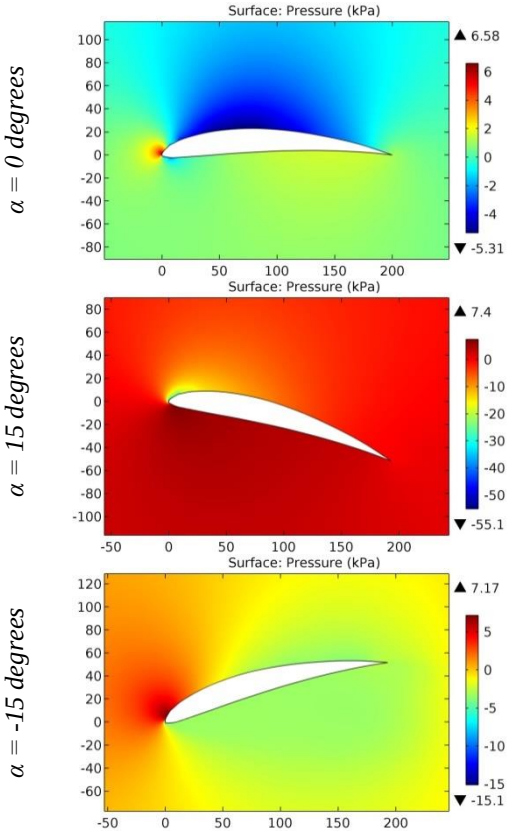


Figure 5. The pressure contours on the surfaces of the DA100B20 airfoil.

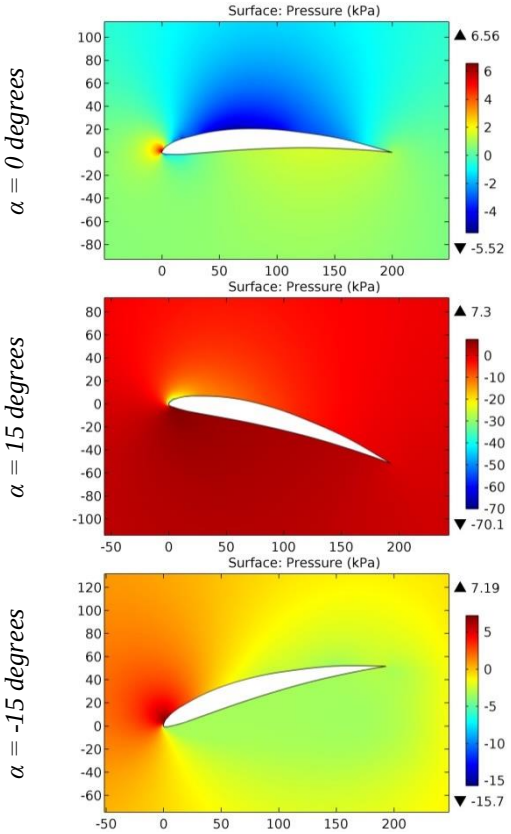


Figure 6. The pressure contours on the surfaces of the DA93B17 airfoil.

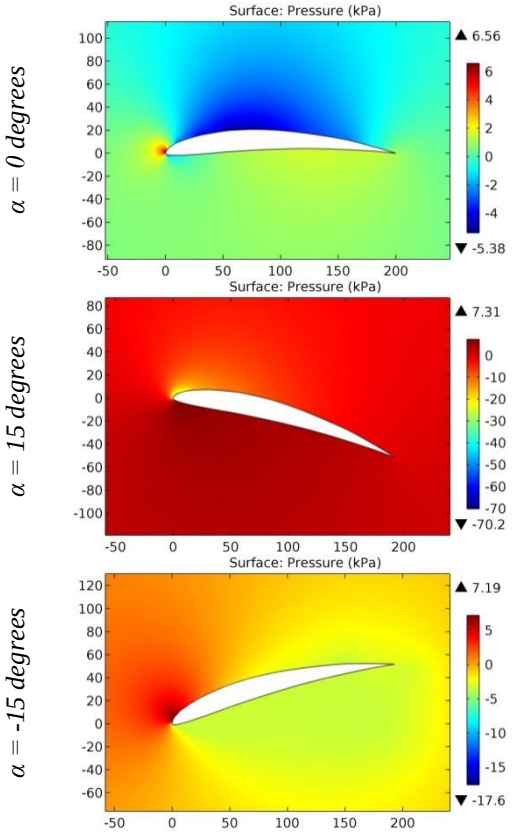


Figure 7. The pressure contours on the surfaces of the DAB76B17 airfoil.

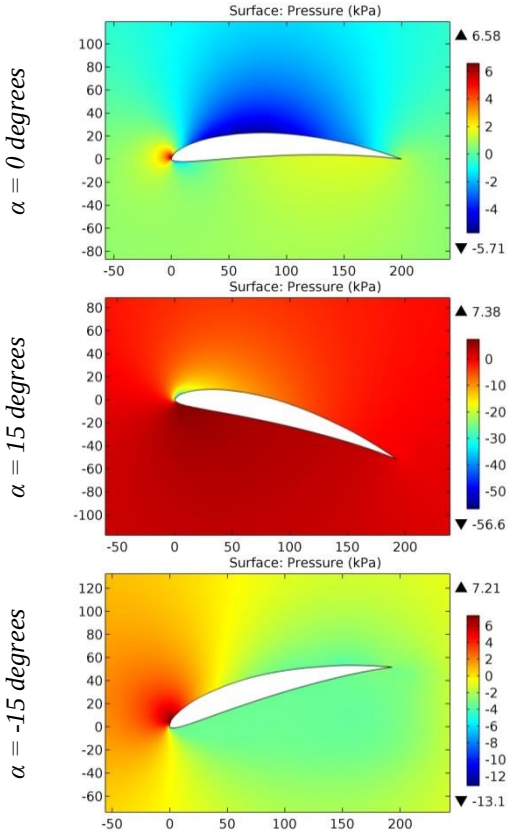


Figure 8. The pressure contours on the surfaces of the DAB80B20 airfoil.

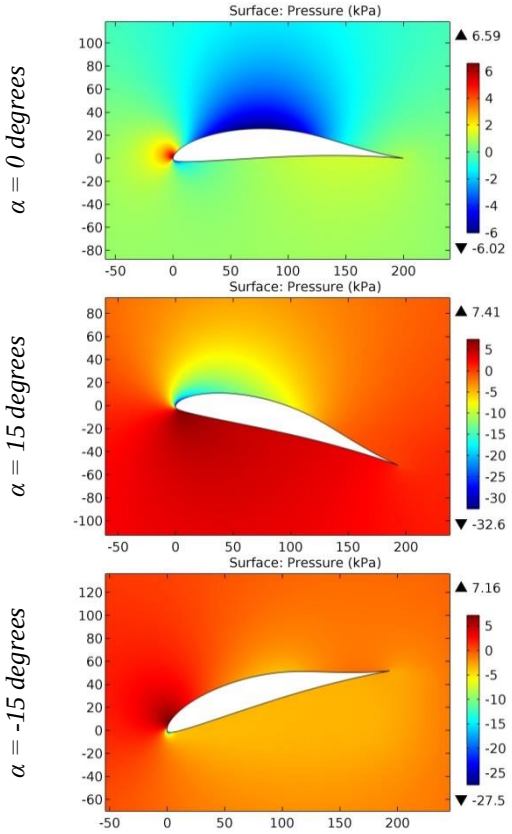


Figure 9. The pressure contours on the surfaces of the DAE-11 airfoil.

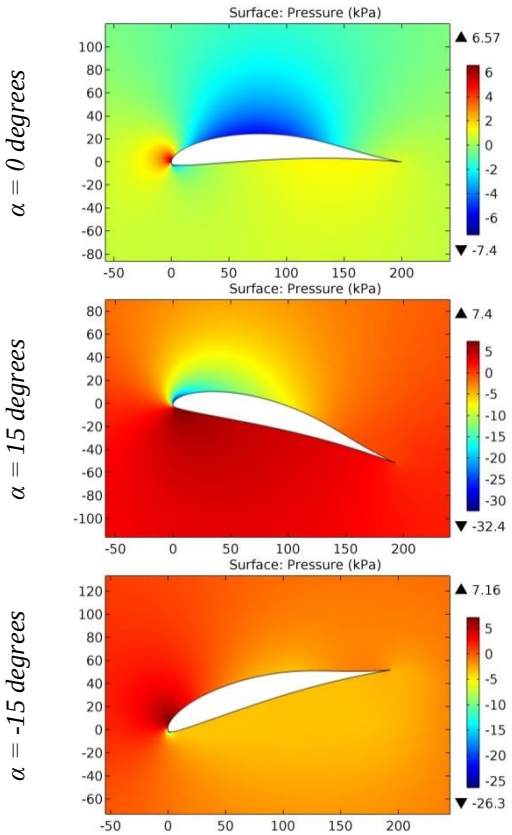


Figure 10. The pressure contours on the surfaces of the DAE-21 airfoil.

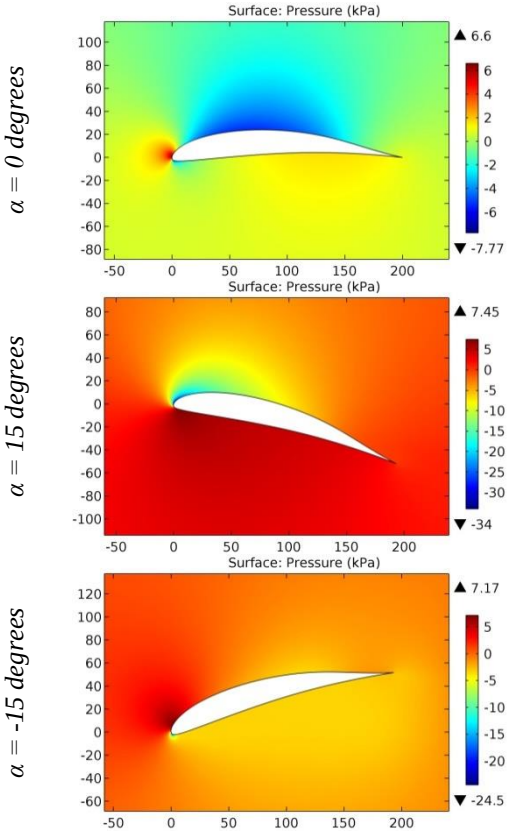


Figure 11. The pressure contours on the surfaces of the DAE-31 airfoil.

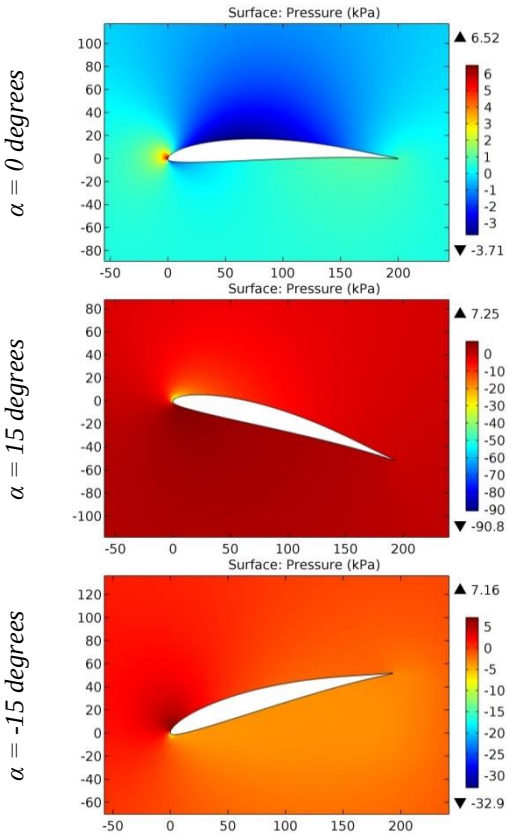


Figure 12. The pressure contours on the surfaces of the DAE-51 airfoil.

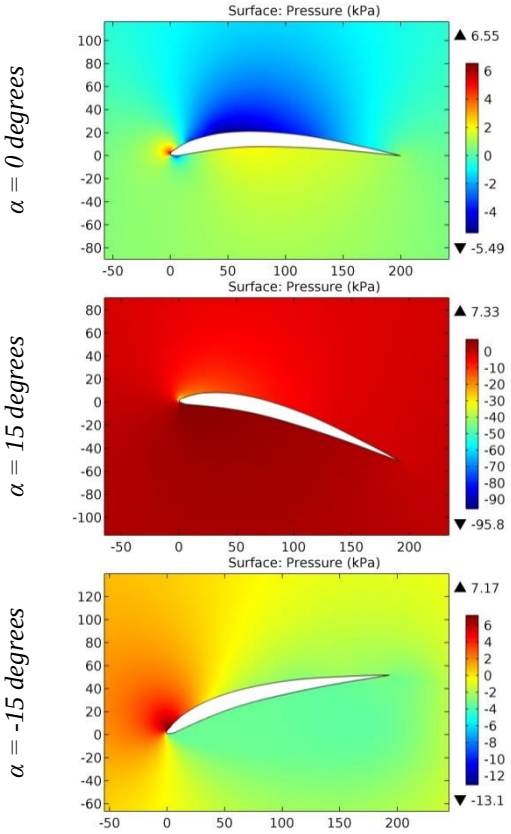


Figure 13. The pressure contours on the surfaces of the DAN-MP airfoil.

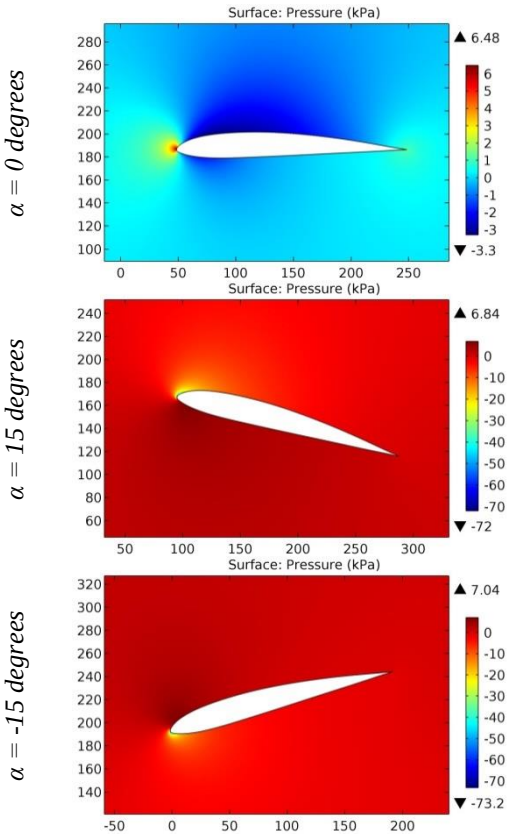


Figure 14. The pressure contours on the surfaces of the David Fraser DF 101 airfoil.

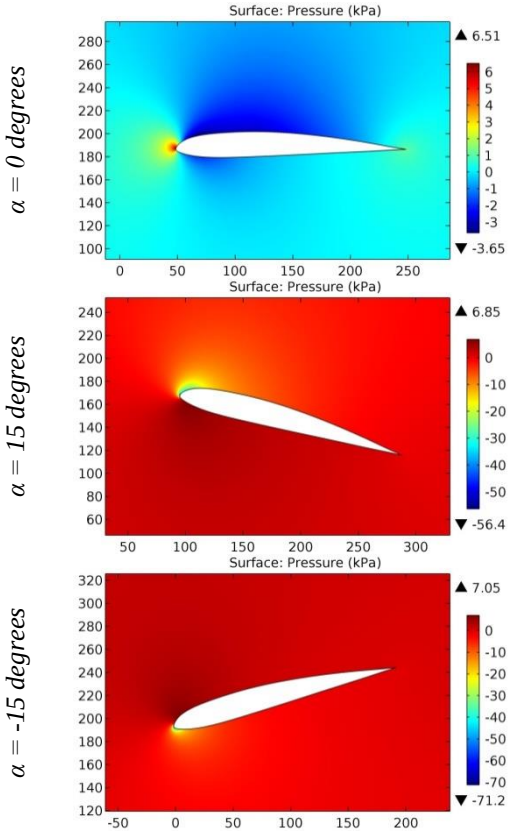


Figure 15. The pressure contours on the surfaces of the David Fraser DF 102 airfoil.

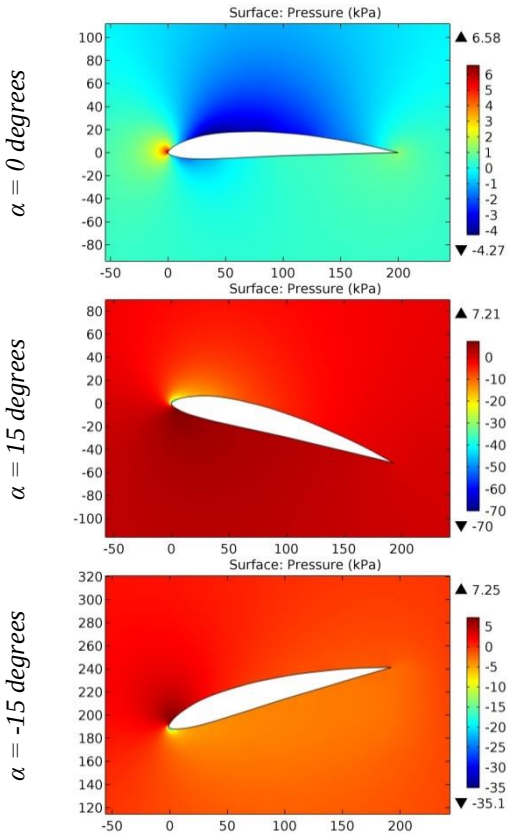


Figure 16. The pressure contours on the surfaces of the Davis airfoil.

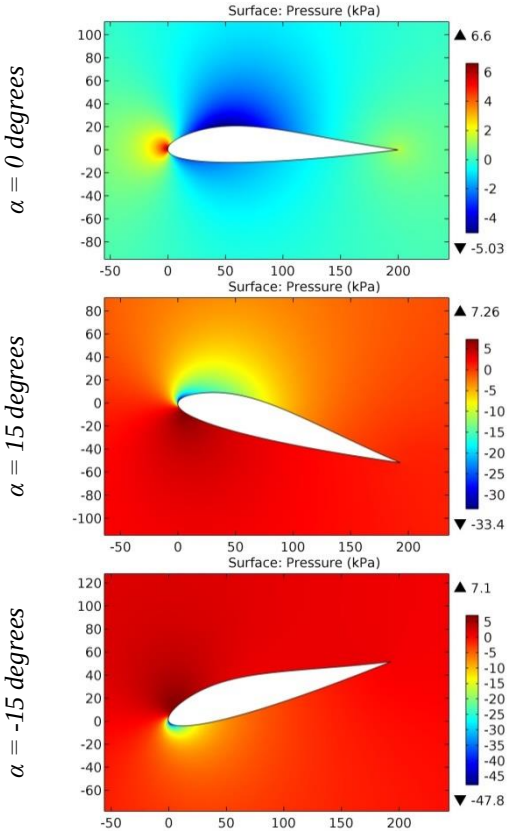


Figure 17. The pressure contours on the surfaces of the DAVIS BASIC B-24 WING airfoil.

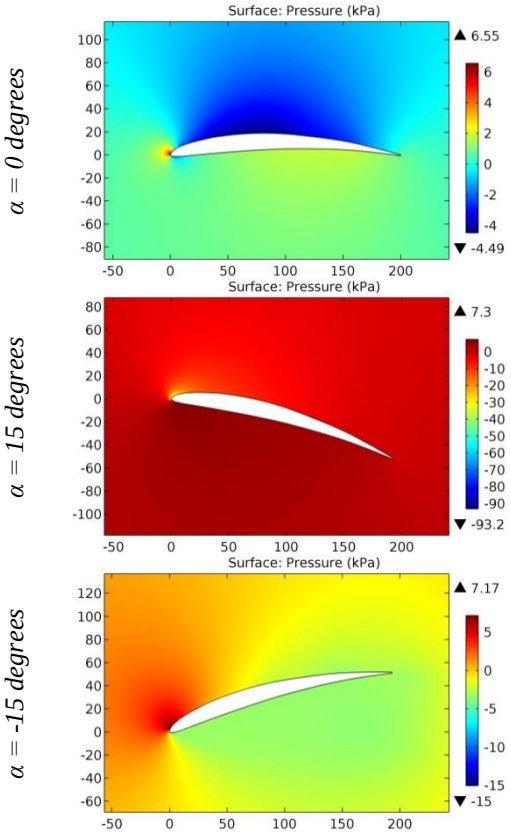


Figure 18. The pressure contours on the surfaces of the DAVIS-N airfoil.

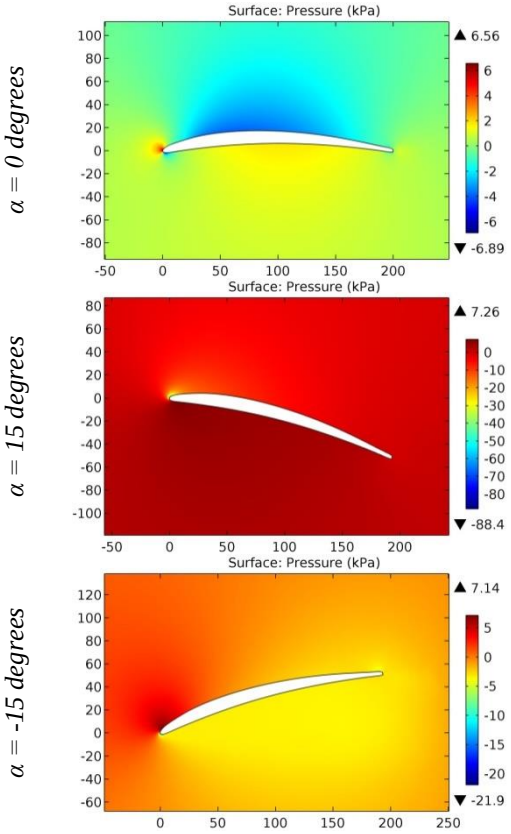


Figure 19. The pressure contours on the surfaces of the davissm airfoil.

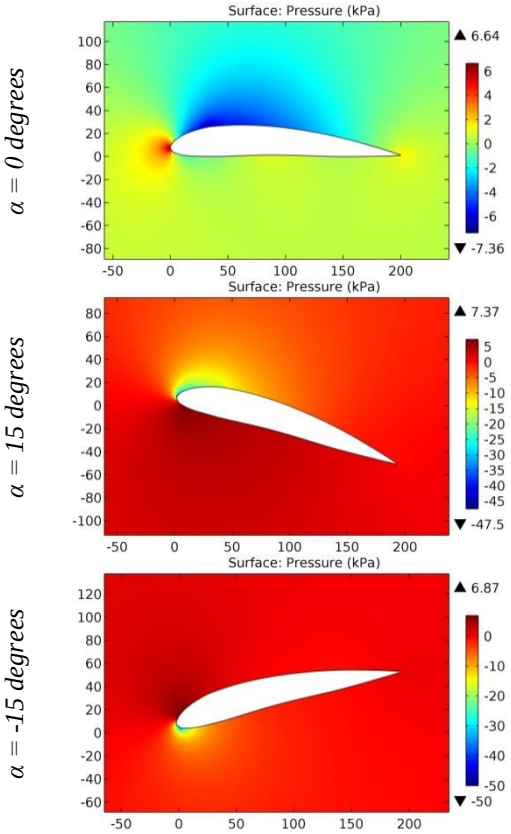


Figure 20. The pressure contours on the surfaces of the Dayton-Wright T-1 airfoil.

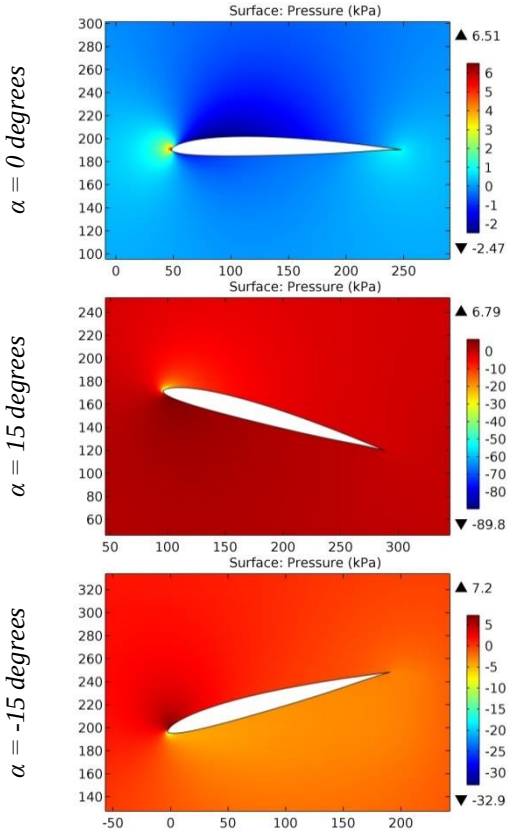


Figure 21. The pressure contours on the surfaces of the dd928416 airfoil.

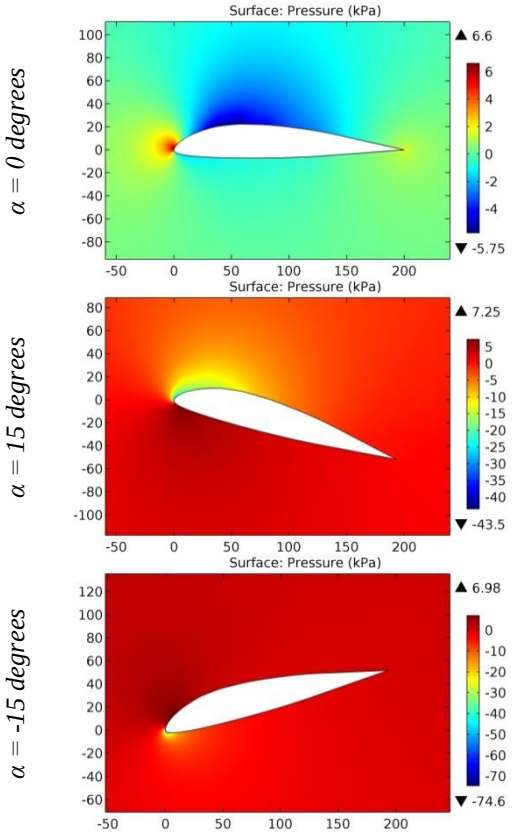


Figure 22. The pressure contours on the surfaces of the DEFIANT CANARD BL110 airfoil.

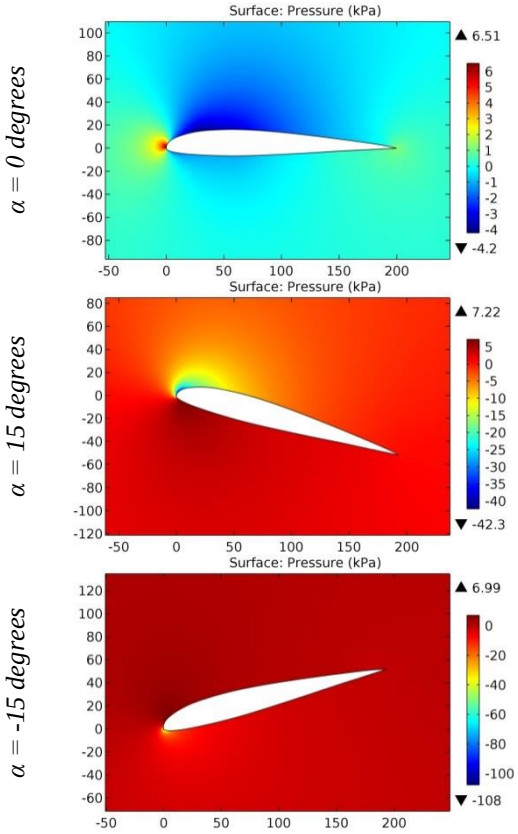


Figure 23. The pressure contours on the surfaces of the DEFIANT CANARD BL145 airfoil.

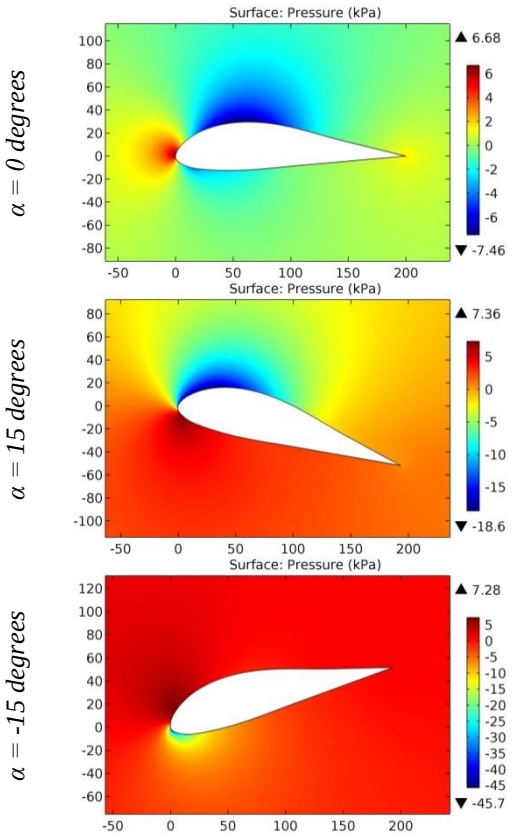


Figure 24. The pressure contours on the surfaces of the DEFIANT CANARD BL20 airfoil.

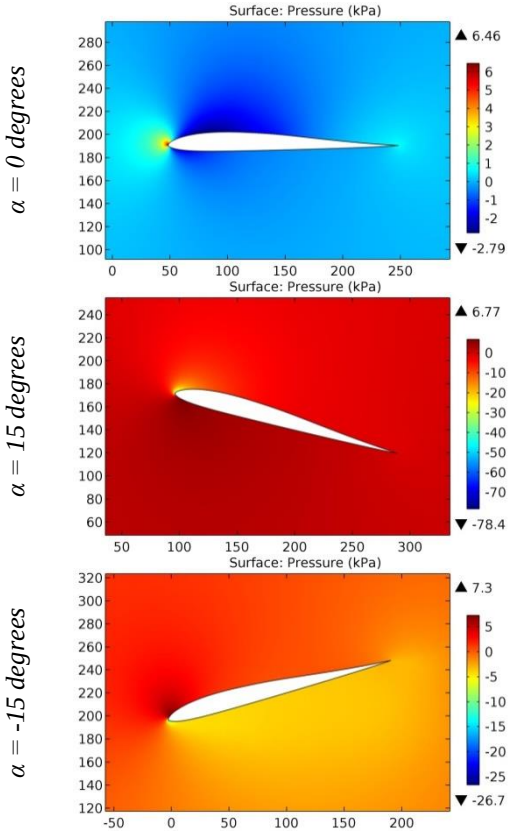


Figure 25. The pressure contours on the surfaces of the Delta 400 airfoil.

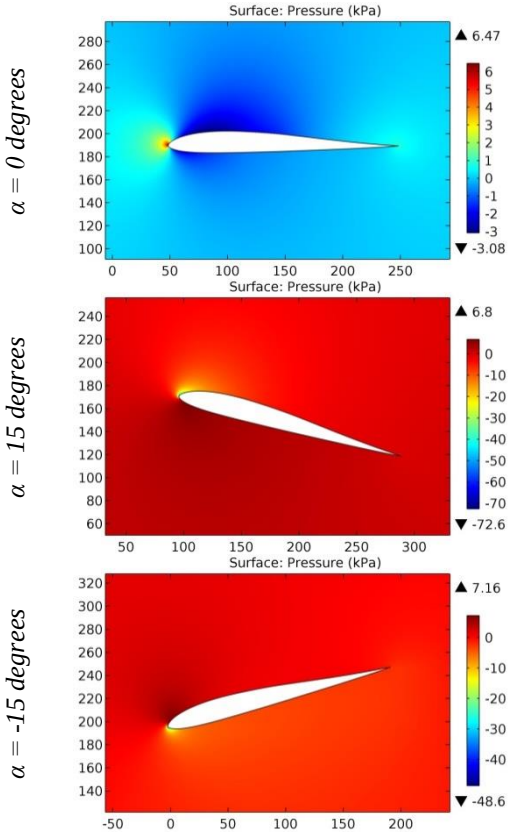


Figure 26. The pressure contours on the surfaces of the Delta 400 + 13% airfoil.

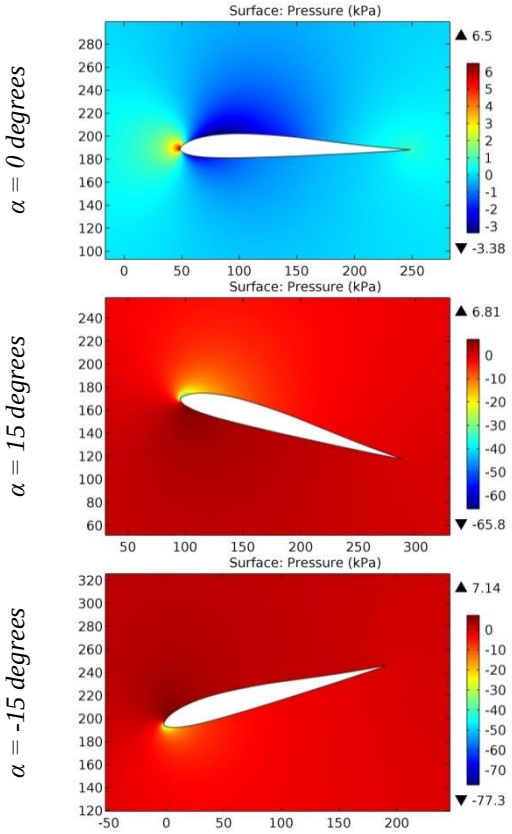


Figure 27. The pressure contours on the surfaces of the Delta 400 + 26% airfoil.

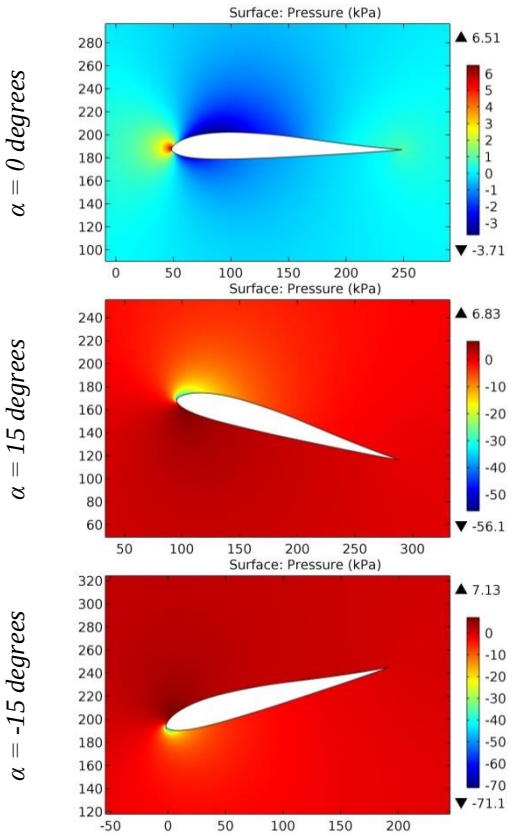


Figure 28. The pressure contours on the surfaces of the Delta 400 + 40% airfoil.

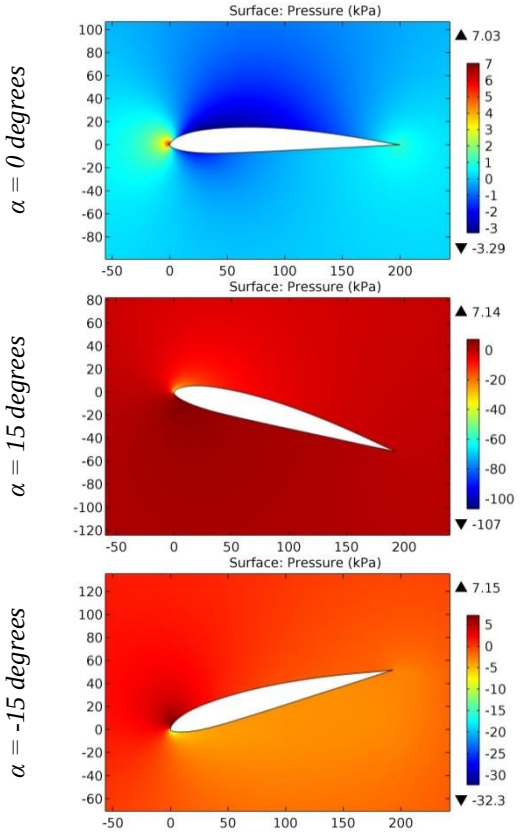


Figure 29. The pressure contours on the surfaces of the DF 101 airfoil.

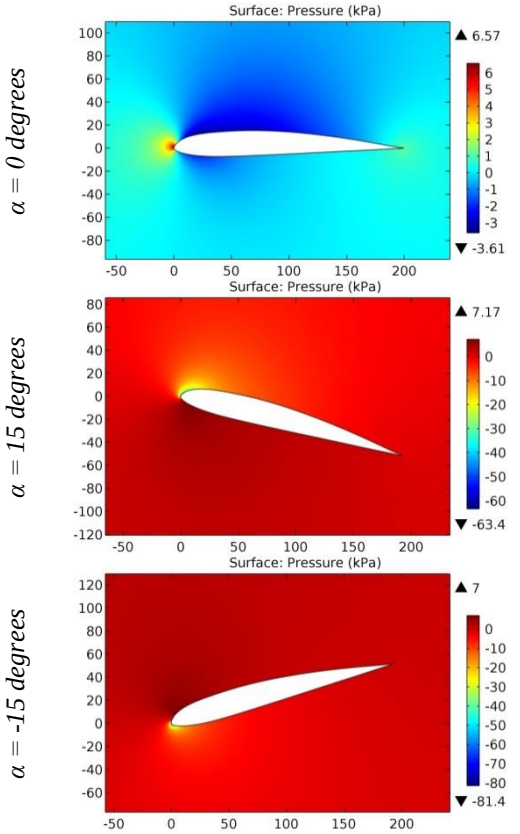


Figure 30. The pressure contours on the surfaces of the DF102 airfoil.

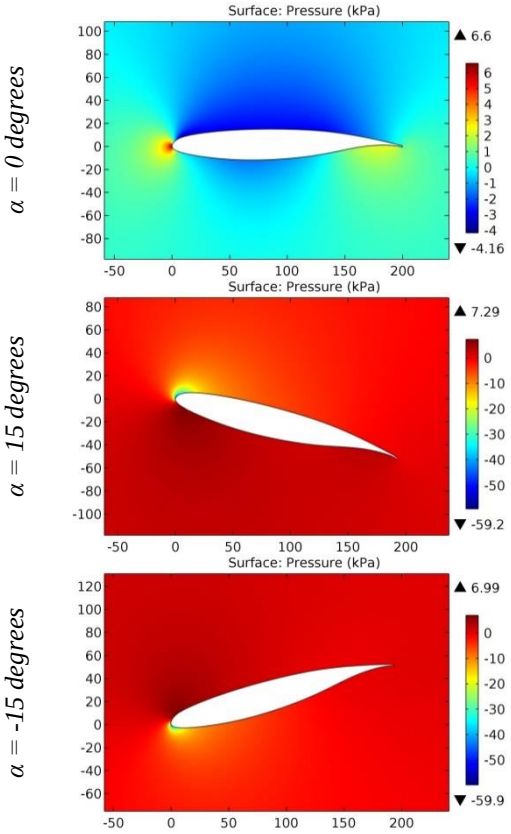


Figure 31. The pressure contours on the surfaces of the DFVLR R-4 airfoil.

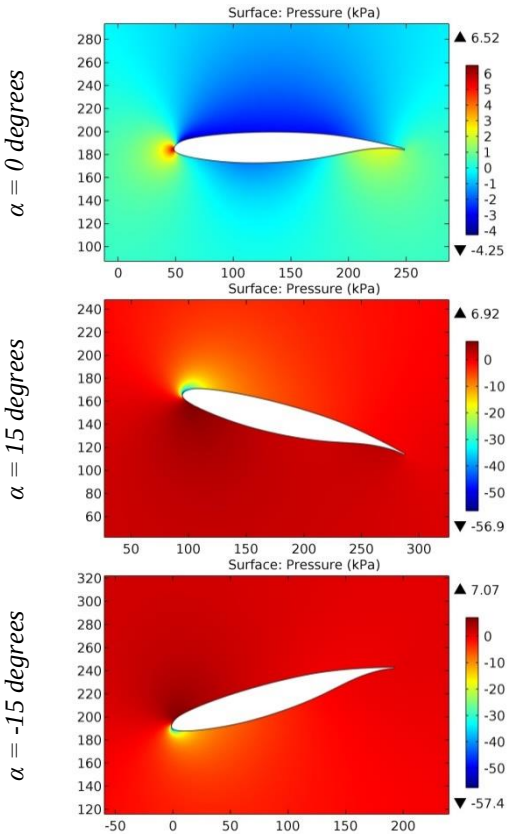


Figure 32. The pressure contours on the surfaces of the DFVLR R-4 transonic airfoil.

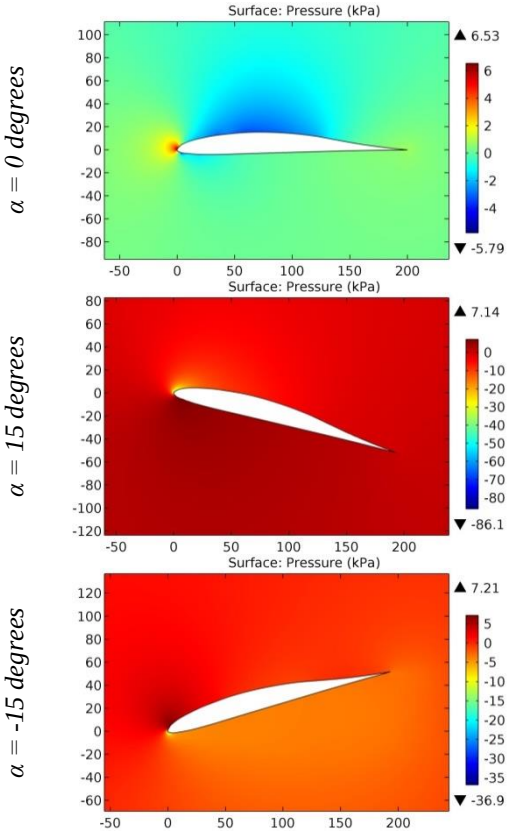


Figure 33. The pressure contours on the surfaces of the DFVLR RA 02 airfoil.

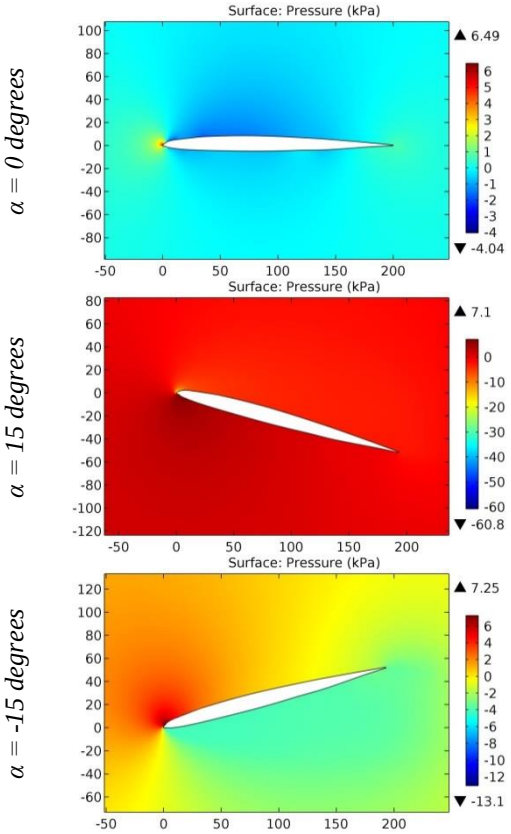


Figure 34. The pressure contours on the surfaces of the DGA 1182 airfoil.

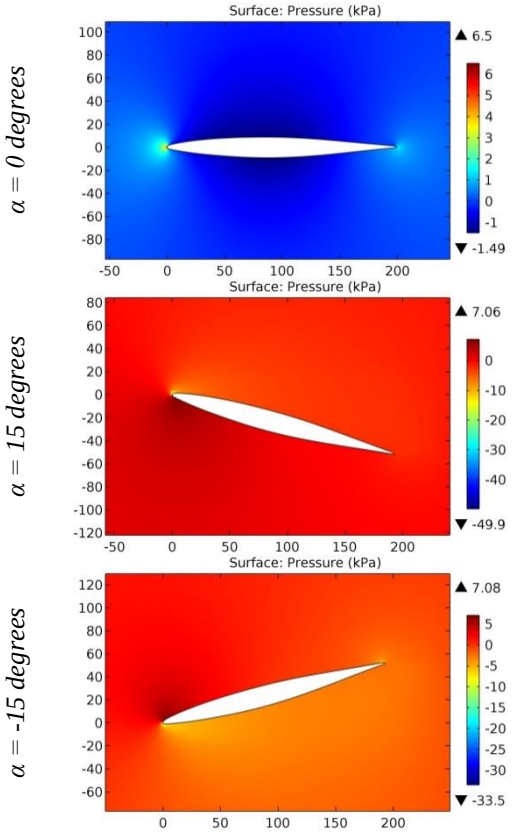


Figure 35. The pressure contours on the surfaces of the dh4009sm airfoil.

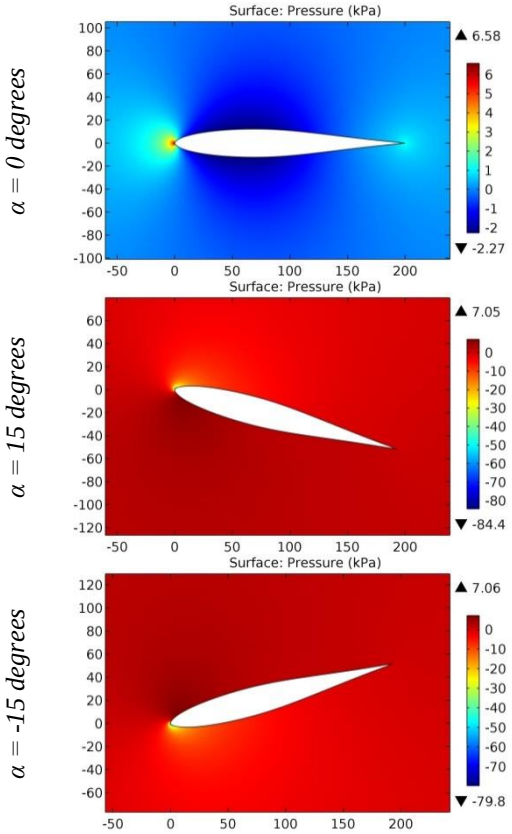


Figure 36. The pressure contours on the surfaces of the Dicke 12,28% airfoil.

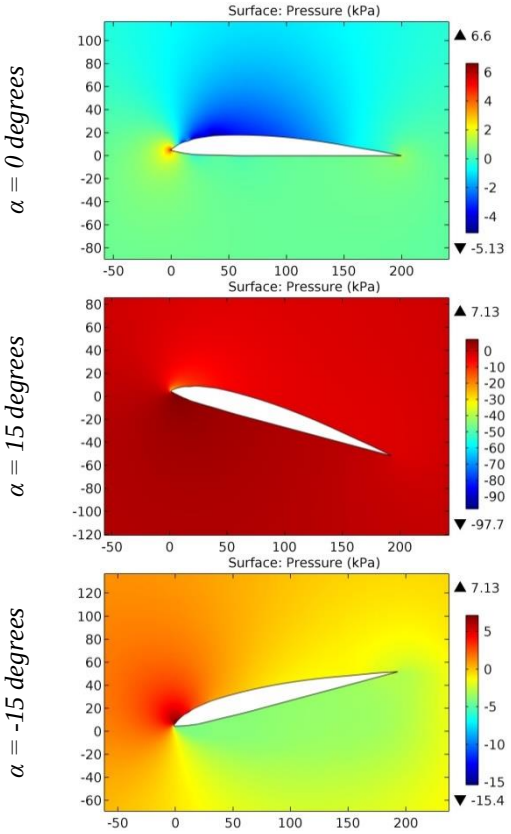


Figure 37. The pressure contours on the surfaces of the Dormoy airfoil.

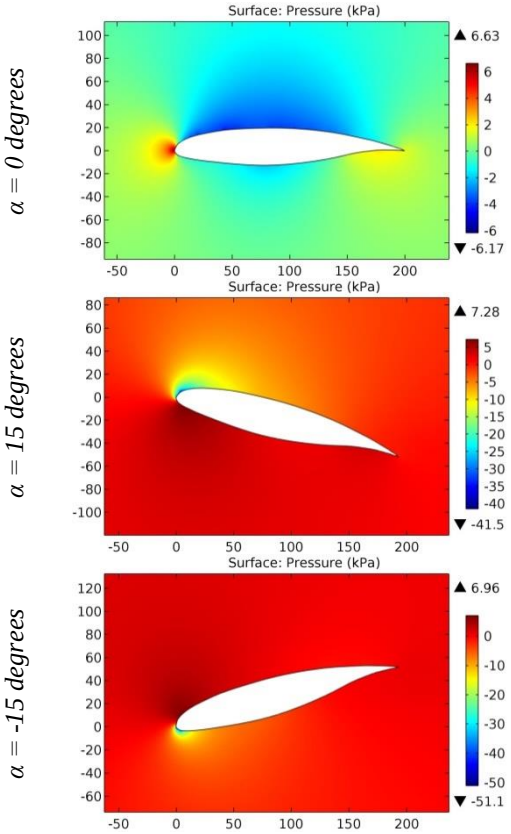


Figure 38. The pressure contours on the surfaces of the DORNIER A-5 airfoil.

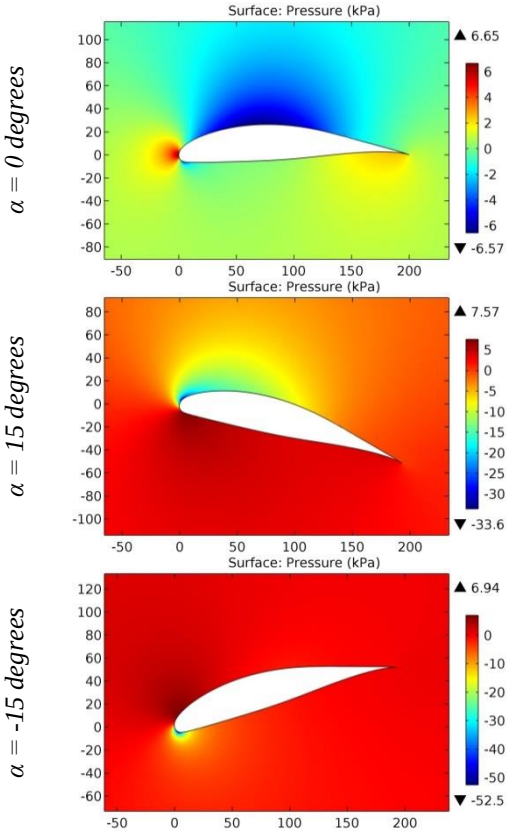


Figure 39. The pressure contours on the surfaces of the DOUGLAS LA203A airfoil.

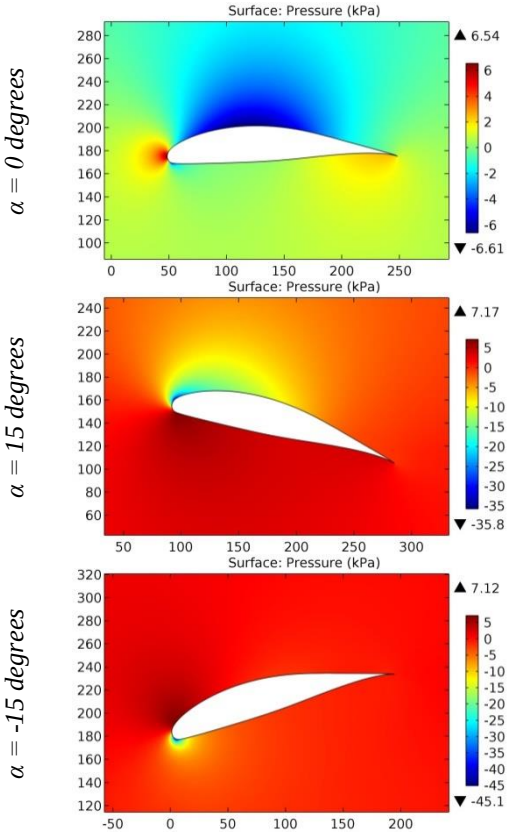


Figure 40. The pressure contours on the surfaces of the Douglas/Liebeck LA203A airfoil.

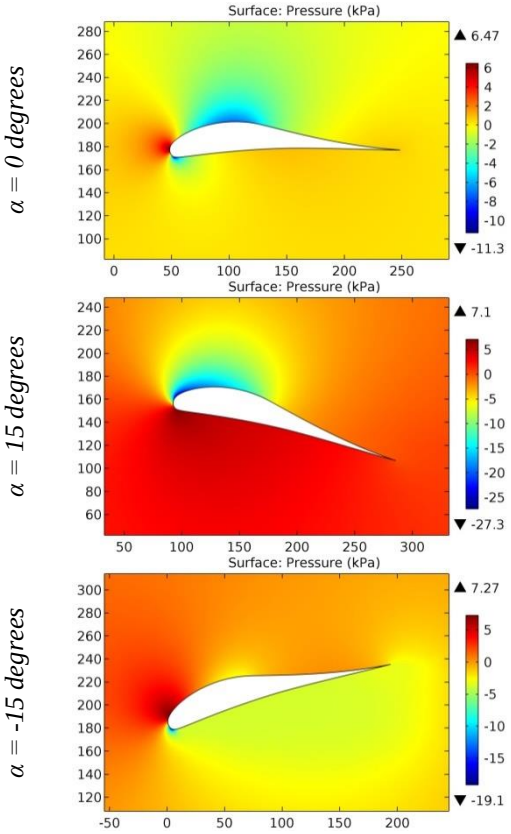


Figure 41. The pressure contours on the surfaces of the Douglas/Liebeck LNV109A airfoil.

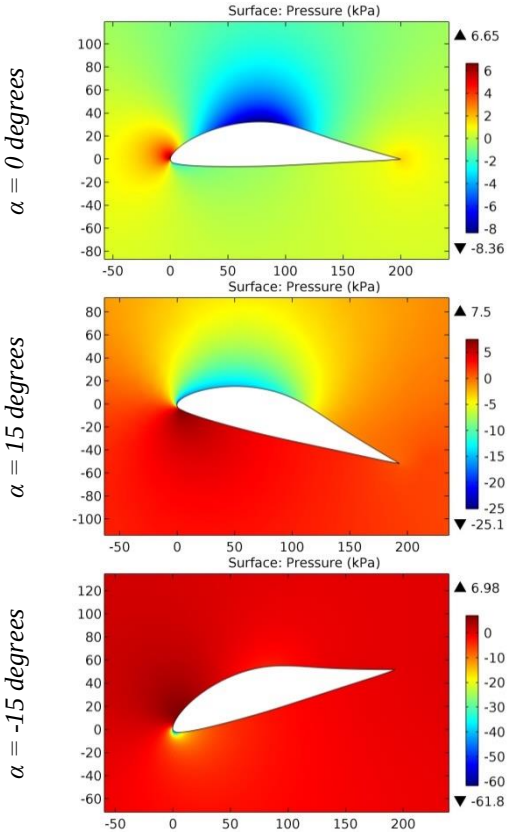


Figure 42. The pressure contours on the surfaces of the DRAGONFLY CANARD airfoil.

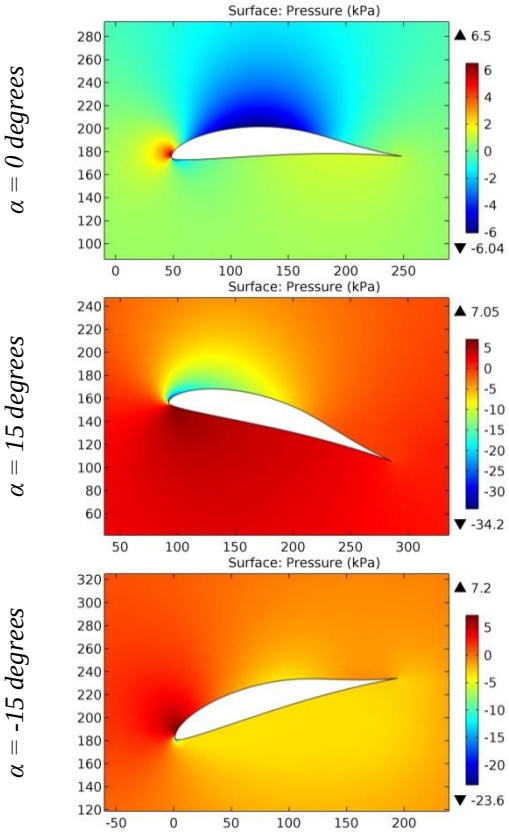


Figure 43. The pressure contours on the surfaces of the Drela DAE11 airfoil.

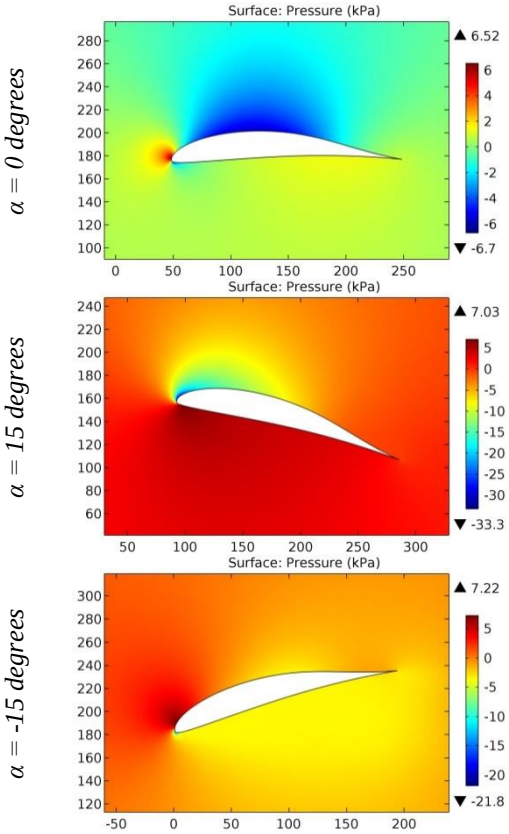


Figure 44. The pressure contours on the surfaces of the Drela DAE21 airfoil.

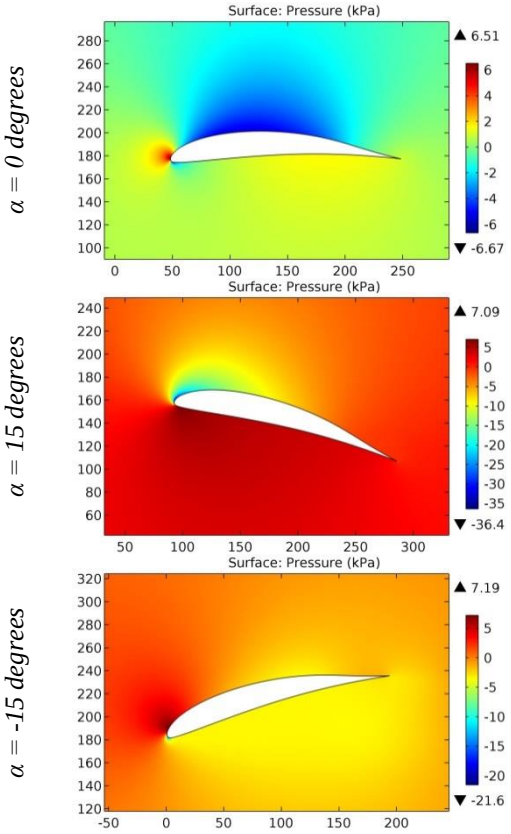


Figure 45. The pressure contours on the surfaces of the Drela DAE31 airfoil.

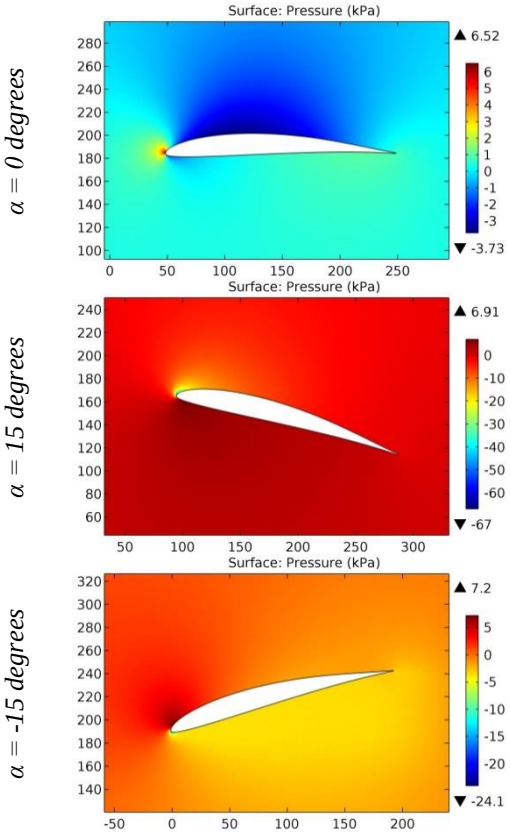


Figure 46. The pressure contours on the surfaces of the Drela DAE51 airfoil.

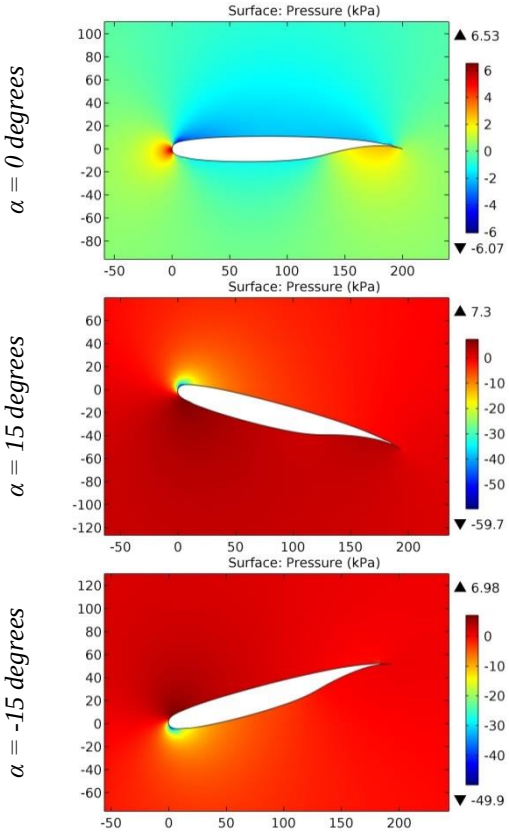


Figure 47. The pressure contours on the surfaces of the DSMA-523A airfoil.

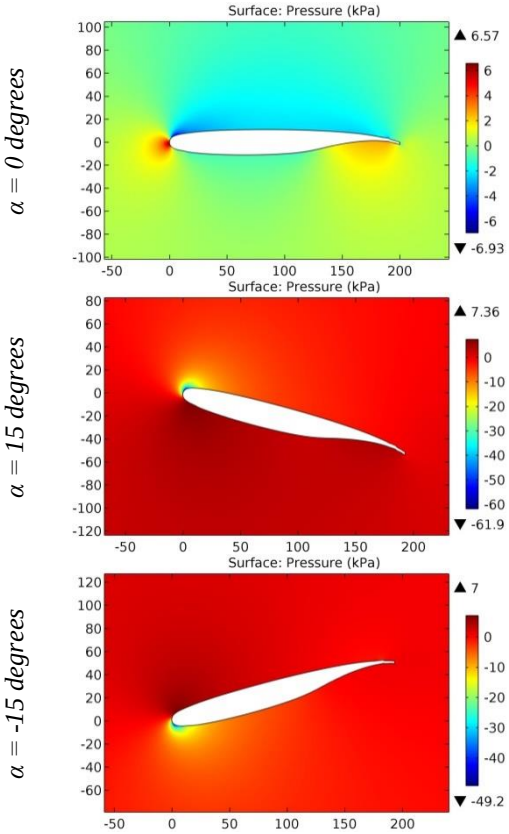


Figure 48. The pressure contours on the surfaces of the DSMA-523B airfoil.

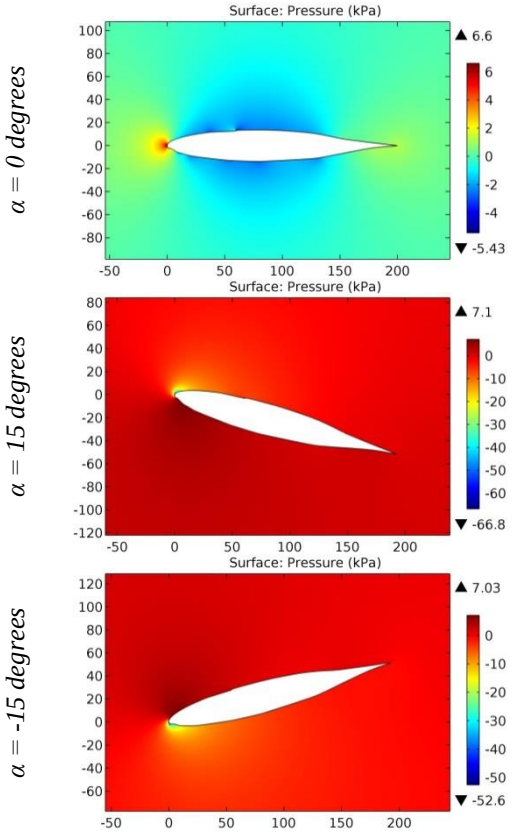


Figure 49. The pressure contours on the surfaces of the DU 86-137-25 airfoil.

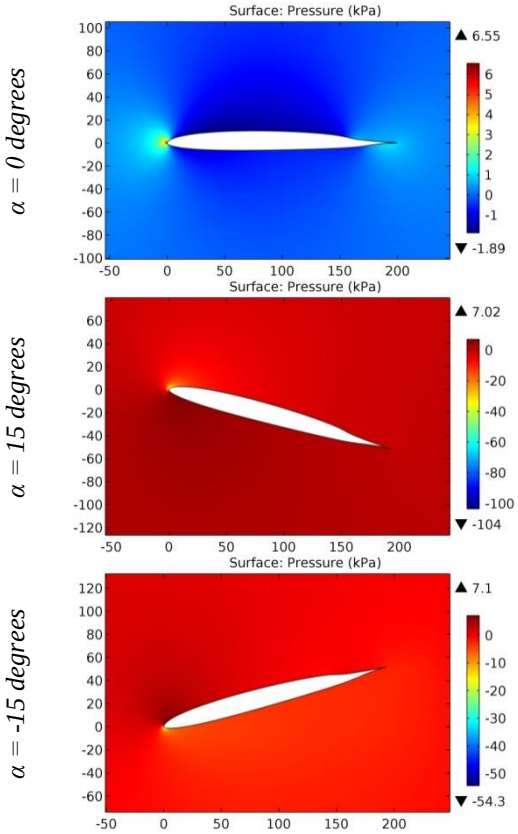


Figure 50. The pressure contours on the surfaces of the DU86-084-18 8,44% airfoil.

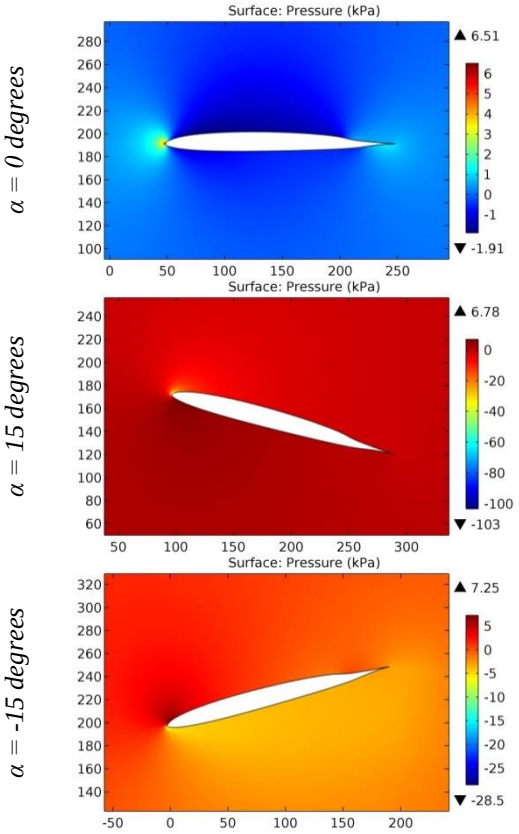


Figure 51. The pressure contours on the surfaces of the DU868418 airfoil.

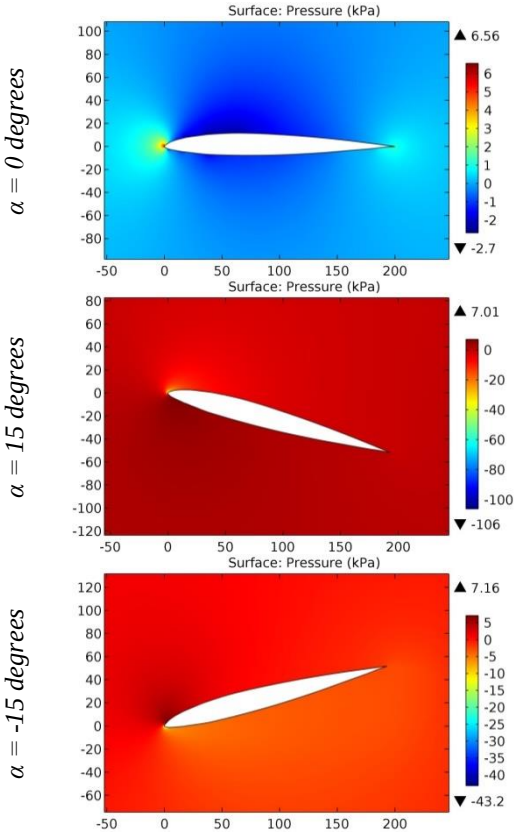


Figure 52. The pressure contours on the surfaces of the Dunham airfoil.

The maximum increase in pressure on the surfaces occurs at the angle of attack of -15 degrees for some airfoils (David Fraser DF 101, David Fraser DF 102, DAVIS BASIC B-24 WING, Dayton-Wright T-1, DEFIANT CANARD BL110, DEFIANT CANARD BL145, DEFIANT CANARD BL20, Delta 400 + 26%, Delta 400 + 40%, DF102, DFVLR R-4, DFVLR R-4 transonic airfoil, DORNIER A-5, DOUGLAS LA203A, Douglas/Liebeck LA203A, DRAGONFLY CANARD). The maximum increase in pressure on the surfaces occurs at the angle of attack of 15 degrees for the remaining airfoils.

Conclusion

The greatest drag occurs at the leading edge of the DF 101 asymmetric airfoil in conditions of horizontal flight of the airplane. This is facilitated by the less rounded leading edge. The large lift develops during the climb by the airplane having the wing with the DA0101 airfoil. However, the airplane's descent with the same airfoil leads to a reduction in the lift by more than 10 times.

References:

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MATHEMATICAL MODELING OF MAGNETO-ELASTIC VIBRATIONS OF AN ANNULAR PLATE IN A MAGNETIC FIELD

Abstract: *The stress state of a flexible annular plate is analyzed in the article under the action of a time-variable mechanical force and a time-variable external electric current, taking into account mechanical and electromagnetic anisotropy.*

Key words: *plate, magnetic field, magneto elasticity.*

Language: *English*

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Introduction

In recent decades, considerable attention in the literature has been paid to the study of the deformation process of electrically conductive bodies placed in an external constant magnetic field under the influence of power, thermal and electromagnetic loads [1,2,3,4,5,6, 7,8,9,10,11,12,13,14,15,16,17,18,19].

Interest in research in this area is associated with the importance of a quantitative study and assessment of the relationship effects observed between mechanical, thermal and electromagnetic processes and their practical application in various fields of modern technology in the development of new technologies, and in the field of microelectronics, modern measuring systems, etc. Modern technology places great demands on structural elements exposed to fields of various natures. This circumstance leads to the need to create new calculation methods that fully and adequately take into account the properties of real materials and the processes occurring in them.

That is why in recent years, nonstationary dynamic problems of electroelasticity and electromagneto-elasticity have attracted the attention of researchers. At the same time, if in electro-elasticity, a relatively large number of completed results are currently known (for both static and dynamic problems), then in electro-magneto-elasticity, the number of such studies is limited. At present, the least studied are the problems of nonstationary dynamics of elastic conducting bodies under the action of mechanical and electromagnetic fields.

I. STATEMENT OF THE PROBLEM. THE EQUATIONS OF MAGNETOELASTICITY.

Let us assume that an electrically conductive body is in a magnetic field formed both by an electric current in the body itself (internal magnetic field) and by a source located at a distance from the body (external magnetic field). The body has finite electrical conductivity and does not possess the property of spontaneous polarization and magnetization. We also assume that, in the general case, surface currents and external charges are absent.

Let us present the equations of magnetoelasticity for similar bodies in the Euler coordinates [2]:

equations of motion:

$$\frac{\partial t_{ki}}{\partial x_k} + \rho\left(F_i + F_i^{\wedge}\right) = \rho\frac{dV_i}{dt}, \qquad (1)$$

$$\rho F_i^{\wedge} = \varepsilon_{ilm} J_l B_m + \rho_e E_i, \qquad (2)$$

Maxwell's equations:

$$\varepsilon_{ijk}\frac{\partial H_k}{\partial x_j} = J_i + \frac{\partial D_i}{\partial t}, \ \frac{\partial B_i}{\partial x_i} = 0, \qquad (3)$$

$$\varepsilon_{ijk}\frac{\partial E_k}{\partial x_j}=-\frac{\partial B_i}{\partial t},\frac{\partial D_i}{\partial x_i}=\rho_e. \quad (4)$$

The following designations are introduced in relations (1)-(4): t_{ij} - components of the tensor of internal stresses; ρF_i - components of the vector of volumetric mechanical forces; $\rho F_i^{\wedge}$ - components of the vector of Lorentz volumetric forces; E_k, D_k, H_k, B_k, J_k - components of the vectors of the intensity and induction of the electric field, the intensity and induction of the magnetic field, respectively; $J_k = J_k^* + \rho_e V_k$ - components of the density vector of total current; J_k^* - conduction current density; $\rho_e V_k$ - convective current density; ρ_e - the density of electric charges; ρ - the density of the substance in its current state; V_k - components of the velocity vector; $\frac{d}{dt}=\frac{\partial}{\partial t}+V_k\frac{\partial}{\partial x_k}$ - total time derivative.

We assume that the geometric and mechanical characteristics of the body are such that a version of the geometrically nonlinear theory of thin plates in the quadratic approximation is applicable to describe the deformation process.

For the considered case of quadratic nonlinearity [1, 3, 4], we assume that deformations and shears are small in comparison with the angles of rotation of the element, and the angles themselves are substantially less than unity.

We also assume that electromagnetic hypotheses are fulfilled with respect to the electric field strength $\vec{E}$ and the magnetic field strength $\vec{H}$ [1].

The elastic properties of the material correspond to an anisotropic body, the main directions, the elasticity of which coincide with the directions of the corresponding coordinate lines. The electro-magnetic properties of the material are characterized by tensors of electrical conductivity σ_{ij}, magnetic permeability μ_{ij}, dielectric constant ε_{ij} $(i,j=1,2,3)$.

The system of equations of magnetoelasticity must be closed by relations connecting the vectors of intensity and induction of the electromagnetic field and by Ohm's law, which determines the density of current conductivity in a moving medium. If an anisotropic body is linear with respect to the magnetic and electrical properties, then the governing equations for the electromagnetic characteristics of the field and the kinematic equation for electrical conductivity, as well as expressions for the Lorentz forces, taking into account the external current in the Lagrange variables, is written, respectively, in the following form [2, 11]:

$$\vec{B}=\mu_{ij}\vec{H},\ \vec{D}=\varepsilon_{ij}\vec{E}, \quad (3)$$

$$\vec{J}=\sigma_{ij}\,\Gamma F^T F^{-1}\left[\vec{J}_{cm}+\vec{E}+\vec{\upsilon}\times\vec{B}\right] \quad (4)$$

$$\rho\,\vec{f}^{\wedge}=\Gamma^{-1}F^{-1}\left[\vec{J}_{cm}\times\vec{B}+\sigma_{ij}\left(\vec{E}+\vec{\upsilon}\times\vec{B}\right)\times\vec{B}\right] \quad (5)$$

Thus, (1), (2) with relations (3) - (5) constitutes a closed system of nonlinear equations of magneto-elasticity of current-carrying orthotropic bodies with orthotropy of conducting properties.

When investigating the deformation of a circular orthotropic plate in a magnetic field, we refer it to a cylindrical coordinate system r,θ,z, so that the middle plane of the plate is connected with the polar coordinate system and the center of the plate is at the origin.

Consider an annular plate in a one-dimensional statement along the spatial coordinate r; suppose that $\partial/\partial\theta=0,\ v=0,\ E_r=0,\ B_\theta=0,\ S=0,\ H_\theta=0,$ $F_\theta=0,\ F_\theta^{\wedge}=0,\ h=h(r),$ where S– is the shear force, $v-$ is the circular displacement.

An account for the diagonal form of the electrical conductivity tensors, the complete system of equations, which makes it possible to describe the geometrically nonlinear model of the magnetoelasticity of orthotropic annular plates, consists of [1, 6, 7]:

equations of magnetoelasticity

$$\begin{gathered}\frac{\partial(rN_r)}{\partial r}-N_\theta+r(F_r+\rho F_r^{\wedge})=r\rho h\frac{\partial^2 u}{\partial t^2};\\ \frac{\partial(rQ_r)}{\partial r}+r(F_z+\rho F_z^{\wedge})=r\rho h\frac{\partial^2 w}{\partial t^2};\\ \frac{\partial(rM_r)}{\partial r}-M_\theta-rQ_r-r\,N_r\vartheta_r=0;\\ -\frac{\partial B_z}{\partial t}=\frac{1}{r}\frac{\partial(rE_r)}{\partial r};\\ \sigma_2\left[E_\theta+0{,}5\frac{\partial w}{\partial t}(B_r^{+}+B_r^{-})-\frac{\partial u}{\partial t}B_z\right]=\\ =-\frac{\partial H_z}{\partial t}+\frac{H_r^{+}-H_r^{-}}{h};\end{gathered} \quad (6)$$

expressions for deformations

$$\varepsilon_r=\frac{\partial u}{\partial r}+\frac{1}{2}\vartheta_r^2;\ \varepsilon_\theta=\frac{u}{r};\ \chi_r=\frac{\partial\vartheta_r}{\partial r};$$

$$\chi_\theta=\frac{1}{r}\vartheta_\theta, \quad (7)$$

where $\vartheta_r=\frac{\partial w}{\partial r}$ is the angle of rotation of the normal;

elasticity relations

$$\begin{gathered}N_r=\frac{e_r h}{1-\nu_r\nu_\theta}(\varepsilon_r+\nu_\theta\varepsilon_\theta);\\ N_\theta=\frac{e_\theta h}{1-\nu_r\nu_\theta}(\varepsilon_\theta+\nu_r\varepsilon_r);\\ M_r=\frac{e_r h^3}{12(1-\nu_r\nu_\theta)}(\chi_r+\nu_\theta\chi_\theta);\\ M_\theta=\frac{e_\theta h^3}{12(1-\nu_r\nu_\theta)}(\chi_\theta+\nu_r\chi_r).\end{gathered} \quad (8)$$

In (6) - (8), the following notations are taken: $\nu_r = \nu_{\theta r}$, $\nu_\theta = \nu_{r\theta}$, $e_r \nu_\theta = e_\theta \nu_r$; ν_r, ν_θ – is Poisson's ratios; e_r, e_θ – are Young's moduli; u, w – are the displacements; N_r, N_θ – are the tangential forces; M_r, M_θ – are the bending moments; Q_r – is the generalized shear force; χ_r, χ_θ – are the main curvatures of the middle surface of the plate; N_r, $B_r^{\pm}$ – are the known values of the tangential components of the magnetic induction on the surfaces of the plate.

The components of the Lorentz force are as follows:

$$\rho F_r^{\wedge} = \sigma_1 h\left[E_\theta B_z - \frac{\partial u}{\partial t} B_z^2 + 0{,}5\frac{\partial w}{\partial t}(B_r^+ + B_r^-)B_z\right];$$

$$\rho F_z^{\wedge} = -\sigma_2 h\Big[0{,}5E_\theta(B_r^+ + B_r^-) - \tag{9}$$

$$-0{,}25\frac{\partial w}{\partial t}(B_r^+ + B_r^-)^2 + \frac{1}{12}\frac{\partial w}{\partial t}(B_r^+ - B_r^-)^2 -$$

$$-0{,}5\frac{\partial u}{\partial t}(B_r^+ + B_r^-)B_z\Big].$$

III. NUMERICAL EXAMPLE. ANALYSIS OF ELECTROMAGNETIC EFFECTS.

Consider a nonlinear magnetoelasticity problem on the stress-strain state of an annular plate of variable stiffness under the action of unsteady magnetic field and arbitrary mechanical load. The plate is elastic orthotropic, made of material with finite electrical conductivity, located in an external magnetic field with strength vector $\vec{H}_0$. The plate is a conductor of a uniformly distributed external electric current of $\vec{J}_{rCT}$ density. Let the magneto-statics problem for the unperturbed state be considered as solved, that is, the vectors of the magnetic induction of the initial state for the outer and inner regions are known.

We investigate the stress-strain state of a metallic boron/aluminum annular plate of constant thickness h, inner radius r_0, outer radius r_1, under the influence of the normal component of mechanical load P_Z and an external magnetic field with a given vector of magnetic induction $\vec{B}^{(e)}$.

The boundary conditions are

$s = r_0 = 0: u = 0,\ w = 0,\ \vartheta_r = 0,\ B_z = 0.5\sin\omega t;$

$s = r_N = 0.0009m:\ N_r = 0,\ Q_r = -100,\ M_r = 0,\ E_\theta = 0.$

The initial conditions are

$$\vec{N}(s,t)\big|_{t=0} = 0,\quad \dot{u}(s,t)\big|_{t=0} = 0,\quad \dot{w}(s,t)\big|_{t=0} = 0$$

The parameters of the plate and the material are:

$r_0 = 0.005m;\ r_1 = 0.009m;\ h = 5\cdot10^{-4}(1-\gamma r^2/r_0)m;\ \gamma = 0.7,$

$\sigma_1 = 0.454\cdot10^8\,(\Omega\times m)^{-1},\ \sigma_2 = 0.200\cdot10^8\,(\Omega\times m)^{-1},\ \nu_r = 0.262;$

$\nu_\theta = 0.320;\ e_r = 22.9\cdot10^{10}\,N/m^2;\ e_\theta = 10.7\cdot10^{10}\,N/m^2;$

$\omega = 314.16\,\text{sec}^{-1};\ P_z = 5\cdot10^3\sin\omega t\ H/м^2;\ P_r = 0;$

$\tau = 1\cdot10^{-2}\,\text{sec};\ \mu = 1.256\cdot10^{-6}\ H/м;\ \rho = 2600\,kg/m^3;$

$J_{\theta CT} = 3\cdot10^7\sin\omega t\ \ A/m^2;\ B_r^{\pm} = 0.5Tл;$

$B_{r0} = 0.5\sin\omega t;\ \Delta t = 1\cdot10^{-3}\,\text{sec};\ 0 \le t \le 1\cdot10^{-2}\,\text{sec}.$

The solution to the problem is determined over time interval $\tau = 10^{-2}\,\text{sec}$, the integration step over time is taken as $\Delta t = 1\cdot10^{-3}\,\text{sec}$ at one hundred points of integration over the length of the shell. The maximum values are obtained at time step $t = 5\cdot10^{-3}\,\text{sec}$. Fig. 1 shows the graphs of deflection change $w(r)$ depending on the radial coordinate of the plate at time point $t = 5\cdot10^{-3}\,\text{sec}$ for three values of magnetic induction. Graphs $1\div3$ correspond to magnetic induction 1. $B_{z0} = 0.1$; 2. $B_{z0} = 0.2$; 3. $B_{z0} = 0.5$, respectively.

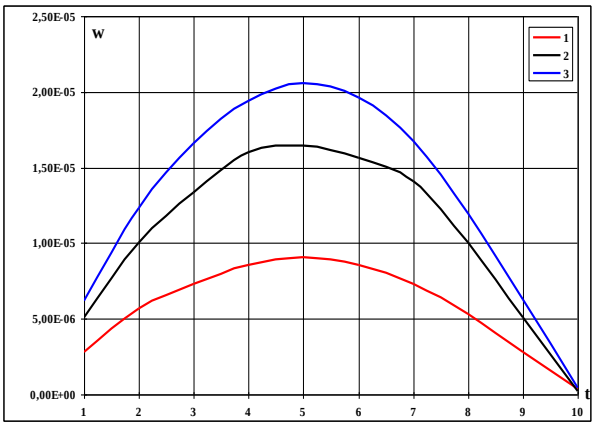

Figure 1. Graphs of deflection changes in time $w(t)$ for the values of the normal component of external magnetic induction

Analyzing the numerical results obtained, it can be seen that with an increase in the values of normal component of external magnetic induction, the deflection of the plate increases.

IV. CONCLUSION.

The article deals with the coupled problem of magnetoelasticity for a flexible orthotropic conductive annular plate taking into account the anisotropy of the conductive properties. A solution was obtained for the nonlinear problem of magnetoelasticity of an annular plate taking into account anisotropic electrical conductivity.

The analysis of the results obtained allows us to evaluate the influence of the normal components of magnetic induction on the stress state of a flexible orthotropic annular plate. Based on the results presented, the magnetoelastic nonlinear problem for a conductive annular plate must be considered in a coupled form.

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PEATLAND COMMUNITY ECONOMIC DEVELOPMENT STRATEGY IN BANGLAS BARAT VILLAGE, MERANTI ISLANDS, BASED ON THE QUINTUPLE HELIX INNOVATION MODEL

Abstract: *Peatland management has its dilemma between meeting community needs and peatland sustainability. The use of peatlands without paying attention to the unique characteristics of the peat itself might make the peatlands degraded (dry), lose nutrients, and cannot return to their original condition.Riau Province is the second province that has the largest peatland in Indonesia, where the area of peatland is 3,864,414 Ha, or 60.1% of the peatland on the island of Sumatra. With an estimated peat thickness of less than 300 cm covering an area of 1,417,762 Ha (36.7%) and a thickness of more than 300 cm covering an area of 2,449,652 Ha (63.3%).*

This study employed The Quintuple Helix Innovation Model. This model described the interaction between the five helixes/components between the government, peatland user industries, universities, the media, and the surrounding community for economic development to increase community income and the regional economy.the results of this study indicate that the community empowerment strategy in Banglas Barat Village based on The Quintuple Helix Innovation Method was currently unable to be implemented properly, and following the theory, because there were still limited main supporting facilities and infrastructure for the implementation of innovation.The fulfillment of the main facilities and infrastructure such as electricity, clean water, telecommunications, and transportation must be carried out immediately.

Of the five helixes involved, it is necessary to optimize research and service activities carried out by universities, provide business capital assistance to the community, optimize peatland protection with the aim of not changing the peat ecosystem, even though the community can still carry out economic activities on it, develop telecommunications and internet networks in villages, and optimize more intense socialization on regulations for preserving peatlands and regulations on community economic development.This is very necessary because peat villages have different characteristics both in terms of people and land.

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Introduction

Peatland management has its dilemma between meeting community needs and peatland sustainability. The population continues to increase forcing people to meet their primary needs in the form of food, clothing, and shelter in the area they are in. From the various studies that have been carried out, there is a contradiction between the fulfillment of the primary needs of the community and the sustainability of the peat ecosystem. The use of peatlands without paying attention to the distinctive characteristics of the peat itself causes peatlands to be degraded (Masganti et al., 2014).

The use and development of peatlands have always been a matter of debate. Differences in views on the use of peatlands are divided into two aspects of interest, namely aspects of environmental interests and aspects of the importance of developing peatlands for strategic commodity agriculture.This condition requires interested parties to find a solution to achieve the balance between these two interests, including through the development of agriculture-based on community participation and land sustainability (sustainable development of peatlands).One of the problems that occur in peatlands that result in damage to the function of the peat ecosystem is the lack of accuracy in the selection of commodities or economic sectors developed on the land. In the agricultural sector, commodities that are not following the characteristics of peatlands and the occurrence of peat water drainage result in drought, which triggers land fires.

Meranti Islands Regency is the only area in Riau Province whose entire area is a peatland. From the researchers' observations, the area has not yet been optimally developed for commodities that have high economic value and can protect the peat ecosystem.For this reason, an analysis of the economic development strategy of the peatland community is needed which focuses on developing commodities in order to provide optimal production results for regional development and peatland management to maintain its sustainability.Banglas Barat Village is one of the villages in the Meranti Islands whose entire area is covered with peatlands with a depth of between 100 and 700 cm.

Source: PRIMS, BRG 2021

Figure 1 - Peat Depth Map of Banglas Barat Village, Tebing Tinggi Subdistrict, Meranti Islands Regency

One method to identify and determine community economic development strategies while still paying attention to the sustainability of the balance of the peatland ecosystem is The Quintuple Helix Innovation Model.This model describes the interaction between the five helixes/components between the government, peatland user industries, universities, the media, and the surrounding community for economic development to increase community income and the regional economy. The figure of the interaction between these five helixes illustrates the relationship between the currently existing helixes in the Banglas Barat Village in the context of community empowerment while maintaining the preservation of peatlands.

Research Method

This study aims to determine the implementation of economic empowerment of peatland communities in Banglas Barat Village, Meranti Islands based on the

innovation model of The Quintuple Helix. Therefore, this study was expected to provide input to the Regional Government of the Meranti Islands to carry out community economic development based on local areas with peatlands that have unique characteristics that affect life and the economy as a whole.

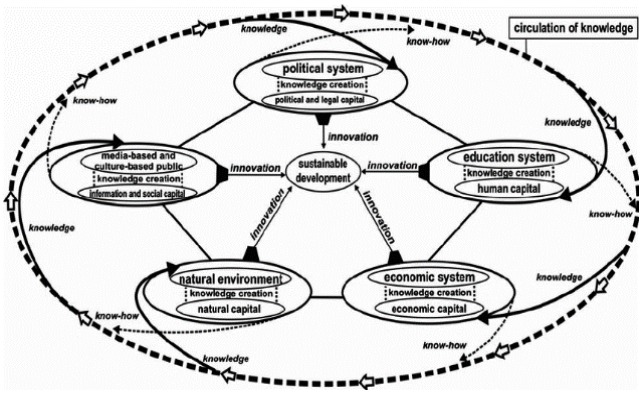

Figure 2 - The Quintuple Helix Model and Its Functions (Carayannis et al., 2012)

The types of data used in this study were primary data and secondary data that have been published by certain parties. Primary data were in the form of data on the participation and contribution of the five helixes (government, peatland user industry, universities, media, and surrounding communities) to the economic development of peatland communities.Primary data were obtained from interviews and observations with parties related to the economic development of peatland communities. The related parties were community leaders and sago processing business actors, totaling 30 (thirty) people.Secondary data used in this study was obtained from Statistics Indonesia, government agencies/institutions, and others in the form of research results, publications, and data from the government.

The obtained data were analyzed using a qualitative descriptive analysis based on The Quintuple Helix Innovation Model. This innovation model described the interaction between the five helixes/components between the government, peatland user industries, universities, media, and surrounding communities for economic development to increase community income and the regional economy.The results of this model can be described in diagrams, tables, and qualitative descriptive.

Research Results And Discussion

Research Results

Education System Helix

From the results of interviews with the village head, village officials, and community leaders/village communities, it is known that community economic empowerment has been carried out by universities/colleges by the education system. Universities/colleges have played a role in community economic development, this is recognized and supported by village officials. Village officials expect various innovations that can be carried out by universities/colleges for the development of the village economy. Of the 12 community leaders interviewed in this study, they stated that there were universities that had come to Banglas Barat Village to provide training related to the development of sago-based SMEs, while a study on peat commonly came directly from the province or district, which did not involve the village.

Lecturers and students from the Universitas Riau (UNRI) have done various research and service in this village. Research and services that have been carried out include the development of diversification of sago products (variants, flavors, types, packaging), water purification systems, and the development of Micro, Small, and Medium Enterprises. The activities carried out aim to improve product quality and village community income. Moreover, various other universities/colleges both from Riau Province and from other provinces also came to research peat and sago, including universities from Maluku, Papua, and Sulawesi.

From the results of interviews and questionnaires, it can also be seen that the role of the university, especially the Universitas Riau, was felt by the villagers during the Student Community Service Program. Most of the respondents or 83.33 percent stated that the training they received for business development was obtained from students of the Student Community Service Program.

Economic System Helix

From the economic system, village heads, village officials, and village communities said that there were people who had received various types of capital assistance, although not all people had felt it and the number of aid funds was still limited.Providing assistance in the form of capital and equipment to businesses both working in the MSME

sector and the sago industry. From this study, it was found that there were only 3 (three) people who received assistance from special business actors processing products from sago.The amount of assistance varies, some between 25-30 million (in-kind) are received by MSMEs who process analog rice from sago, then 7-8 million (in-kind) who make sago noodles, and less than 2 million (cash) also for SMEs hat process sago noodles. They said that it was rather difficult to get assistance, especially for product development, because the donors also had special requirements that MSMEs could not fulfill. Apart from this, they only received 1 (one) assistance during their business.The actors who received the assistance were all MSMEs engaged in sago processing, while the refineries and also woven thatched roofs in the Banglas Barat Village had never received any assistance, be it from the government, private sector, or from other parties such as political parties. Craftsmen or business actors of thatch roof weaving said that they needed the help of tools such as tools to take the leaves of thatch and tools to weave the roof. They said that the selling price of a thatched roof is very cheap, IDR 300,000 for 100 pieces, which means that one piece of a thatched roof is priced at IDR 3,000.They said that such income is not enough to support daily life. This is exacerbated by the fact that people have started to abandon thatched roofs as their roofs and replace them with a more durable tin roof.

Natural Environment Helix

The results of the interviews with all key informants regarding the helix of the natural environment all said that they knew that they lived on peatlands. A total of 96.67 percent stated that they know how to maintain and conserve peatlands. The way to maintain peatlands is to not burn the land and keep the land wet. The key informants also said that if they burned the peatlands they could be arrested by the police and sent to prison.The socialization of peatland protection was obtained by the village head and other village officials, and the socialization was obtained from the sub-district government and regional government. Meanwhile, from universities/colleges, they have never received anything about peatland protection.

Media-based and Culture-Based Public Helix

In the media-based and culture-based public helix, the people of Banglas Barat Village are currently still limited to accessing the internet due to limited facilities and supporting infrastructure. Community leaders who can freely access the internet are village officials, while there is a special internet network in the village office. Meanwhile, very few business actors who can access the internet, 4 (four) people) from 18 business actors engaged in sago or 22.22 percent. The rest of the business actors admit that they cannot access the internet because of limited knowledge and no communication equipment uses the internet. Apart from the internet, business actors use telephones to contact buyers or agents who want to take their products.

Political System Helix

In general, all key informants know that there are regulations related to peatland conservation. They know that they are not allowed to burn land or damage existing plants because there will be sanctions, imprisonment.Many key informants did not know the regulations related to improving the community's economy because they only think that they have to develop the economy just to survive and fulfill all their needs.

In the political system, this village already has various village regulations which are derivatives of central, provincial, and district regulations in which there are various programs for community economic empowerment. The Banglas Barat Village apparatus prioritizes the issue of food security based on labor-intensive, indicating that the village tries to promote or explore the potential of the village which is summarized in the slogan "one village one product."The regional or village government continues to socialize to people who want to work outside that it is better to work in their area, because the potential that exists in this village is still very much, but only constrained by how to manage and develop it.

Discussion

Various studies and community services from various universities/colleges have been developed and conducted in Banglas Barat Village. Therefore, the education system helix has been implemented. However, further, development is needed regarding innovation, especially in the electricity, clean water, and community economic development sectors.The most basic challenge for the community in the village is the level of education. The average village community only graduated from elementary school, indicating that the problem lies in human resources. Low human resources might cause the absorption of information and technology to be minimal and limit the economic development considering the current rapid development of information and technology.

The roles of universities in community empowerment are:

a. Building public discourse for a democratic society, nation, and state. This is important considering that changes in conflict situations in the future will continue to color the process of change in society and these things cannot be avoided as a natural process towards democracy.

b. Developing a development model that is truly based on local resources and local knowledge.

c. Building a scientific development base that is truly relevant to the needs of society on the one hand

and in response to changing global dynamics on the other.

d. Developing a community learning center. This is very important related to the preparation of human resources.

e. Assisting in the development of sound policy studies on local, national, and international level policy reform frameworks.

There have been various innovations to develop products and obtain business capital in Banglas Barat Village, although the amounts are still relatively small. There is a need for additional capital to enable the community's economic activities to run well and to improve people's living standards.Problems lie in electricity, clean water, and sanitation. Electricity in this village has not yet been fully supplied by PLN (State Electricity Company). Most of the area still uses diesel generators as a source of electrical energy. This diesel engine can only live for 6 (six) hours a day.

Innovation in the natural environment is environmentally friendly peat technology. The natural environment of Banglas West Village is in the form of peatland, which is indeed the use of which has been regulated in laws and government regulations.Therefore, it is necessary to develop innovations for economic development without destroying the peatland ecosystem.

Banglas Barat Village is not an underdeveloped village, for communication and internet access can be enjoyed even though it is very limited. various community activities and profiles from the village can be accessed by the public outside the village. Thus, there is an overview of the users of the information and can be useful for those who are interested in developing the economy of their community.

The laws on electricity, water resources/clean water, and government regulations on peatland management have been regulated by the Government of the Republic of Indonesia. However, currently, it has not been maximally felt by the village community since it is still considered for various fundamental and technical reasons. Currently, the Banglas Barat Village Government also has various regulations and development plans which are summarized in the Village Medium Term Development Plan and Village Development Work Plan documents.

Empowerment of the people's economy is an effort to make the economy strong, large, modern, and highly competitive in the market mechanism because the constraints of people's economic development are structural constraints.Therefore, the empowerment of the people's economy must be carried out through structural changes. The structural change in question is a change from a traditional economy to a modern economy, from a weak economy to a strong economy, from a subsistence economy to a market economy, from dependence to independence.

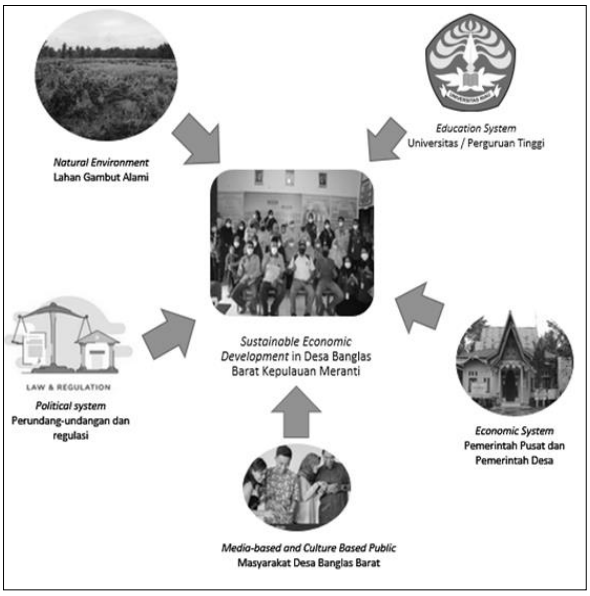

Figure 3 - The Quintuple Helix Innovation Model of Peatland Community Economic Development in Banglas Barat Village

Table 1. Ideal Conditions in The Quintuple Helix Innovation Model in Peatland Community Economic Development in Banglas Barat Village, Tebing Tinggi Subdistrict, Meranti Islands Regency

No	Quintuple Helix Model	Knowledge Creation	Input	Output	Innovation	Related Parties/Components
1	Education System	Human Capital	High investment in the education system	Human resources who are skilled and understand the importance of protecting peat and empowering the community's economy	Application of sustainable knowledge about peat ecosystems, especially clean water and electricity and their use for the economy	Universities/Colleges (Universitas Riau and other universities/colleges in Riau/Indonesia)
2	Economic System	Economic Capital	Sustainable values and ideas about the synergy of peat ecosystems and community economic development	A high quality economy that can enter the market in order to create new jobs and economic growth in peatlands	Management of peatlands to meet economic needs while maintaining the peat ecosystem and meeting the needs of clean water and electricity	Central Government, Regional Government, Private Parties, Banglas Barat Village Communities
3	Natural Environment	Natural Capital	Protecting the peatland environment	Peatlands are sustainable and preserved	Peat eco-friendly technology	Natural Peatlands
4	Media-based and Culture-Based Public	Information and social capital	Lifestyle/new lifestyle	New quality of life	A new balance created between a new lifestyle and nature	Banglas Barat Village Community
5	Political system	Political and Legal Capital	Opinion, satisfaction, and citizen participation	New ideas, solutions, programs, and legislation in line with peatland sustainability	Creation of a sustainable and legal framework for peatlands accelerated electricity flow, and clean water management	Law No. 17 of 2019 on Water Resources Law No. 30 of 2019 on Electricity Government Regulation No. 57 of 2016 on Protection and Management of Peat Ecosystems

Source : Research Team, 2021

Conclusion

Based on the research that has been done, the community empowerment strategy in Banglas Barat Village based on The Quintuple Helix Innovation Method is currently unable to be implemented properly and following the theory because there are still limited main supporting facilities and infrastructure for the implementation of the innovation. Therefore, the steps that should be taken are to fulfill the main facilities and infrastructure such as electricity, clean water, telecommunication, and transportation. It is necessary to optimize research and service activities carried out by universities in the context of empowering peatland communities, providing business capital assistance to the community to open a business or to increase their business productivity, then optimize peatland protection with the aim of not changing the peat ecosystem, where the community can still carry out economic activities on it. The point is that there is a balance that must be struck between meeting economic needs and preserving peatlands.

The development of telecommunication and internet networks is expected for the media and

culture-based public. In the political system, more binding regulations and a better focus on protecting peatlands at the village level are expected because peat villages have different characteristics both in terms of people and land.

To increase people's income and regional income, areas with peatlands are suggested to try to explore the potential for local resource-based economic development to create superior economic products that have a good marketing network.

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TORSIONAL VIBRATIONS OF THE TRANSMISSION OF A CAR WITH TWO POWER PLANTS IN THE SIMULINK ENVIRONMENT

Abstract: *The results of the calculated ratios to determine the forces and moments acting on the dynamic model, we obtain differential equations of free and forced torsional vibration transmission with two power units, which are the basis for determining the natural frequencies, the study of amplitude-frequency characteristics, as well as the analysis of virgin loads Over clocking on the transmission components of mobile machines with two power units.*

Key words: *model, vibrations, car.*

Language: *Russian*

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КРУТИЛЬНЫЕ КОЛЕБАНИЯ ТРАНСМИССИИ АВТОМОБИЛЯ С ДВУМЯ СИЛОВЫМИ УСТАНОВКАМИ В СРЕДЕ SIMULINK

Аннотация: *В статье приведены результаты расчетных соотношений по определению сил и моментов действующих на динамическую модель, получены дифференциальные уравнения свободных и вынужденных крутильных колебаний трансмиссии с двумя силовыми установками, которые являются основанием для определения собственных частот, исследования амплитудно-частотных характеристик,*

а также анализа девствующих нагрузок в режиме разгона на элементы трансмиссии автомобиля с двумя силовыми установками.

***Ключевые слова**: модель, колебания, автомобиль.*

Введение

Задачами исследования динамики трансмиссии, после выбора способа моделирования и составления динамической модели, упрощения динамической модели, составления приведенной к валу двигателя динамической модели, являются определение возмующих воздействий на динамическую модель, вывод дифференциальных уравнений свободных и вынужденных крутильных колебаний трансмиссии автомобиля.

На рис.1 приведена динамическая модель трансмиссии автомобили с двумя силовыми установками и колесной формулой два 4х4 приведенная к валу двигателей, где:

J_1, J_2-моменты инерций вращающихся масс правого и левого двигателей;

J_3, J_4, J_5, J_6- приведенные моменты инерций вращающихся масс колёс 4^x мостов;

J_7- приведенный момент инерции крутильной массы, эквивалентной поступательно движущееся массе автомобиля;

C_1, C_2, C_3, C_4- приведенные крутильные жесткости трансмиссий 4^x мостов;

C_5, C_6, C_7, C_8-приведенные тангенциальные жёсткости шин 4^x мостов;

M_{g_1}, M_{g_2}-крутящие моменты на валах двигателей;

$M_{C_1}, M_{C_2}, M_{C_3}, M_{C_4}$- приведенные крутящие моменты сопротивлений качению на колесах;

M_{C_5}- опрокидывающий момент, действующий на корпус машины;

$\varphi_1, \varphi_2, \varphi_3, \varphi_4, \varphi_5, \varphi_5, \varphi_6, \varphi_7$- обобщенные координаты.

Приведенные податливости трансмиссии правого и левого двигателей определяются по формуле.

$$\frac{1}{C_1} = \frac{1}{C_{КП1}} + \frac{1}{C_{Кв^1}} i_{01}^2 + \frac{1}{C_{Кв_1}} i_{01}^2 \cdot i_{12}^2 + \left(\frac{1}{C_{ПО_1}} + \frac{1}{C_{ПО_2}}\right) i_{01}^2 \cdot i_{12}^2 \cdot i_{23}^2 + \left(\frac{1}{C_{Кв_5}} + \frac{1}{C_{Кв_6}}\right) i_{01}^2 \cdot i_{12}^2 \cdot i_{23}^2 \cdot i_{34}^2; \quad (1)$$

$$\frac{1}{C_2} = \frac{1}{C_{КП_1}} + \frac{1}{C_{Кв^1}} i_{01}^2 + \frac{1}{C_{Кв_1}} i_{01}^2 \cdot i_{12}^2 + \left(\frac{1}{C_{ПО_3}} + \frac{1}{C_{ПО_4}}\right) i_{01}^2 \cdot i_{12}^2 \cdot i_{23}^2 + \left(\frac{1}{C_{Кв_7}} + \frac{1}{C_{Кв_8}}\right) i_{01}^2 \cdot i_{12}^2 \cdot i_{23}^2 \cdot i_{34}^2; \quad (2)$$

$$\frac{1}{C_3} = \frac{1}{C_{КП_2}} + \frac{1}{C_{Кв^1}} i_{01}^2 + \frac{1}{C_{Кв_3}} i_{01}^2 \cdot i_{12}^2 + \left(\frac{1}{C_{ПО_5}} + \frac{1}{C_{ПО_6}}\right) i_{01}^2 \cdot i_{12}^2 \cdot i_{23}^2 + \left(\frac{1}{C_{Кв_9}} + \frac{1}{C_{Кв_{10}}}\right) i_{01}^2 \cdot i_{12}^2 \cdot i_{23}^2 \cdot i_{34}^2; \quad (3)$$

$$\frac{1}{C_4} = \frac{1}{C_{КП_2}} + \frac{1}{C_{Кв^1}} i_{01}^2 + \frac{1}{C_{Кв_4}} i_{01}^2 \cdot i_{12}^2 + \left(\frac{1}{C_{ПО_7}} + \frac{1}{C_{ПО_8}}\right) i_{01}^2 \cdot i_{12}^2 \cdot i_{23}^2 + \left(\frac{1}{C_{Кв_{11}}} + \frac{1}{C_{Кв_{12}}}\right) i_{01}^2 \cdot i_{12}^2 \cdot i_{23}^2 \cdot i_{34}^2 \quad (4)$$

Приведенные моменты инерции деталей трансмиссии правого и левого двигателей определяются по формулам:

$$J_1 = J_{gвПР}; \quad (5)$$

$$J_3 = J_\partial \frac{1}{i_{01}^2 \cdot i_{12}^2 \cdot i_{23}^2} + \left(J_{K1} + J_{K2}\right)\frac{1}{i_{01}^2 \cdot i_{12}^2 \cdot i_{23}^2 \cdot i_{34}^2}; \quad (6)$$

$$J_3 = J_\partial \frac{1}{i_{01}^2 \cdot i_{12}^2} + J_\partial \frac{1}{i_{01}^2 \cdot i_{12}^2 \cdot i_{23}^2} + \left(J_{K3} + J_{K3}\right)\frac{1}{i_{01}^2 \cdot i_{12}^2 \cdot i_{23}^2 \cdot i_{34}^2};$$

$$J_5 = J_\partial \frac{1}{i_{01}^2 \cdot i_{12}^2 \cdot i_{23}^2} + \left(J_{K5} + J_{K6}\right)\frac{1}{i_{01}^2 \cdot i_{12}^2 \cdot i_{23}^2 \cdot i_{34}^2}; \quad (7)$$

$$J_6 = J_\partial \frac{1}{i_{01}^2 \cdot i_{12}^2} + J_\partial \frac{1}{i_{01}^2 \cdot i_{12}^2 \cdot i_{23}^2} + \left(J_{K7} + J_{K8}\right)\frac{1}{i_{01}^2 \cdot i_{12}^2 \cdot i_{23}^2 \cdot i_{34}^2}; \quad (8)$$

$$J_7 = J_\partial \frac{1}{i_{01}^2 \cdot i_{12}^2 \cdot i_{23}^2 \cdot i_{34}^2} = ma\frac{r_K^2}{i_{01}^2 \cdot i_{12}^2 \cdot i_{23}^2 \cdot i_{34}^2}; \quad (9)$$

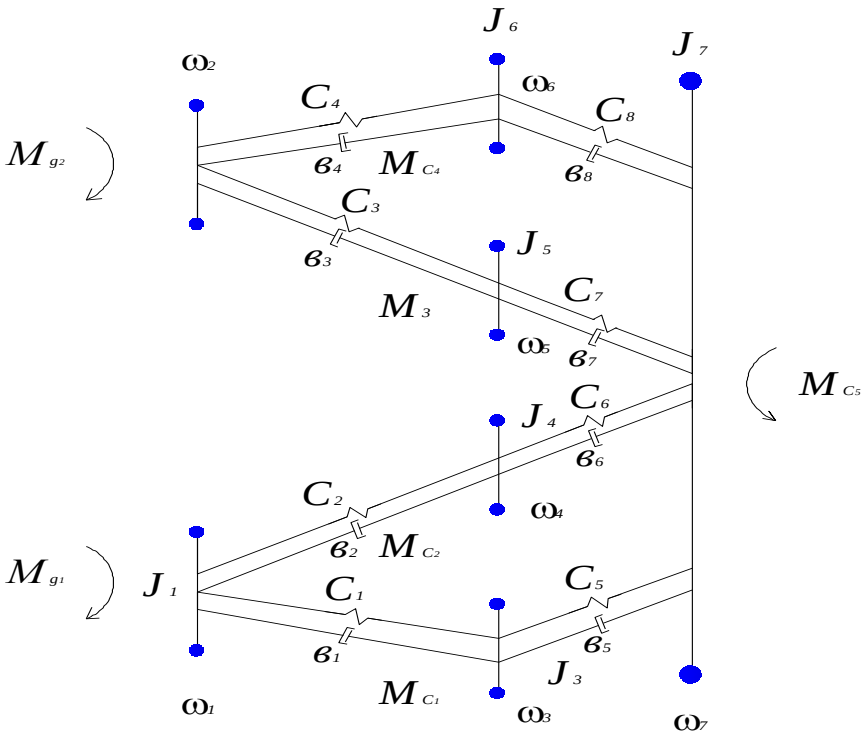

Рис. 1. Динамическая модель трансмиссий автомобилей с приведенными к валам двигателя

Для вывода вынужденных крутильных колебаний трансмиссии необходимо определить силы и моменты действующие на динамическую модель.

В работе [1,2] приведена формула для определения суммарного момента сопротивления, действующего на трансмиссию:

$$M_C = M_{K_C} + M_{K\upsilon} + M_в + M_П, \quad (10)$$

где: M_{K_C} - постоянная составляющая сопротивлению качения ведущих колес, обусловленная радиальной нагрузкой;

$M_{K\upsilon}$ - переменная составляющая сопротивлению качения ведущих колес, обусловленная неровностью дороги;

$M_в$ - лобовое сопротивление воздуха; $M_П$ - сопротивление подъема.

В режиме установившегося движения мобильной машины все составляющие момента сопротивления, кроме M_{K_υ}, приближенно можно считать постоянной [1,2,3].

Приведенные моменты сопротивлений на трансмиссии правого и левого двигателей и опрокидывающий момент действующий на корпус автомобилей определяются по формулам:

$$M_{C1} = \frac{M_{K1} + M_{\kappa 2}}{i_{01} \cdot i_{12} \cdot i_{23} \cdot i_{34}}; \quad (11)$$

$$\grave{I}_{\tilde{N}2} = \frac{\grave{I}_{\hat{E}3} + \grave{I}_{\hat{e}4}}{i_{01} \cdot i_{12} \cdot i_{23} \cdot i_{34}}; \quad (12)$$

$$\grave{I}_{\tilde{N}3} = \frac{\grave{I}_{\hat{E}5} + \grave{I}_{\hat{e}6}}{i_{01} \cdot i_{12} \cdot i_{23} \cdot i_{34}}; \quad (13)$$

$$\grave{I}_{\tilde{N}4} = \frac{\grave{I}_{\hat{E}7} + \grave{I}_{\hat{e}8}}{i_{01} \cdot i_{12} \cdot i_{23} \cdot i_{34}}; \quad (14)$$

$$\grave{I}_{\tilde{N}5} = \frac{M_A}{i_{01} \cdot i_{12} \cdot i_{23} \cdot i_{34}}; \quad (15)$$

Диссипативная функция для принятой динамической модели имеет вид:

$$\phi = \frac{1}{2}\left[\hat{a}_1(\dot{\varphi}_1 - \dot{\varphi}_3)^2 + \hat{a}_2(\dot{\varphi}_1 - \dot{\varphi}_4)^2 + \hat{a}_3(\dot{\varphi}_2 - \dot{\varphi}_5)^2 + \hat{a}_4(\dot{\varphi}_2 - \dot{\varphi}_6)^2 + \hat{a}_5(\dot{\varphi}_3 - \dot{\varphi}_7)^2 + \hat{a}_6(\dot{\varphi}_4 - \dot{\varphi}_7)^2 + \hat{a}_7(\dot{\varphi}_5 - \dot{\varphi}_7)^2 + \hat{a}_8(\dot{\varphi}_6 - \dot{\varphi}_7)^2\right];$$

Дифференциальные уравнение вынужденных крутильных колебаний трансмиссии автомобилей с двумя силовыми установками получим используя уравнения Лагранжа второго рода:

С учетом движущих моментов двух двигателей, приведенных моментов сопротивлений (14), опрокидывающего момента (15), диссипации энергии дифференциальные уравнения вынужденных крутильных колебаний трансмиссии автомобилей с двумя двигателями имеют вид:

$$\begin{aligned}
&\ddot{\varphi}_1 + A_{11}(\dot{\varphi}_1 - \dot{\varphi}_3) + A_{12}(\dot{\varphi}_1 - \dot{\varphi}_4) + A_{13}(\varphi_1 - \varphi_3) + A_{14}(\varphi_1 - \varphi_4) = \frac{M_{g_1}(\omega_1)}{J_1};\\
&\ddot{\varphi}_2 + A_{21}(\dot{\varphi}_2 - \dot{\varphi}_5) + A_{22}(\dot{\varphi}_2 - \dot{\varphi}_6) + A_{23}(\varphi_2 - \varphi_5) + A_{24}(\varphi_2 - \varphi_6) = \frac{M_{g_2}(\omega_2)}{J_2};\\
&\ddot{\varphi}_3 + A_{31}(\dot{\varphi}_3 - \dot{\varphi}_1) + A_{32}(\dot{\varphi}_3 - \dot{\varphi}_7) + A_{33}(\varphi_3 - \varphi_1) + A_{34}(\varphi_3 - \varphi_7) = \frac{M_{C_1}(t_1)}{J_3};\\
&\ddot{\varphi}_4 + A_{41}(\dot{\varphi}_4 - \dot{\varphi}_1) + A_{42}(\dot{\varphi}_4 - \dot{\varphi}_7) + A_{43}(\varphi_4 - \varphi_1) + A_{44}(\varphi_4 - \varphi_7) = \frac{M_{C_2}(t)}{J_4}; \quad (16)\\
&\ddot{\varphi}_5 + A_{51}(\dot{\varphi}_5 - \dot{\varphi}_2) + A_{52}(\dot{\varphi}_5 - \dot{\varphi}_7) + A_{53}(\varphi_5 - \varphi_2) + A_{54}(\varphi_5 - \varphi_7) = \frac{M_{C_3}(t)}{J_5};\\
&\ddot{\varphi}_6 + A_{61}(\dot{\varphi}_6 - \dot{\varphi}_2) + A_{62}(\dot{\varphi}_6 - \dot{\varphi}_7) + A_{63}(\varphi_6 - \varphi_2) + A_{64}(\varphi_6 - \varphi_7) = \frac{M_{C_4}(t)}{J_6};\\
&\ddot{\varphi}_7 + \grave{A}_{71}(\dot{\varphi}_7 - \dot{\varphi}_3) + \grave{A}_{72}(\dot{\varphi}_7 - \dot{\varphi}_4) + \grave{A}_{73}(\dot{\varphi}_7 - \dot{\varphi}_5) + \grave{A}_{74}(\dot{\varphi}_7 - \dot{\varphi}_6) +\\
&+ \grave{A}_{75}(\varphi_7 - \varphi_3) + \grave{A}_{76}(\varphi_7 - \varphi_4) + \grave{A}_{77}(\varphi_7 - \varphi_5) + + \grave{A}_{78}(\varphi_7 - \varphi_6) = \frac{\grave{I}_{C_5}}{J_7};
\end{aligned}$$

Полученные дифференциальные уравнения решены численным методом в среде SIMULINK

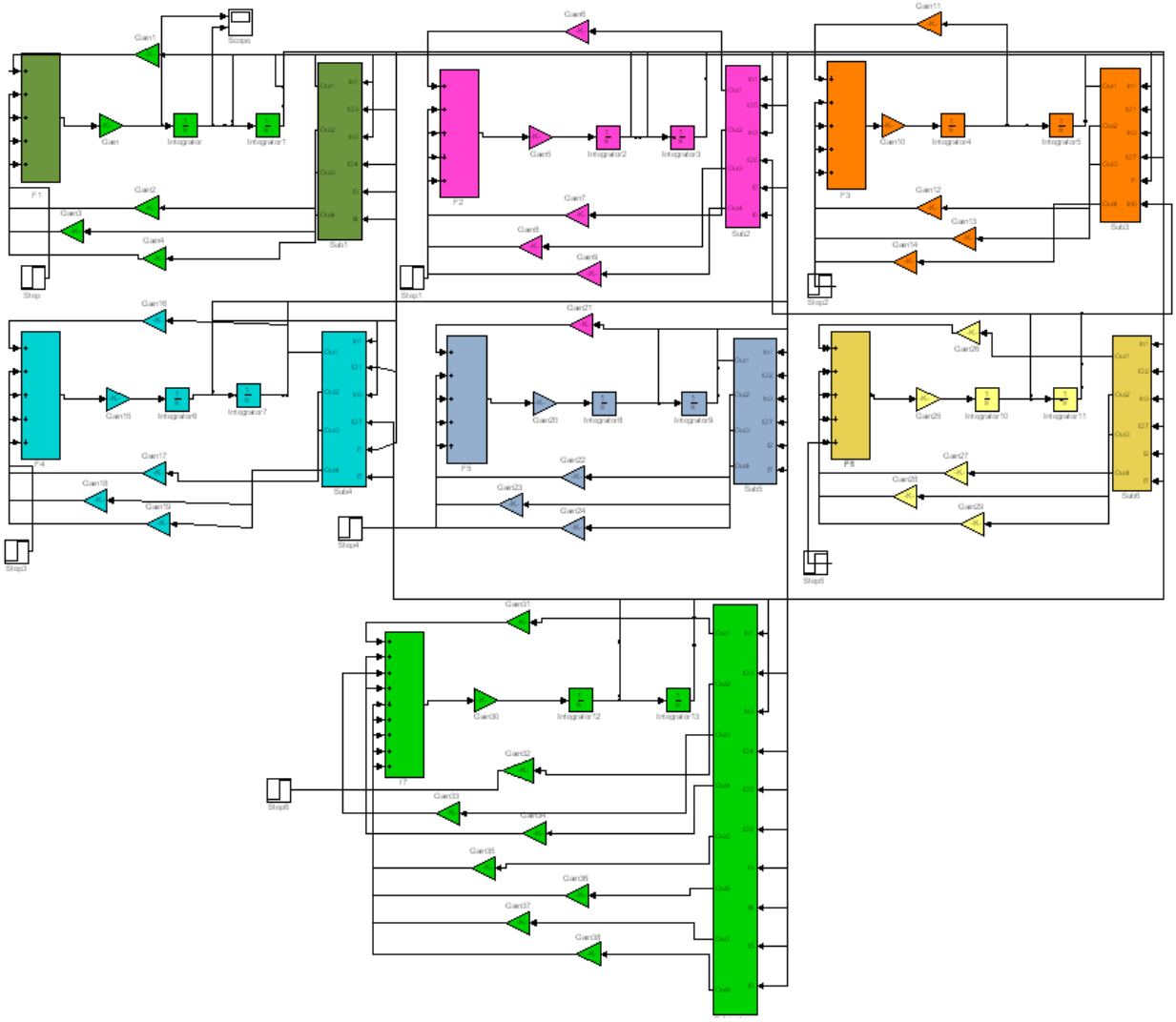

Рис.2. Дифференциальные уравнения решены численным методом в среди SIMULINK

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