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SECTION 4. Computer science, computer engineering and automation.

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THE INTEGRATED SIMULATION MODEL OF A PROMISING ACTIVE SAFETY SYSTEM FOR THE EXECUTIVE CLASS VEHICLES

***Abstract**: In the article the authors developed an integrated simulation model of a promising active safety system for the executive class vehicles and the algorithm for positioning the group of vehicles in the conditions of visual information shortage based on the approach of a same virtual informational space.*

***Key words**: drivers' computer support system, digitized roadway borders, satellite navigation tools, same virtual informational space, visual information shortage.*

***Language**: English*

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Introduction

For cars of high-ranking officials of the state there are special requirements for their active and passive safety. Different kind of provocation in the form of the creation of smoke or light curtains, spray paint substances on windshields or bad weather should not reduce the operating efficiency and safety executive cars. It is necessary to take into account the specifics of this particular class of vehicles, which are operated in a complex organized support group, the number of which reaches several tens of units [1; 2; 3; 4; 5; 8; 9; 10]. Consequently, in the event of critical situations due to total or partial lack (deficiency) of visual and navigational information business class car should be the guarantor not only of passive safety, for example, due to reliable armor protection, but do not allow potential saboteurs make confusion in action participants support, disrupt the safe and timely movement of VIPs. The development of these technologies is strategic in nature, it determines the prestige of the country and due to significant scientific- and capital intensity is not feasible without the direct involvement of the state, its academic and university organizations.

Materials and Methods

The difficult foreign policy situation once again confirms the need to develop its own advanced active safety systems, while necessarily taking into account the existing international experience of scientific schools and multinational corporations to create their own versions of high-precision positioning systems in cars conditions of lack of information.

One of the modern ways of solving this problem is to actively develop high-precision positioning systems for cars in advance digitized boundaries of the roadway using modern satellite navigation tools (SNT) new generation of wireless and information sharing technologies between vehicles throughout the support group.

There is also an urgent need to improve the information content of external executive cars using encrypted wireless communication channels and high-precision navigational information and technologies for display on the display board computer detailed position (orientation) of all participants in support groups.

The aim of section is to improve executive vehicles active safety under the conditions of insufficient visibility on the base of new methods and means of drivers computer support on roads.

To achieve this goal were solver following problems [6; 7]:

 developed the conception of active safety improvement for executive class vehicles under the conditions of information shortage;

 developed the integrated simulated model of perspective active safety and also algorithmic and software for vehicle positioning on road under the conditions of information shortage by means of SNT «GLONASS/GPS»;

 accomplished the analysis of movement of vehicles in poor visibility conditions using the developed prototype system.

The conception of work is based on generalization and systematization of progressive foreign and national experience in the area of active safety development, particularly with the use of SNT «GLONASS/GPS» and «V2V» technologies.

Drivers' computer support system (DCSS) structural diagram for the executive class vehicles is presented on figure 1.

The input parameters are the following:

 coordinates of latitude, longitude and altitude $K = \{x_1, y_1, z_1, x_2, y_2, z_2\}$ of vehicle location on satellite navigation tools data from antennas M_1 and M_2;

 setting parameter vector R of vehicle positioning system on roadway;

 approximation method parameters $W = \{m_i, d\}$, where m_i – approximation algorithm, d – approximation coordinated diapason of vehicle motion path;

 flow of video information V_R under vehicle front axle;

 signals definition vector Z_t at times t from vehicle odometer;

 vector of longitude and transverse slopes $G_t = \{p, r\}$ at time t from angle of slope unit installed on the back axle of vehicle.

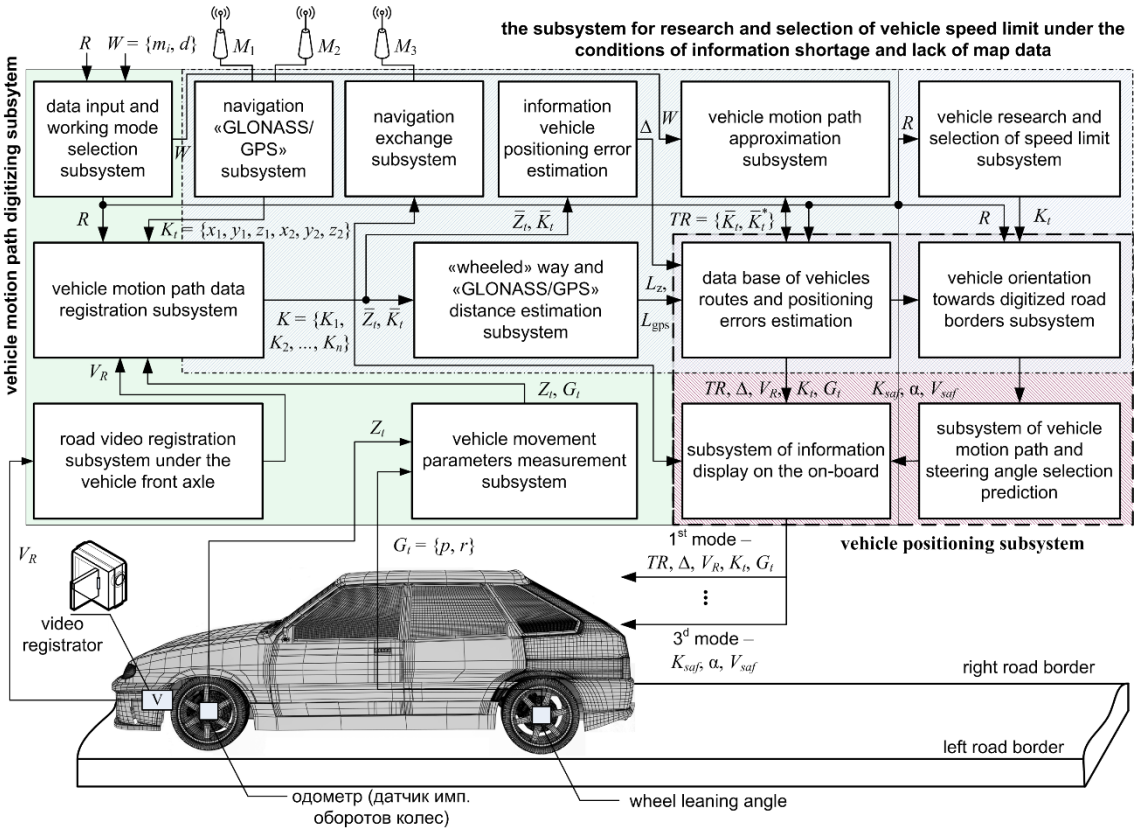

Figure 1 – DCSS structural diagram by executive class vehicles positioning moving in organized convoy (cortege) on the roadway under the conditions of VIS.

The presented system works in following modes [6; 7]:

1st mode – automation of collecting, recording and processing data on the trajectory of car movement. This mode is also used in road mode digitizing boundaries, when the vehicle moves left and right sides of the road. Enroll navigational road coordinates boundaries derived vector coordinates undergo smoothing, produced histograms of probability distributions coordinate deviations from the smoothed line.

2d mode – research and selection of high-speed car modes information deficit on different graphics primitives digitized road sections. This road is considered as an extended object in space whose boundaries are digitized with the desired increments. The input data for the selected mode are graphic primitives digitized road sections; the coordinates of

the initial position of the first and second antennas navigators located, respectively, on the front and back parts of the body and determine the base; discrete obtain navigation data; vehicle speed of movement; the time scaling factor; the distance to the edge of the road, which must adhere to the vehicle. Selecting vehicle movement trajectory is carried out based on the geometric characteristics of an extended object and the desired speed of vehicle.

3d mode – research of vehicle positioning mode in the absence of map data, as well as in conditions of poor visibility. This mode of operation of the system is also used as a guide for choosing a safe corridor of car movement in view of estimating the probability of hitting the edge of the shoulder of the road.

System output parameters depending on selected mode are the following:

- 1st mode – digitized motion path of mobile object *TR*, error estimation Δ of car positioning, video information flow V_R under the front axle, coordinates *K* of existing car positioning, angle of slopes $G_t = \{p, r\}$ of roadway;
- 2d mode – graphics distance traveled as a function of the base and the vehicle speed until the deviations from the planned trajectory, when the vehicle is outside the allowed boundaries of the road;
- 3d mode – recommended driving corridor recommended by a rotation angle and speed of the car in the conditions of lack of information.

The proposed system has a modular architecture, with all its subsystems are interconnected, change parameter values of one subsystem affects the output characteristics of the other.

On figure 2 presented the diagram of vehicle positioning moving in organized group under the conditions of information lack towards digitized road borders.

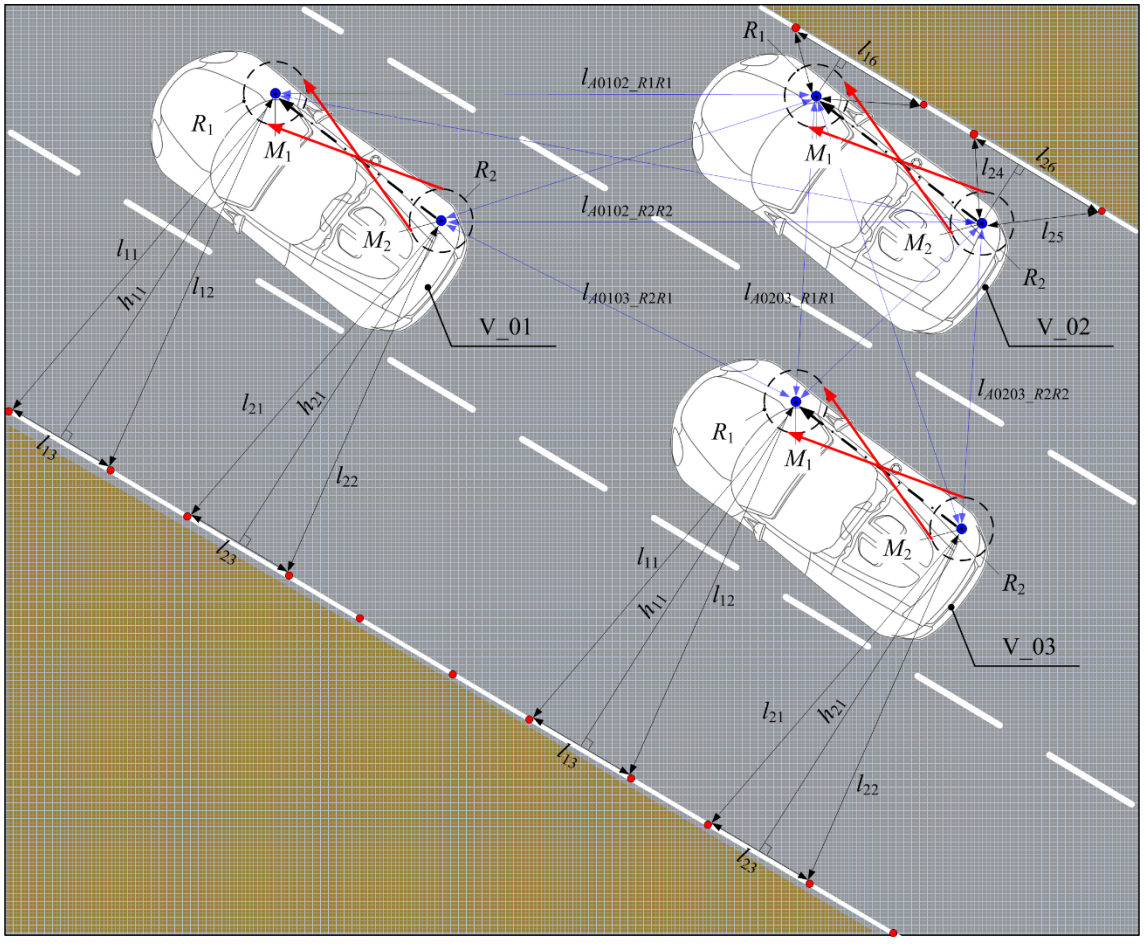

Figure 2 – The diagram of cortege positioning on the roadway.

The algorithm of positioning of vehicle group consists of following stages [5; 6; 7]:

1. In on-board system of each car is given the discrete receiving navigation data and the accuracy of satellite navigation - R_1 and R_2. Database of digitized road borders the desired travel route is downloaded.

2. In the process of vehicle driving the operator (navigator) uses evidence-board system to determine deviations from the recommended corridor of movement, taking into account the geometric characteristics of the road surface, the base of the vehicle, discreteness and errors of received navigation data.

3. The navigation coordinates of all the participants of support groups through exchange of navigation information subsystem input to the onboard system and form a single virtual information.

4. The same virtual informational space contains distance vectors between the vehicles and their location towards digitized road borders at each time *t*. Pointed parameters are displayed on the screen of on-board system.

Under *same virtual informational space* (SVIS) is meant the presence of all the participants of informational interaction (vehicle groups) equal copies of dynamic image Q_t, by changing of structure or content of which at time *t* modified image Q_t' becomes equally renewed for every member of informational interaction i.e. in all created copies. The example of SVIS method is the game «Sea Battle» and also modern computer online (command) games [7, 88 p.].

On commands the navigator driver performs positioning of the vehicle on the road: selects the vehicle speed, adhere to the regulated distance between the participants and to accompany the digitized boundaries of the roadway.

On figure 2 points M_1 and M_2 define the location of SNT «GLONASS/GPS» antennas for each group member – «V_01», «V_02» and «V_03». Circles R_1 and R_2 are error radiuses of satellite navigation. Distances l_{11} – l_{26} define the lengths between digitized road borders and vehicle antennas location. Distances to digitized borders are h_{11} – h_{22}. Dash-and-dot line M_1M_2 defines the orientation of each vehicle towards digitized road borders and (or) road markings.

Distances l_{A0102_R1R1} – l_{A0203_R2R2} between convoy participants is defined by navigational coordinates of antennas M_1 and M_2 for each vehicle taking into account car body dimensions and error radiuses R_1 and R_2 of SNT «GLONASS/GPS».

Each vehicle has its own unique identifier, for example the first vehicle in group has identifier «V_01», and the second one – «V_02» and so on.

To coordinate all participants of convoy, in driver computer support system is created for each driver same virtual information space. Mentioned space is like multipage dynamic massive of complex system that is used by subsystems for selection of necessary recordings and positioning the vehicles under the conditions of information shortage.

The massive contains the following pages: navigation coordinates of all members of the group at each time point t, the vector distances between them and their location relative to the digitized boundaries of the roadway.

Conclusion

The results can be recommended for the improvement of existing and development of new advanced active safety systems for motor vehicles. The greatest demand for computer support system drivers can receive a collection service for cars and to increase the active safety of vehicles of senior government officials, diplomatic and peacekeeping missions, subject to state protection.

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SECTION 22. Policy. Innovations. Theory, practice and methods.

SOMETHING-STAN: THE STEREOTYPICAL REPRESENTATION OF KAZAKHSTAN IN INTERNATIONAL MOVIES VS. THE OFFICIAL NATION-BRANDING OF THE KAZAKH GOVERNMENT

Abstract: *This article critically examines and compares the representation of Kazakhstan in the framework of international popular culture and in the official Kazakh nation-branding strategy. The first section of this article reveals how European and American movies have regularly depicted Kazakhstan through stereotypes and labels. The second section critically evaluates western audience reactions by assessing movie reviews published in the Internet Movie Database (IMDb). The third section analyses the strategy adopted by the Kazakh government for shaping a positive image of Kazakhstan abroad.*

Key words: *Republic of Kazakhstan, popular geopolitics, movie representation, audience reaction, nation branding.*

Language: *English*

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Introduction: popular culture and geopolitics

Popular geopolitics firstly emerged in the 1990s as a branch of critical geopolitics, but only in recent years this area of research gained a more widespread consensus and thorough consideration in the academic field.

Popular geopolitics examines the way in which the world is depicted in various manifestations of popular culture (like, for example, books, movies, and video-games) with the objective of analysing how such narratives "might either reinforce or contest geopolitical images and or representations" [1, p. 74].

According to Gallaher, "representation constitutes the manner through which ideas, beliefs, values and images are both produced and provided with meaning" [2, p. 308]. In many cases, popular culture provides a fictional representation of a place by assigning to a geographical space an exclusive set of imagined features and values. But, a "place is also a way of seeing, knowing and understanding the world" [3, p. 11]. Therefore, by creating a common sense that induces people to associate certain images and meanings over places, such representations have concrete implications on people's interpretation of real events and their perception of global political spaces. Thus, "popular culture not only reflects but also *constitutes* world politics" [4, p. 19].

Moreover, representing a place is also a process that reveals "how we describe the Other-the peoples and places that are deemed fundamentally different than "us" [5, p. 156]. For instance, the representation of the world according to simplistic bipolar categories (such as, for example, good/evil, civilised/barbaric and friends/enemies) is often part of a wider political strategy aimed to strengthen the sense of identity of a specific community through a radical distinction between 'our' (positive and desirable) values and 'their' (negative and undesirable) values. According to Said: "It is perfectly possible to argue that some distinctive objects are made by the mind, and that these objects, while appearing to exist objectively, have only a fictional reality. A group of people living on a few acres of land will set up boundaries between their land and its immediate surroundings and the territory beyond, which they call "the land of the barbarians." In other words, this universal practice of designating in one's mind a familiar space which is "ours" and an unfamiliar space beyond "ours" which is "theirs" is a

way of making geographical distinctions that can be entirely arbitrary. I use the word "arbitrary" here because imaginative geography of the "our land-barbarian land" variety does not require that the barbarians acknowledge the distinction. It is enough for "us" to set up these boundaries in our own minds; "they" become "they" accordingly, and both their territory and their mentality are designated as different from "ours"" [6, p. 54].

For the recently independent countries of Central Asia, which are still wrapped in an aura of mystery for many people of the world, such representations have a strategic relevance. As stated by Stanley, "We live in a world where labels are powerful, whether used by citizens to identify themselves or to distinguish them from "others" around them" [7, p. 296]. Therefore, a positive image can strengthen the international political role of a country, support the development of new business opportunities by attracting foreign direct investments, and increase the number of incoming tourists. On the contrary, a negative representation risks to slow down its ambitious plans of development by holding it at the edge of the international networking.

The first part of this article aims to examine how Kazakhstan have been depicted in European and American movies of the last 20 years. Through the analysis of movies like "Air Force One" (1997), "The World Is Not Enough" (1999), "Rollerball" (2002), "The Cavern" (2005), "Borat: Cultural Learnings of America for Make Benefit Glorious Nation of Kazakhstan" (2006), and "Mercenaries" (2014), the goal is to understand what is the image of Kazakhstan fostered by these films.

But the relation between movie representations and audience reactions is sometimes controversial. As sustained by Dodds, "It is important to recognize that not only are films capable of being understood in radically different ways but also that different audiences exist in the first place" [8, p. 120]. Thus, the second part of this article extrapolates western audience reactions by critically assessing the movie reviews posted on the Internet Movie Database (IMDb).

The third part of this article briefly describes how the Kazakh political élites has progressively invested a consistent amount of resources in the development of a dynamic state-branding campaign aimed to improve the reputation of Kazakhstan in the world. Such process can be partially interpreted as a response to the stereotypical interpretation of Kazakhstan diffused by those movies mentioned above.

The last part summarizes key points and offers some critical conclusions.

The grotesque depiction of Kazakhstan in international movies

The international reputation of a country is the result of many top-down policies (how the government aims to promote its country "internally and externally") as well as bottom-up popular processes (the sum of all the representations offered in the various products of popular culture). In this section the attention will be focused only on one specific type of popular culture: movies.

Movies have the power to affect people's minds through the imaginative representation of places. Sometimes such representations are accurate and honestly reflect the core features of the depicted place. Other times, on the contrary, they offer more grotesque and stereotypical views. How to interpret such diversified outcomes is a complex issue because, as sustained by Ridanpää, "In many cases the products of popular culture contain political messages, but whether their intervening nature is acknowledged or not is a much more complicated issue" [9, p. 156].

In the last 20 years, few American and European movies have been set in Kazakhstan or have referred to the citizens of this country. Nevertheless, all of them have tended to offer a negative representation of this place.

The 1997 American political-thriller "Air Force One" follows a group of merciless terrorists who hijack the Air Force One to demand the release of Kazakhstan's authoritarian leader (General Ivan Radek), formerly arrested by a joint operation of US and Russian special forces. In one of the first scene of the movie, Kazakhstan is described by the US President (interpreted by Harrison Ford) as a war land where Radek's regime murdered over 200,000 people.

In the 1999 James Bond movie "The World is Not Enough" the plot is mostly set in Spain, Azerbaijan and Turkey, but for a while the action moves to Kazakhstan. In this short scene, the villain (Viktor "Renard" Zokas) easily steals a plutonium bomb from a former USSR military base in Kazakhstan, thus revealing a lack of security.

In the 2002 remake of the American science-fiction movie "Rollerball", the protagonist (Jonathan Cross, interpreted by Chris Klein) moves to Kazakhstan to play in the local team of Rollerball, a new extreme sport which combines handball, roller-skating and violent physical contacts. What emerges from this movie is a violent and corrupted society where few enjoy a luxury life, while most of local people live in poverty. The same sportive competitions are rigged by the owner-promoter of the Rollerball Championship (Alexis Petrovich, interpreted in the film by Jean Reno) to have spectacular accidents aimed to increase the levels of audience.

The 2005 horror movie "The Cavern" takes place in an unexplored cave of the Kyzyl Kum desert of Kazakhstan (but the movie was filmed in

California) and narrates how a group of speleologists is hunted and killed by a "strange creature". Although the references to Kazakhstan are limited, the evoked atmosphere is the one of an exotic location with dangerous-hidden mysteries.

In the 2006 British-American mockumentary comedy "Borat: Cultural Learnings of America for Make Benefit Glorious Nation of Kazakhstan" the producer and actor Sacha Baron Cohen proposes an even more grotesque representation of Kazakhstan. The entire movie turns around the story of the Kazakh report Borat and his travel to the United States. In one of the first scene, the protagonist briefly present his native village (but the scenes were filmed in the village of Glod - Romania), introducing to the viewer the local rapist, showing the local kindergarten where babies play with rifles, presenting the mechanic who is also the abortionist, exalting his sister as the fourth prostitute of whole Kazakhstan and revealing the interior of his house partially occupied by a cow. In the rest of the movie the protagonist repeatedly adopts an anti-Semitic, sexist and barely civilian behaviour. Due to its unpolitically correct jokes this movie generated many controversies and it was banned in Kazakhstan as well as in the entire Arab countries (excluded Lebanon).

The idea of Kazakhstan as an insecure and unsafe country is revived in the 2014 movie "Mercenaries". In this story a band of exclusively female mercenaries is formed to free the daughter of the US American president, who has been kidnaped by an insurrectionist group of Kazakhstan. In the movie, Kazakhstan is depicted as a failed state where violent warlords make money by selling weapons to Middle-Eastern terrorist groups and forcing local women to sexual-slavery.

In all these movies, the Republic of Kazakhstan is described as a decadent, dangerous and underdeveloped place. In these fictional representations, moreover, local authorities seem unwilling or incapable to face serious challenges like, for example, poorly controlled nuclear stocks, extreme social inequality and widespread violence. The citizens of these societies are sometime described as corrupted, cynical and opportunistic individuals, other times as caricatured figures still following a medieval style of life.

This speculative representation of Kazakhstan might be the result of multiple factors. First, this area of the world is still relatively unknown to many Europeans and Americans and, therefore, different movie makers have taken advantage of such condition for using Kazakhstan as background for different scenarios. Second, there are some common clichés about the Central Asian countries, including their "post-Soviet" label and a widespread (although deceiving) association between "-stan" states and war (diffused after the 2001 military intervention in Afghanistan), that have been exploited to frame various action movies' plots. Third, some movies have referred to concrete problems that have affected (or are still currently affecting) the Republic of Kazakhstan in the last decades. For example, the James Bond's scene depicting Kazakhstan nuclear disarmament makes reference to a concrete geopolitical issue. After the collapse of Soviet Union, the newly independent Republic of Kazakhstan had to deal with the USSR nuclear warheads dislocated in its territory. The government of Kazakhstan, finally, decided to return such weapons to Russia, dismantle the Semipalatinsk nuclear testing site and remove hundreds of kilos of highly enriched uranium (Project Sapphire) [10; 11].

Whatever might be the logical explanation behind such negative representations, the fact is they anyway create a narrative which:

- contributes, by stereotyping the 'others', to the "articulation and reproduction of *national identities*" [1, p. 75]. In the theoretical framework of "we" (western countries) and the "other" (Central Asian countries), these representations reflect what European and US societies supposed not to be (backward, corrupted, vicious, etc.).
- reflects "contemporary anxieties among western strategic planners about the role of regions like the Central Asia in the aftermath of the 11 September attacks" [12, p. 127].
- risks to generate political and socio-economic controversies by shaping a misleading image of Kazakhstan. For example, Saunders have defined 'irresponsible' Sacha Baron Cohen's verbal attacks against Uzbekistan during the marketing campaign of Borat [13, p. 73].

The international audience reactions on the Internet Movie Database (IMDb)

The section above provides a succinct overview of the representations of Kazakhstan in European and US movies. In order to understand how such movies shaped individual knowledge, however, this section examines the issue of audience reactions. The core objective is to realize what kind of message do people got watching these films being aware that, on one side, there might be multiple audiences [8, p. 123-124] and, on the other, the influence of media is conditioned by a range of personal and social factors (such as, for example, age, education and origin) [14, p. 98].

Addressing the audience reactions is a fundamental step in popular geopolitical analysis because "audiences have differing degrees and varieties of cultural capital, audiences create their own systems of meanings within a text, consciously and unconsciously, which may or may not overlap or

reflect that which it was originally intended to convey" [15, p. 1669]. Such argument is further sustained by Dodds: "A word of caution is due when considering the interpretation of films and their possible cultural and political influence (even though analysis of audience reaction may well be possible through audience surveys and film media critiques): there is no guarantee that the viewing public will adopt the meanings the directors and politicians have anticipated" [1, p. 83]. In other terms, the same movie might provoke diverse reactions in different social groups and people.

Following the example of other authors (like Dodds and Ridanpää) the Internet Movie Database (IMDb) has been used as archive for collecting empirical evidences on audience reactions to the movies introduced in the previous section.

As sustained by Ridanpää, movie reviews offer two set of information: "First, film reviews represent multiform and multi-voiced reflections on how people conceive their political environments. On the other hand, and of primary importance as concerns this paper, all film reviews function simultaneously as 'guide books' for the audience, offering multiple 'instructions', essentially implicit orders, about how to dissect the film in question and thus how to understand the political meanings related to it" [9, p. 144]. IMDb reviews, however, offer data about a restricted category of audience because most of internet (and IMDb) users are young, educated people mostly living in North America and Europe [8, p. 121].

Almost one hundred fifty thousand people have assigned an average mark of six point four stars on ten to the movie "Air Force One". Three hundred ninety-four IMDb users have also written a review for this film. Overall, many users have appreciated a good acting, but they have also raised many doubts about the credibility of the story (e.g. shootings and explosions in the airplanes do not cause sever damages, six terrorists defeat all US President's bodyguards, but then the US President alone-interpreted by Harrison Ford-is able to overcome them, etc.). Assessing the IMDb's comments also come out a certain confusion on the origin of the terrorists. Some users describe them as Russian, while others interpret them as Kazakh. The confusion is such that a user wrote: "for me the most glaring absurdities are in the geography: Kazakhstan is referred to as though it's part of Russia, not a separate republic".

Most of the geopolitical comments are associated with the stereotypical association "Russian language-bad guys" proposed in this movie. As a result, various users have defined this movie as a patriotic American film: "the entire thing seems to be a US propaganda movie, with the bad Russians and the good Americans". There are, on the contrary, few comments on Kazakhstan, but two of them are emblematic for this study. According to one reviewer: "A more interesting question is how did they pick up the villains? Kazakhstan rebels? A rouge group of Russians? This is rather retro stuff because absolutely nobody watching the movie knows or cares about Kazakhstan or its internal affairs. The simple fact is that viewers will see and hear the heavies speaking Russian and that will be enough for them". Another reviewer, on the contrary, affirms that this movie "conveniently ignores political reality", thus showing concerns about its oversimplification of world politics.

Around one hundred sixty-thousand IMDb's users have evaluated the movie "The World Is Not Enough" assigning, as in the previous case, an average mark of six point four stars on ten. Six hundred eighty-five users have published a movie review. Most of the users appreciated this movie, but there are also several ones who have criticised the script as excessively "action-oriented" as well as the casting choices (for many, Denise Richards does not fit well with the figure of a nuclear scientist). Being part of a saga, many reviews refer to earlier James Bond movies and they often compare the acting of Pierce Brosnan (James Bond), Sophie Marceau (Elektra, the fake-friend) and Denise Richards (Dr. Christmas Jones, the "Bond girl") to former interpretations.

Few and very shallow are the geopolitical comments of the IMDb's movie reviewers. This outcome might be related to the producers' decision to shift the scene in many different places with a resulting poor characterization of the explored locations. Still, a shared opinion among the reviewers is that the Kazakh scene and the Caspian setting were, overall, quite realistic. At the same time, as already explained by Dodds critically assessing James Bond fans, "there is clearly an expectation that James Bond will be *both* contemporary and also 'timeless'. In other words, it was considered ideal if the film [Die Another Day, the Bond movie released after The World Is Not Enough] touched in the lightest way possible on real-life events without actually being clearly situated or inspired by particular events" [8, p. 125-126].

Over twenty-two thousand IMDb's users assigned an average of three stars on ten to the sci-fi movie "Rollerball" and two hundred eighty-nine of them also published a movie review. Most of these comments are unenthusiastic criticisms to the film: the prevailing opinion is that this film is a pointless remake of the original 1975 movie "Rollerball", being characterized by a poor storyline, a weak direction and a terrible acting. Less than 10% of the total comments provide remarks over the geopolitical representations included in this movie. Compared to the original movie, which was set in a distant future, the 2002 version is set in contemporary (2005) Central Asia. Many viewers have expressed serious

doubts about such 'bizarre' choice and one of them interestingly stated: "This version is set in the present, but it tries to maintain its believability by locating the league in Southwest Asia, under the parochial assumption, I suppose, that that part of the world is every bit as alien, exotic and dehumanized as any hypothetical future society".

Other users expressed some concerns on how the story deals with the hidden political message. Many believe that the violent and corrupted context of the story (mostly settled in Kazakhstan and Russia) was a captivating narrative device which, nevertheless, had to be examined in more detail. One user wrote: "There was a vague lawlessness that I would have really enjoyed learning more about... people "disappearing," the criminal economy, the lack of respect for human life on the part of the Reno character...". Another one supported such view, affirming: ""Rollerball" is supposed to be talking about the corruption of human beings by an oppressive government. That message is lost here".

The general idea is that some of the problems revealed in this movie might be real challenges faced by Kazakh people. However, they are not examined enough deeper to get to any conclusion.

The horror movie "The Cavern" received an average rate of two point eight stars on ten and it was commented by eighty-nine reviewers. Most film reviewers harshly criticize several aspects of the movie: the story line is too simple, the actors are awful and the movie is, technically, shot badly. There are a few comments on the setting of the film in Kazakhstan, but all of them support a shared idea, which is well expressed by a user: "The movie opens with a suggestion that the scene is in the desert of Kazakhstan. I'm not sure why the picked Kazakhstan… But they should have just started inside the cave, because the outside was obviously not Kazakhstan". This comment reveals a basic geographical knowledge, namely that the 'jungle' shown at the beginning of the movie does not fit well with the users' image of Kazakh steppe.

The controversial movie "Borat: Cultural Learnings of America for Make Benefit Glorious Nation of Kazakhstan" was rated by over three-hundred thousand IMDb's users and it received an average evaluation of seven point three stars. The total number of users who commented the movie is one thousand two hundred one. These data reveal the massive public attention achieved by this film through its provocative, but well-structured marketing campaign. According to audience reactions, Borat is a movie that people loved or hated it. Some people saw in Borat the new frontier of comedy, while other have perceived it as an unsophisticated experiment based on "toilet" humour. As a result, over 90% of IMDb's film reviewers are equally split in two categories. On one side, there are those who perceived this movie as hilarious being able to break cultural taboo with an offensive, but smart humour. Generally, these people highly rated this movie with eight, nine or ten stars. On the other side, there are those who were shocked by the crude content of this movie and, therefore, defined it stupid, outrageous and disgusting. They poorly valued this movie with one or two stars. About the remaining 10% of users, mostly enjoyed the sense of comedy and timing of this movie, but they did not consider Borat a masterpiece or Sacha Baron Cohen a genius. Therefore, they rated Borat with six or seven stars.

IMDb's users have also expressed contrasting opinions on the geopolitical representations of this movie. Most of those who loved it believe that Borat is much more a severe criticism to the USA rather than an offensive attack against Kazakhstan. In other terms, while the representation of Kazakhstan is clearly fictional and the character of Borat is intentionally grotesque, the reactions of US citizens to Borat's racist and homophobic jokes reveal a genuine, but frightening image of US society. One reviewer commented: "The movie does not make fun of Kazakhstan, it makes fun of Americans, in a criticizing way. Kazakhstan is merely used as a platform to show the (of course exaggerated) contrasts between the advanced and 'civilized' America and the simplistic Kazakhstan and how a simplistic man, from such a simplistic place, such as Borat Sagdiyev (Sacha Baron Cohen) is capable of pinching right through the advanced and civilized Americans and puts his finger right on the spot". Sacha Baron Cohen's movie, therefore, does not really target Kazakh people but, as wrote in another comment, it simply exploits "the fact that average Americans don't even know where Kazakhstan is".

Still, several users have contested the decision to describe Kazakhstan in such paradoxical and ridiculous tones. Most of those who poorly ranked Borat (but also some of those who liked it) offer moral sustain to the protests of the Kazakh government against the release of this movie. These users remark the overall lack of references to real Kazakhstan: for example, the language spoken by the protagonist is not Kazakh, the village shown at the beginning of the movie is, actually, in Romania, and most of the stereotypical representations offered in the movie have no relations with Kazakh customs and traditions. Thus, one film reviewer asserts that "a make-belief country could have easily been done with instead of having to offend an already existing country".

But the core question is whether Borat's grotesque representation of Kazakhstan could be interpreted as realist by the audience. Once more, the opinions expressed by IMDb's users are contrasting. One user, for example, writes that "anyone who knows and understands this film actually sees Borat as a character or anyone remotely real", while

another user argues that "Central Asia remains, for most people, not an identifiable place, but a blank space that can easily be filled with the fears, fantasies and prejudices of film-makers and audiences". Critically assessing the IMDb's reviews on Borat, it seems that a tiny minority (less than 1% of users) have interpreted the movie as a faithful representation of Kazakhstan and its citizens. IMDb's users are, however, just a narrow and specific category of movie watchers. Therefore, the impact of Borat on people's geopolitical imagination might be much more widespread. One Kazakh lady I personally interviewed, for example, told me that, during a research period in Europe, she was addressed as liar when she claimed to be from Kazakhstan because, according to the accuser who confidentially referred to Borat, "Kazakh people are not Asian".

About the Kazakh official response, Dittmer reports that "when Kazakhstan protested its treatment as an anti-Semitic and misogynist country in *Borat: Cultural Learnings of America for Make Benefit Glorious Nation of Kazakhstan* (2006) it was publicly scorned by the American public. However, the president of Kazakhstan, Nursultan Nazarbayev, paid for an advertisement in the *New York Times* and subsequently flew to Washington D.C. to meet with President George W. Bush in order to foster a more "authentic" image for his country" [5, p. xvii]. Nevertheless, after an initial aversion the establishment of Kazakhstan realized that it could be more beneficial to exploit the momentum because, although the movie offered a deformed and unrealistic image of Kazakhstan, still it placed 'Kazakhstan on the map' [16]. As highlighted by Saunders, "the ensuing controversy promoted tourism to Kazakhstan… Many young westerns realized that Baron Cohen's Boratistan was purely a plot device for his strange brand of humour, and wished to learn more about the real Kazakhstan" [13, p. 70].

Finally, the movie "Mercenaries" received an average rate of three point eight stars and it was reviewed by twenty-five users. Mostly the movie is criticized for its low budget, the scarce acting and its unsophisticated plot. Essentially, it is interpreted as the mock buster version of the film "The Expendables". But, in the view of different reviewers, the scenario is unbelievable and the representation of the Central Asian context is completely wrong.

Overall, most of the IMDb users seem to watch movies for pure enjoyment, without being particularly interested in the assessment of the political reality they show. Therefore, their comments are mostly focused on the credibility of the plot, the quality of acting, and the director's technical skills. On the base of such parameters they tend to value the movie and compare it with other titles of the same genre. The number of people who proposed some critical reflections on the geopolitical representations offered by these films is much more restricted. Most of them are rather able to distinguish between stereotypical and realistic narratives, but some viewers still have a predetermined and blurred image of Kazakhstan.

Moreover, although for each of the considered movies it was possible to identify a dominant interpretation, a diversified range of feelings and reactions characterized the IMDb movie-reviewers' community. Such diverse response in front of the same product can be explained considering that "media is neither static as it is believed to be, nor the audience a fixed or passive receiver of messages" [17, p. 8]. In other terms, the cinematic experience of a viewer cannot be decontextualized from his/her educational background (here interpreted as the whole set of knowledge and memories gained, intentionally or accidentally, by a person during his/her entire life) and, therefore, "the same messages are "downloaded" and interpreted with different effects by different receivers in different settings" [18, p. 44].

The official response of Kazakhstan: re-shaping the international image of the country through nation branding

European and US movies have mostly offered a negative representation of Kazakhstan. But for newly independent post-Soviet countries the creation of a positive reputation in the international framework is a key asset that may "facilitate their entrance into favored economic or cultural alliances." [7, p. 299].

Nation branding can be defined as "the unique, multi-dimensional blend of elements that provide the nation with culturally grounded differentiation and relevance for all of its target audiences" [19, p. 15]. In other terms, as sustained by the Kazakh Minister of Information and Communications, Dauren Abayev, "A country brand is not just a logo, but a state's large-scale image strategy that is oriented at being positively positioned in the eyes of the international community" [20].

In the last twenty years, the government of Kazakhstan has attempted to create an appealing and trustworthy nation-branding, which might sustain its ambitious political goals. But, as stated by Saunders, "While older countries enjoy well-established national images at home and abroad, the past century has seen the emergence of roughly one hundred new nations that face a double challenge. They are charged first with crystallizing a coherent national image in the domestic realm, and second with transmitting a positive image of their country to the world community" [13, p. 65].

At national level, the Kazakh government faced many challenges in the development of a collective national identity as well as in the consolidation of

state legitimacy. As for the other Central Asian countries, Kazakhstan had "little history of independent statehood and even less experience of any ideological context that legitimizes a specific set of political arrangements, other than the discredited Marxist model of the Soviet system" [21, pp. 135-136]. In response to such difficulties, the other Central Asian countries have identified a sense of identity in the framework of ethnicity and religion. But, in a multi-ethnic society like Kazakhstan, such approach could result problematic. Therefore, the Kazakh government attempted to promote both an exclusive ethno-centric narrative as well as an inclusive civic Kazakhstani identity [22, p. 400].

At international level, the problem was to construct a new image of independent Kazakhstan. If with Borat many people in the world became aware about the existence of this country, the new challenge for the Kazakh government became to deconstruct such grotesque representation and promote a more realistic and welcoming reputation. For such an aim, the Kazakh government decided to operate on multiple fronts in order to target the "three broad groups of international audience: businesses, politicians and tourists" [23, p. 1125]. The embraced policy includes: accurate marketing strategies, massive investments in successful projects, international activism, local movies production, support to exchange programs abroad, and the progressive removal of barriers for travelling to Kazakhstan.

In the course of the years, the Kazakh government has elaborated an articulated marketing campaign with the aim to internationally promote Kazakhstan as a land of great opportunities. The Kazakh national slogan "Kazakhstan, the Heart of Eurasia", for example, highlights the core geostrategic position of this country and its role as bridge between European and Asian markets. Another example is the reference to the "Eternal Land" (Mangelik Yel), which reflects the ambitions of Kazakhstan to preserve its independence, while further strengthening intercultural harmony in order to build "a happy country that allows its citizens to have fulfilling lives and to look at the future with faith" [24]. Likewise, the catchphrase of Astana, "where the dreams come true", symbolically refers to the historical evolution of this futuristic city (Astana became the capital of Kazakhstan only in 1997, after a rapid and massive process of urban development) as well as to the multiple life prospects offered by this new Central Asian hub. All these labels intend to emphasize the fundamental values, beliefs and prospects of the Republic of Kazakhstan, such as interculturality, unity and progress. As the member of Majilis (lower house of the Kazakh Parliament) Talgat Yergaliev affirmed "We, Kazakh people like positive energy, believe in good names and title" [25].

The Kazakh government has also devoted many resources to the development of international top-leading institutions operating in various areas. Some examples are the Nazarbayev University (founded in 2010, this institution is nowadays one of the main educational center in Central Asia), Air Astana (since its foundation, in 2001, the main Kazakh airline has significantly grown so that the 2016 Skytrax World's Top 100 airlines places it in 43rd position) and the Astana Pro Team (a professional cycling team that, since 2007, has won some of the most important international competitions included Tour de France, Giro d'Italia and Vuelta a España). In addition, large-scale investments have been directed to expand industrial innovation through the "2010-2014 National Programme of Forced Industrial and Innovative Development of the Republic of Kazakhstan" and the "State Programme of Industrial-Innovative Development 2015-2019" [26]. According to Aben, "the proactive position of the government is aimed at boosting economic development in order to provide a solid basis for its successful branding" [27].

In the last years, international activism has been the leading strategy to promote in the world Kazakhstan's stable society and developing economy. Among the most important events hosted by Kazakhstan there are political summits (like the 2010 OSCE chairmanship), sportive competitions (such as the 2011 Asian Winter Games and 2017 Almaty Winter Universiade) and economic exhibitions (as EXPO 2017). As reminded by President Nazarbayev, "Kazakhstan is the first-Soviet country to chair the Organization for Security and Cooperation in Europe and to host the OSCE Summit, and will now be the first to host EXPO 2017 – a world-class event" [28]. Such policy of active participation in the international framework has achieved its peak in January 2017, when Kazakhstan occupied a seat as non-permanent state within the United Nation Security Council.

Since the creation, in 2005, of the Kazakhfilm joint-stock (in which the government holds the largest share) movies have also been used in the nation-building process as well as in the international promotion of Kazakh nationhood. As sustained by Isaacs, "the constant repetition of 'national' signs through the medium of cinematic works can contribute to the shared imagination of history, tradition and nationhood which allows nation-states to sustain themselves over time" [29, pp. 138-139]. In general, Kazakhstan has disseminated "similar narratives for both domestic and international audiences" [23, p. 1123]. Governmental-sponsored movies have primarily sustained a binary representation of Kazakhstan: their goal was to strength the Kazakh national identity, meanwhile supporting the reputation of Kazakhstan as an open, friendly and multi-ethnic society. The blockbuster

movie *Nomad* (2005), for example, follows an ethnic narrative aimed to emphasize the historical roots of Kazakh nationhood and to strength the sense of patriotism, while the film *The Gift for Stalin* (2008) offers a more civic-line narration aimed to depict Kazakhstan as a tolerant and hospitable country [29, p. 146 *et seq.*]. Despite the parallel rise of counter-narrations in local independent movies, this strategy seems successful. A 2011 survey reveals that people of Kazakhstan identify with citizenship (56%) and nationality (26%) their most relevant affiliation, thus "nationality and poli-ethnicity can be laid in the foundation of formation of positive political brand of the country, because they are the basic elements of identification of the people of Kazakhstan" [30, p. 160].

The educational sector has also been considered as a fundamental asset to improve the reputation of Kazakhstan in the world. In 1993 the President of the Republic of Kazakhstan, Nursultan Nazarbayev, introduced the "Bolashak Programme", a governmental scholarship awarded to those excellent students wishing to improve their skills through a studying/professional experience abroad. The scholarship fully covers all study related costs, but it requires that, after the completion of their studies, the awarded scholars would return to Kazakhstan to work for at least five years. To date, several thousands of students have made request and received this grant. Moreover, since 2005, the Kazakh government has increased the investments in this initiative and it has also extended the opportunity to receive the scholarship to government officials, academic and teaching staff, technical workers and medical personal. Overall, the "Bolashak Programme" primarily offers the opportunity to train Kazakh people in high-demands fields at world's top universities. But, making travel out of the country the most talented people of Kazakhstan, it also "has a significant influence on the creation of a positive image of the Republic of Kazakhstan, both within the country and abroad" [31, p. 284].

Finally, in summer 2014 the Kazakh government has unilaterally removed the touristic visa requests for the citizens of different western countries. Such policy has been further strengthened in the last two years so that, since January 2017, the citizens of 45 countries now enjoy a 30 days' visa-free regime (without considering those states like, for example, Russia, Kyrgyzstan and Georgia, which signed bilateral agreements with Kazakhstan for visa free-regimes up to 90 days). These measures should increase the tourist flows, especially in relation to EXPO 2017, thus allowing Kazakhstan to exploit more the word-of-mouth as mean of advertising.

Conclusions

Movies are powerful, but ambiguous tools for constructing geopolitical knowledge because they risk to promote misleading stereotypical interpretations with direct consequences on real-life political actions. Perhaps, as suggested by Dittmer, "What we need is an entertainment industry that is merely socially aware, and does not resort to unsubtle processes of Othering and fear" [5, p. 162]. But, at present, this is a hardly achievable wish.

This article reveals that there is a huge gap between the image of Kazakhstan passed by European and American movies and the one officially promoted by the Kazakh government. International movies have depicted Kazakhstan as a dangerous land, where corrupted and cynical individuals take advantage over a poor and backward population. On the contrary, the Kazakh government has officially presented Kazakhstan as a stable, reliable and friendly country, which is rapidly evolving from a socio-economic perspective, but it is also deed in the preservation of its customs and traditions.

For Kazakhstan, the positive note is that IMDb reviewers have shown a certain awareness to distinguish between fictional and realistic representations. However, there are no evidence to sustain that this consideration might be extended to the whole audience and, in addition, there might be some undesirable side effects associated with a repeated negative representation (e.g. underestimation, misconception and erroneous pessimistic connotation of the country's values). Further studies in this field are certainly required because "modern information and communication technologies open up new gates into the subject of 'audience' and necessitate new ways of investigating, contextualizing and interpreting audiences". [17, p. 8].

The negative note is that the image of Kazakhstan abroad remains blurred and the Kazakh national branding policy is still far from achieving its ambitious goals. This evaluation seems confirmed by the 2014-15 Bloom Consulting Country Brand Ranking (Tourism Edition), which places Kazakhstan only in 85th position worldwide and 26th among Asian countries, the 2017 Bloom Consulting Digital Country Index, which places Kazakhstan only in 96th position worldwide and 29th among Asian countries, and the 2016 Reputation Institute's Most Reputable Countries, which positioned Kazakhstan among the group of countries with a weak or vulnerable reputation [32; 33; 34]. Other consulting companies have offered a more optimistic assessment of the Kazakh national brand. According to the Brand Finance's ranking "National Brands 2016", for example, Kazakhstan is placed in 47th place (although it lost 3 positions compared to 2015) [35]. Still, Kazakhstan is ranked behind countries like Colombia, Nigeria and Bangladesh.

These results do not imply that the Kazakh official strategy has been unsuccessful. Nation

branding is a long-term process that need to be regularly sustained and renewed before giving some relevant outcomes. Therefore, the measures adopted till now by the Kazakh government must be interpreted as the first steps in a long path. Nevertheless, there are at least two improvements that the Kazakh government should introduce in the next future. First, as sustained by Beyzhanova and Rysbaeva, "to date, Kazakhstan belongs to a few recognizable country brand. The main reason is the lack of systemic work on the formation and development of country brand in Kazakhstan" [30, p. 162]. Therefore, a more consistent representation of Kazakhstan, sustained and jointly supported by the different agencies of the Kazakh government, is a required step toward the affirmation of the Kazakh nation branding. Second, a successful national image "cannot be separated from the processes taking place inside the country" [23, p. 1128]. If the Kazakh government wants to improve its reputation as a stable and peaceful country than it must further proceeds with the recognition and enforcement of political rights at national level. Otherwise, news like, for example, the sentencing to five years' imprisonment of Max Bokayev and Talgat Ayan for the organization of peaceful protests in April 2016, which has been recently condemned by the EU spokesperson, risk to drastically undermine the image Kazakhstan as tolerant state [36]. While the construction of a deep-rooted positive reputation abroad is a hard and time-consuming process, the blast of a scandal may be enough to reverse any efforts made in the previous years. This is especially true for the newly independent countries like Kazakhstan that still do not have a clear representation in the collective imaginary of the western world.

Still, if Kazakhstan will correct its nation branding strategies according to the suggestions here remarked, there are all the essential conditions to gain public recognition in the international context. This condition will not necessarily constrain the cinematographic representations of Kazakhstan in grotesque terms, but it will certainly make the audience more aware about the values and traditions of the Kazakh society.

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GIF (Australia) = 0.564	ESJI (KZ) = 1.042	IBI (India) = 4.260
JIF = 1.500	SJIF (Morocco) = 2.031	

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SECTION 24. Sociological research.

SOCIAL NETWORK SITES: ORAL PERFORMANCE OF EFL LEARNERS

Abstract: *Social Networks are Web-based services that allow people to construct a public, or somewhat public, profile. Social networking can sometimes result in negative outcomes, some with long-term consequences. There are millions of people on the internet who are looking to meet other people and to gather and share information and experiences on a variety of topics. The growing popularity of social networking sites (SNS) among the Internet users demands an introspection of personal and social behavior of human beings. The present study was set out to investigate the effect of social hubs on improving EFL learners' speaking skill. The participants of the study were 42 female students between the age of 17 and 25. They were randomly assigned to two groups of experimental and control. Each group consisted of 21 participants. An Oxford Placement Test (OPT) and the pre-test were administered to both groups at the beginning of the study. The treatment lasted 4 weeks and it was held in a private institute in Rasht, Iran. The experimental group was allowed and encouraged to use social channels in addition to the traditional class activities. Further, a course of communication on social networks was administered to the experimental group while the control group attended the traditional regular classes and they were not allowed to use computers for communication. In the end, the post-test was administered to both groups. The findings displayed that social networking had a positive impact on speaking ability of Iranian EFL students.*

Key words: *Speaking ability, Social channels, Social Networking Service, EFL Learners.*

Language: *English*

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Introduction

The intensification of the internet age has enabled us to live a life at a faster hop. The younger section of society like children, pre-teens and teens accounts for a very large portion of the internet populace. Online Social networking is a type of virtual communication that allows people to connect with each other. This concept arises from basic need of human beings to stay together in groups forming a community. Innovative and pedagogically effective ways to improve language learning include instructional uses, students' perceived learning gains, instructors' use of the technology, social impact and economic viability for use by the students (Facer & Abdous, 2011).

Online Social Networking

Boothby (2006:1) argues that today's knowledge worker can work efficiently in large virtual teams, and social networking sites create such an electronic platform. Wenger (2004:2) and Bryan, Matson and Weiss (2007) concur and add that groups of people, who interact regularly, such as virtual teams, are bound to improve their skills through knowledge sharing. Therefore, notice should be taken to knowledge workers of today who not only function efficiently in large virtual teams, but thrive in such an environment to an extent where they advance their knowledge sharing skills. If knowledge sharing can be increased by a virtual CoP, then social networking sites may prove to be the catalyst to promote interaction (Boyd and Ellison, 2007:211; Ryberg and Larsen, 2008:103−115). Considering the potential of virtual teams interacting within a CoP by utilizing the OSN platform, the effect may be an increase in productivity of those employees who actively search and employ their list of contacts as well as others' linked-in profiles and their contacts and by updating and growing their own list of contacts. If these 'connected individuals' spend time interacting with

other individuals who possess knowledge about the relevant working environment, increased knowledge sharing is likely to take place.

Positive Effects of Social Networking

We can access information in better way. People who have a childhood and pubescent life minus the internet are faced with the difficulty of getting access to vital information and knowledge they need for education. This means that when you need to do research on something, you have to spend tons of effort and go miles in order to find books, periodicals, and other paper sources just to get started. Additionally, you may also need to conduct interviews and surveys so as to get more information about a certain issue you're tackling. But with the birth of the internet, every single bit of information or knowledge a child or teen needs to learn is compiled in a very large library called the World Wide Web. With social networking, research is a thousand times easier and getting the information you want may be done in minutes. Social networking provides interactive involvement with other peoples. Social networks function in the online environment through social networking sites, that is, technology that allows people to set up profiles, link to other individuals' profiles and view, navigate and interact with others in the social network. Lange (2008:361) views the linking of profiles together with the ability to view the resulting connections on others' profiles as the most tangible mechanisms reflecting existing social networks. Boyd and Ellison (2007:211) add that this technology allows people to articulate their relationship to others in a way that is visible to anyone who can access their profile. Being linked or connected to others can lead to potential benefits such as improved collaboration and information sharing, greater productivity and enhanced communications among coworkers, business partners and customers. In this environment, individuals know who knows who, what each member is currently involved in and how they can be reached. In short, OSN provides a simpler and more intuitive approach for members of the same community of employees to find each other based on complementary knowledge or need for knowledge.

Statement of the Problem

In Iran as most of the policy makers' focus is on the regular classroom activities, they have ignored the role of students' activities at home and environment. Students are making a huge revolution to become a member of a social network in order to communicate with others. As the students communicate through social networking, they make progress in many abilities. Further, the social networking in the near future might become the main channel to communicate for most of the people all over the world. Moreover, education and training through the Internet is becoming more obvious and common in the world. In many developing countries as well as in Iran, colleges are being interested in online training. They attempt to absorb pupils to use the Internet to perform their training process. The academic institutions need to devise appropriate policies and strategies on how they can utilize social networking sites to support education and learning beyond the classroom. Rubin (1987) believed that communication strategies are less directly related to the learning of language and are used more for the aim of communicating; therefore, they are not listed under learning strategies in her classification. Hence, there is the need to fashion out some means of selecting and using the right social networking site responsibly. This study is concerned with the trend of use of the sites, what benefits students derive from using the sites, the dangers associated with them and ways to avert such dangers. Despite assumption that the lecture is cohesive and consistent to all attendance, exchanging ideas, sharing knowledge, and expanding understanding is very required outside the classroom boundaries. Here, the part of sharing and cooperating activities among students and between students and the lecturers appear to be very urgent. From this point, social networking sites appear very helpful in building academic groups to achieve better academic learning and communication. It is then, the purpose of this study to provide a better understanding of how students are investing their skills, time, and willingness in using their Social Networking (SN) sites for better academic achievements and to examine factors affecting their use.

Research Question

Based on the above mentioned problem, the researchers tried to answer the following question:

RQ: Does social networking have any effect on the speaking ability of Iranian EFL learners?

Methodology

Participants

This study was conducted with the participation of the students from a private institute in Rasht, Iran. There were 21 female students in each of the experimental and control groups; they ranged in age from 17 to 25. The sample of this study was chosen from among 62 private institute EFL students. The institute was chosen because it is equipped with many facilities, such as language labs and internet access. To provide at least half of the students with the Internet is one of the vital requirements for conducting the present study. Among the whole

population of the experiment, those who obtained one standard deviation below and above the mean were selected. 42 students had the criteria to participate in the study. In order to divide students into the experimental and control groups, the computer randomized procedure was employed. According to the process of randomization, 21 students were chosen to be in the experimental group and the rest were the control group.

Instrumentation

Oxford Placement Test (OPT)

This test was administered to determine the language proficiency level of the participants and classify them into the sample. This test consisted of 60 items which was developed by Oxford University Press and University of Cambridge Local Examinations Syndicate. OPT test was used to specify the sample of the experiment among 62 available students in the private institute in Rasht.

IELTS Speaking Test

The sample IELTS speaking test from the book 'prepare for IELTS' written by Cameron and Todd (2005) was used. This test was considered as pretest and post test of the study.

Treatment

In order to investigate the effect of social networking on speaking ability of the students, the researcher made a forum in WWW.Google.com sites. And asked the participants of experimental group to sign up there and became a member of it. The duration of treatment was lasted for three months. In fact two weeks (6 session) for 30 minutes in every session, participants join to the forum and communicate there with their classmates. They discussed together and shared the information. Every session they had a specific topic. Moreover, they were instructed by traditional methods of class too. The control group did not receive any treatment. The participants learnt the lessons through traditional method of teaching.

Procedure

In order to determine the role of social hubs on the speaking ability of students, Oxford Placement Test was administered among 62 EFL learners out of whom those whose scores were between one SD below and above the mean were selected for the study. The participants were assigned in to two groups randomly. After the pre-test, learners received the instruction based on the materials covered in the class. There wasn't any control on the gender. Their age was ranged from 17 to 25. Then the pretest of speaking from the book" prepare for IELTS' written by Cameron and Todd (2005) was used. This test was repeated for the post test of the study too. For three months experimental group participate in the forum and tried to communicate base on specific topic for every sessions. It took 30 minutes for every session. And the control group did not receive any kind of treatment. They were followed traditional method of teaching in class. At last the post test of ILETS Speaking was administered in order to observe the differences and developments.

Results

In order to have homogenized participants in terms of their general English language proficiency, the Oxford Placement Test was administered. The descriptive statistics for the OPT test are displayed in following table.

Table1

Descriptive Statistic for OPT Test.

N	Mean	Median	Std	Variance	Min	Max	Max
Valid	61.315	62.000	9.6304	144.257	35.00	91.00	38.00
Missing	0						

Out of 65 participants, 42 were considered as homogenous members based on one SD above and one SD below the mean. Figure 1 below shows the histogram for the OPT test. Before working on the research question, it should be mentioned that the speaking test section was rated using two raters holding M.A. in TEFL. Table 2 below shows the inter-rater reliability.

Table2

Inter-rater reliability Between the Two Scores.

Cronbach 's Alpha	Cronbach 's Alpha Based on Standardized Item	N of Items
.785	.818	2

As it can be seen in table(2), the inter-rater reliability index is .785 which shows high reliability between two scorers. In order to answer the question of the study, an independent sample test was run to compare the scores of students in the experimental and control group. The data revealed that there was no significant difference between the speaking ability of the two groups.

Table (3) shows the descriptive analysis for the pretest and posttest of general English in the experimental group of the study:

Table3

Descriptive results of the experimental group of the study.

	N	Mean	Std. Deviation	Std. Error Mean
Pre-test	21	15.2343	1.52120	0.40024
Post-test	21	17.6011	1.02150	0.34773

As it is indicated in table (3) the number of participants has been 30 in each experiment (N=21). There has been no missing value which shows all selected students took part in the experiments of the study. The mean for the pretest scores of general English exam in the experimental group was shown to be 15.2343, as compared to the mean for posttest scores in the same group which was 17.6011.As for the standard deviations obtained for the experimental group, there seems to be more variability among the pretest scores than the posttest. This confirms that group work learning led to better achievement and was effective in better learning. This may demonstrate the participant's posttest scores are more homogenous after conducting the treatment of the study. The same descriptive analysis has been done for the pretest and posttest of general English in the control group of the study. As you can see in table (5) below:

Table 5

Descriptive results of the control group of the study.

	N	Mean	Std. Deviation	Std. Error Mean
Pre-test Cont	30	15.0333	1.09807	0. 2415
Post-test Cont	30	15.0542	1.07425	0.1961

Table (5) shows that the number of participants has been 21 in each experiment (N=21), and there has been no missing value. The mean for the pretest scores of general English in control group was shown to be 15.0333 as compared to the mean for the posttest scores of the same group which was shown to be 15.0542. As for the standard deviation obtained for the control group, there seems to be more variability among the pretest scores in the poet test.

Inferential Analysis of the Data

This part focuses on the inferential analysis of the obtained data of the study. Such analysis was done using the SPSS (Statistical Package for Social Science) from which the compare mean, In dependent sample test were selected for calculating the T value.

Table6

Independent Samples T-test results of the study t-test for Equality of Means.

	Levene's Test for Equality Variance		**T-Test for Equality of Mean**						
	F	**Sig.**	**T**	**df**	**Sig.(2-tailed)**	**Mean Difference**	**Std. Error Difference**	**95% Confidence interval of the Difference**	
								Lower	**Upper**
Writing Equal Variances comprehension	0.000	0.756	0.079	58	0.0093	0.5556	.69923	-1.36545	1.47657

assumed						
Equal Variances not assumed		0.0093	0.5556	.69923	-1.36555	1.47666

Table (6) shows that the observe T-value of the study was calculated as to be (4.3, 4.2) and the degree of freedom was (58). The level of significance was calculated as to be 0.000. In each group of the study, the results have been illustrated in the table (4.4).

Table7

Paired Sample results of the study.

	Observed T	Critical T	df	Sig. (2-tailed)
Pre-test Ex- Post-test Exp	4.541	3.045	33	0.089
Pre-test Cont Post-test Cont	0.817	0.905	29	0.042

According to table (7), the covariance between the two sets of pretest and posttest scores in the experimental group is 4.541 while it is 0.817 in the control group of the study. The critical T in two groups is different. The hypothesis of the study which aimed the effect of social network on Iranian EFL learners ' oral performance was rejected. Because observe T is bigger than the critical T. And the level of significant is 0.05.

Discussion

Social networking sites are already widely-spread and are here to stay. Nevertheless, it is still a rather young phenomenon and by far not at its end of development. On one hand, we have to deal with rather new communication and interaction patterns with which many users still have to get familiar with and to find its added value in the long term. On the other hand, the respective 'tools' and the technical platforms, are by far not really mature and stable yet. In addition, the regular changes of the existing features, e.g. on Facebook, strategy modifications, e.g. at Twitter, as well as the emergence of new platforms may be interpreted as the platforms' search for their position and sustainable business model. Most of the social network users are young individuals most of whom are university students. Hence, social network sites are considered to play an active role in younger generation's daily lives (Lenhart, 2009; Koca 2009). The finding of this study is in line with the results obtained by Rambe (2011). In line with the finding of Rambe (2011) who worked more specifically on the influence of social networking services on power lecture, this study was engaged more with the influence of SNS on a language skill. More consistently, Clark and Gruba (2010) obtained the same results as the present study. They claimed that using social networks is one of the effective ways to enhance foreign language learning. These findings are the same with the research conducted by Kirschner and Karpinski (2010). Their experiment illustrated that there is a direct relationship between social networking site usage and the progress in academic performance of students. Among the 148 university pupils, it was concluded that Facebook users not only had a much lower Grand Point Average. Nevertheless, other studies such as Cohen (2007) showed completely opposite results. His study has been unable to prove any connections between GPA and SNS wide usage. According to the findings of the study done by Naditz (2009), there are numerous apparent advantages based on her experiences with integrating social networking sites in foreign language classrooms. First, using social networks tend to have a significant impression on language learning. The second benefit is that it helps students engage with peers in a familiar way and for academic purposes. More significantly for language learners, it provides opportunities for informal conversations in the target language. Further, Hung and Yuen (2010) pointed out that educational usage of social networking websites indeed positively affects educational performance of the students. Like study it was concluded that social networking affect students' oral performance. Further, a study conducted by Stanciu, Mihai and Aleca (2012) described the social networking as an alternative environment in which the students at higher levels of education develop their knowledge. The same results were also concluded by the present research.

Conclusion

Technology is a double-edged sword. Its power for bad and good resides in the users Baran (2010). Based on this, it is instructive to note that the relevant government authorities and other sponsors of the students have to take good measures to ensure

that they (student) are made to be aware of how and why they use the social networking sites. Social networking is a phenomenon which has existed since the beginning of societies. Social networking provides a comfortable interface for speakers as students, collogues and teachers. There are a number of ways to use social networking Web sites to encourage EFL learners to listen and to produce their own materials to share on the Internet. This type of activity used to be very difficult to integrate into EFL lessons due to costs and technical limitations; however, these barriers have slowly been fading, and it is now possible to use these online tools to improve students' English ability. This is useful, but challenges remain. There is a certain amount of time needed for teachers and students to learn how to use Web 2.0 technology. Even if one is familiar with computers, there is still a need to learn how to use software, to search for podcasts, and set-up accounts with social networking Web sites. Additionally, the privacy issues of using social networking are a cause for concern. The security and privacy requirements of these sites are complicated and not well understood or defined (Ahn, Shehab, & Squicciarini, 2011). Thus it may become necessary for teachers to become knowledgeable in security policies on the shared data of students.

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SECTION 20. Medicine.

FEATURES OF PSYCHO-EMOTIONAL CHANGES IN WOMEN DURING PREGNANCY

Abstract: *The special features of psycho-emotional changes in women during pregnancy is examined in the article. Violation of mental adaptation during pregnancy is multifactorial education associated with clinical manifestations and characteristics of the individual, different psychosocial characteristics.*

Key words: *pregnancy, psycho-emotional changes, mental adaptation, psychological prevention.*

Language: *English*

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Introduction

Emotional changes are detected in 80% of pregnant women, and 56% of them are depressive disorders of varying severity [7, p. 107; 9, p. 9]. The results of overseas epidemiological studies depressive disorders are recognized as the most frequent neuropsychiatric disorders in pregnant women [2, p.27; 10, p. 130]. Emotional disorders increase the risk of developing complications of pregnancy, have a dysfunctional impact on the social functioning of women [6, p.20; 8, p. 64]. It is established that the incidence of depressive disorders is increased in pregnancy, in adolescence and early adolescence and in pregnant women with low socio-economic status [1, p.18]. Despite the high prevalence of mental and emotional changes in pregnant women, a larger number of cases are undiagnosed [3, p. 184; 4, p. 260].

The aim of the study was the identification and definition qualitative originality of psycho-emotional disorders in women during pregnancy, the study of the factors influencing their formation, with the aim of developing the earliest methods of psychological prevention and correction of psycho-emotional changes of the pregnant woman.

Material and methods: During the research on identification of stress factors in pregnant women were examined 48 nulliparous women and 22 women who already had children. They were offered a questionnaire compiled on the basis of structured interviews with pregnant women, where women answered questions about the duration of pregnancy, desire of pregnancy, family relationships, his health, emotional state, experience the fears, the plans associated with the child and the future life, the idea of childbirth and the postpartum period. To determine the level of anxiety in nulliparous women was the technique used for the measurement of personal and situational anxiety Ch.D. Spielberg - Yu.L.Khanin, to determine the level of anxiety (low, moderate, high).

Results and discussion: According to the study of anxiety level among pregnant women, you can see that among pregnant women who participated in the study, women with the same level of anxiety as high occur equally frequently among both nulliparous and multiparous women. The patient complained of decreased mood, joined, or with which was combined the anxious feelings and fears of the challenges ahead, dangers and changes of life. Alarming experiences, were mainly presented as alarming gipotonii, that is, reduced mood, associated with anticipation of danger (in the course of childbirth, impending motherhood, etc.). Fears pregnant women wore dominant character. They were connected with the real situation that prevailed in the mind, displacing all other thoughts, and prevented focus on current activities.

In nulliparous pregnant women during the first trimester of pregnancy, most often a moderate level of trait anxiety (53.5 per cent). 17.8% of cases noted

high level of personal anxiety and 28.6% of cases low level of personal anxiety. In the second trimester of pregnancy, a moderate level of trait anxiety was observed in 64.2% of cases, there was an increase in the number of cases with high anxiety of 21.4%, a low level of personal anxiety was found in 14.2% of cases. A high level of personal anxiety was manifested in emotional discomfort (83,4%), asthenia (78,8%), feeling strange threats and insecurity, anxiety evaluation perspectives (63,4%). In nulliparous women personal anxiety wore irrational. The alarm had real events or circumstances. Women themselves has described as a sense of inner tension, which is present either constantly, or as it were "rolled over" unexpectedly and lasted for various periods of time. In the third trimester of pregnancy low levels of personal anxiety were not recorded, there was a significant increase in the number of women with a high level of anxiety (42,8%), a moderate level of personal anxiety was revealed in 57.1% of cases. Some of the patient had hypochondriac reaction as the result of over anxiousness.

The level of situational anxiety in nulliparous pregnant women during the first and second semester of pregnancy does not change, so a high level of situational anxiety was detected in 7,1% of cases, moderate level of situational anxiety in 57.1% of cases, low level of situational anxiety was observed in 35.7% of patients. By the third trimester significantly increases the number of participants with a moderate level of situational anxiety – 71.4% with a high level of anxiety – 14,2%, while a low level of situational anxiety was found only in 14.2% of patients. It is connected with the approach of birth.

In nulliparous women personal anxiety wore irrational. The alarm had real events or circumstances. Women themselves has described as a sense of inner tension, which is present either constantly, or as it were "rolled over" unexpectedly and lasted for various periods of time.

Multiparous women in the first trimester prevails a moderate level of personal anxiety – 66,6%, the lowest level of anxiety was detected in 8.3% of patients, with a high level of personal anxiety in 16.6% of cases. In the second trimester of pregnancy has high level of anxiety – 50%, moderate level of anxiety were detected in 8.3% of cases, low level of anxiety was detected in 41.6% of patients. In the third trimester compared to first trimester significantly reduced the number of women with a medium level of anxiety to 16.7%, however, high levels of anxiety detected in 41.6% of cases.

In respect of situational anxiety in the first trimester in multiparous women tends to have a low level of 41.6%, a moderate level of personal anxiety was revealed in 33% of cases, in 25% of cases - high level. In the II trimester in multiparous women is dominated by a high level of personal anxiety - 50% of patients. The low level of personal anxiety was noted in 41.6% of cases, moderate anxiety level is 8.3% of cases. In the third trimester of a low level of anxiety is 58,3%, with a high level of anxiety is reduced to 33.3%, moderate level of anxiety were found in 8.3% of cases.

In multiparous women, the anxiety wore on a rational basis and was due to a real sources: the burdened anamnesis, dysfunctional ending of previous pregnancies, presence of abnormalities during the pregnancy, severe somatic or degraded condition of the woman. For most women, anxiety and depressive experiences associated with the attitude of a pregnant (65%). This may reflect the unwillingness of these women to changes in family and social spheres of life.

Severe anxiety, self-doubt and dissatisfaction with pregnancy and motherhood according to the researches, in all cases combined with the deviation from the adequate style pregnancy experiences, adverse family situation, with a negative attitude to the changes in their body and dissatisfaction with the attitude of others, with a deviation from the adequate perception of the values of the child and the unfavorable trend of the interference values, with the deviation from the adequate type of maternal relationship.

Attitude to changes in his condition and claims of others, including the child's father, relatives, medical personnel, reflect a dissatisfaction with the situation of motherhood and pregnancy and can serve as one of the diagnostic indicators. In the process of research revealed the types of experiences of pregnancy, most susceptible to changes during the course of pregnancy and leading to a variety of abnormalities in the maternal style of relationship.

Analyzing the influence of stress factors on the development of anxiety in pregnant women it was found that in the first trimester as one of the most important stress factors pregnant women identified a change in their own well-being, fatigue fatigue. In the second trimester of pregnancy among stress factors associated with increased anxiety it is possible to allocate admission to the hospital, conflicts at work, fear of childbirth. The change of their health condition had no effect on the development of personal anxiety, due to the fact that the woman gets used to his situation. In the third trimester of pregnancy there are significant changes. All stressors are positively related with levels of anxiety. It is in the third trimester women singled out as the most significant for yourself stress factor of concern for the future baby. And all the other factors in one way or another can affect the health of the unborn child, and therefore cause an increased level of anxiety.

For multiparous women among stress factors, influencing the development of anxiety were noted diseases of older children, illness of parents or

husband. In women undergoing medical or spontaneous abortion such stressors as anxiety for the baby and the hospitalization, the hospital has taken a leading position throughout pregnancy. The emotional state of a pregnant woman is very unstable, it constantly thinks about the upcoming birth, and about their health and the health of the unborn baby, so "poor sleep during pregnancy", "fatigue, tiredness", "fear of childbirth" – all entail a higher level of anxiety.

High levels of anxiety were found in 67.5% of pregnant women, indicating that the manifestation of anxiety in a variety of situations. This is a violation of the emotional sphere of the individual, indicates a lack of adaptation of man to certain social situations. This level of anxiety can disrupt any activity, which in turn may lead to lowered self-esteem, lack of confidence, this state can act as a mechanism of development of neurosis, as it tends to exacerbate personality conflicts. In 73% of pregnant women found the average level with a tendency to high anxiety, which indicates the tendency of the pregnant woman to experience anxiety, i.e. the emotional state that occurs in situations of uncertain danger and manifested in expectation of unfavorable developments. The increased threshold of anxiety due to the fact that throughout pregnancy there are global changes in a woman's body, which cause anxiety. Stress factors and emerging as a result of them mixed anxiety and depressive disorder are one of the causes of threatened miscarriage in the 1st and in the 2nd half of pregnancy. The analysis of the peculiarities of psycho-emotional disorders showed the following results: emotional lability (83%), irritability (88%), agitation (25%), depression (43%), tearfulness (79%), apathy (18%), memory impairment (29%), violation of focus (38%), fatigue (69%), weakness (60%), sleep disturbances (42%), anxiety (24%), feeling of boredom (16%), disorders of libido (4%), hypersensitivity to sounds and smells (10%), olfactory and auditory hallucinations (2%). The clinical symptomatology varies depending on the trimester of pregnancy.

Conclusions

Thus, the violation of mental adaptation, which is observed in the clinical pattern is multifactorial education associated with clinical manifestations and characteristics of the individual, and the structure of neurosis-like disorders and various psychosocial characteristics. It is important to note that all these symptoms are associated with the same physiological mechanism as pregnancy.

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SECTION 20. Medicine.

TOBACCO SMOKING AS A PREDICTOR OF BRONCHIAL HYPERRESPONSIVENESS IN TEENAGERS AND YOUNG MEN

Abstract: *There were examined 120 young men and teenagers. Some of them are active (53 persons) and others are passive (67 persons) smokers. All patients have hyperreactivity of bronchus but only 33,3% have bronchial obstruction. We show that active smokers' patients have early signs of chronic bronchitis, "smokers' cough" and reversible obstruction.*

Key words: *smokers, hyperreactivity of bronchus, bronchial obstruction.*
Language: *Russian*
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ТАБАКОКУРЕНИЕ КАК ПРЕДИКТОР ГИПЕРРЕАКТИВНОСТИ БРОНХОВ У ПОДРОСТКОВ И ЮНОШЕЙ

Аннотация: *Исследовано 120 юношей и подростков. Некоторые из них являются активными (53 человека) и другие являются пассивными (67 человек) курильщиками. Все пациенты имеют гиперреактивность бронхов, но только 33,3% имеют бронхиальную обструкцию. Нами выявлено, что ранние признаки хронического бронхита, симптомы обратимой бронхиальной обструкции, «кашель курильщика» чаще встречались в группе активных курильщиков.*

Ключевые слова: *курильщики, гиперреактивность бронхов, бронхиальная обструкция.*

Введение

Табакокурение является одним из агрессивных факторов риска, приводящих к раннему развитию заболеваний, несущих обществу большое социальное бремя. Широкое распространение табакокурения в различных странах мира приводит к снижению продолжительности жизни населения, что доказано многими научными исследованиями как отечественных, так и зарубежных авторов [2, с.35; 10, с. 1477]. В последние десятилетия табакокурение среди лиц подросткового возраста приобрело массовый характер, без особых различий среди лиц женского и мужского пола. По оценкам ВОЗ более 150 миллионов подростков в мире употребляют табак, и это число неуклонно растет. В настоящее время около 5,4 миллиона человек умирают каждый год из-за болезней связанных с курением, которое является единственной и предотвратимой причиной смерти [3, с. 84; 9]. Прогнозируется, что цифра возрастет до 8 и более миллионов в год к 2030 году. Если тенденция сохранится, то основная масса смертей случится в развивающихся странах, где каждый год будет умирать более 7 миллионов людей в результате болезней, связанных с табаком, а это больше, чем от малярии, травматизма и условий жизни вместе взятых [5, с. 9; 8, с. 15; 11, с. 611].

Каждый пятый человек в мире - подросток, и образ жизни, привитый в юном возрасте, обязательно дает результаты в возрасте зрелом, трудоспособном. Такие привычки, как курение табака, отсутствие физической активности скажутся на формировании различных заболеваний, в том числе хронических, приводящих к ранней инвалидности, к снижению показателей функции внешнего дыхания и, как следствие, более низкой работоспособности,

толерантности к физической нагрузке, раннему формированию хронических заболеваний органов дыхания и сердечно-сосудистой системы [1, с. 462]. Известно, что развитие зависимости к никотину наиболее быстро происходит в молодом возрасте [4, с. 111]. Поэтому основной аудиторией для активной профилактики табакокурения считают молодежь, подростков, среди которых проблема формирования зависимости к табаку приобрела в последнее десятилетие характер эпидемии [7, с. 8].

Особую опасность для детей представляет пассивное курение. Отрицательное его влияние выражается в увеличении риска развития инфекции нижних дыхательных путей (бронхит, пневмония), накопление жидкости в среднем ухе, появлении симптомов воспаления верхних дыхательных путей (кашель, мокрота, одышка), достоверным снижением функциональных показателей бронхиальной проходимости, более тяжелым течением бронхиальной астмы. Дети плохо успевают в школе, быстро утомляются, с трудом воспринимают новый материал [6, с. 148].

Целью исследования явилось изучение влияния курения табака на возникновение гиперрактивности бронхов у подростков и юношей.

Материалы и методы исследования.

В исследовании участвовали 120 подростков и юношей от 15-18 лет (учащиеся колледжей города Ташкента), в анамнезе которых отмечалось активное и пассивное курение табака.

Исследование функции внешнего дыхания проводили на аппарате «Мастерлаб» (фирмы «Ерих Егер», Германия) с анализом всех скоростных и объемных показателей. Определяли степень обструкции бронхиального дерева посредством анализа кривой поток-объем и по нарастанию бронхиального сопротивления воздушному потоку.

На следующем этапе исследования у пациентов проводилась оценка гиперреактивности бронхов с помощью недельного мониторирования пикфлоуметрии, для определения которой рассчитывался показатель суточных колебаний К:

К = ((max пиковая скорость выдоха за неделю – min пиковая скорость выдоха за неделю) / max пиковая скорость выдоха) х 100 %

Кроме того, для определения обратимости бронхиальной обструкции проводился бронхолитический тест. Бронхолитический тест считался положительным, если при его проведении FEV1 или PEF увеличивались более чем на 12 %.

Результаты исследования и их обсуждение.

Анализ данных опроса выявил, что лишь 53 – были активными курильщиками (44,2%) и 67 (55,8%) - пассивными. При этом, отягощенная наследственность была характерна для пассивных курильщиков.

Клинические проявления бронхиальной астмы были типичными у 88,2% больных, у которых наблюдались при активном курении приступы экспираторного диспноэ и кашель с трудноотделяемой вязкой мокротой, отхождение которой приводило к значительному улучшению состояния. Приступы удушья возникали преимущественно в ночное время и только у 18% - в дневное. Нами была проведена сравнительная характеристика больных бронхиальной астмой – активных и пассивных курильщиков (табл.1). 83,0% активно курящих больных предъявили жалобы на кащель с выделением мокроты в утреннее время («кашель курильщика»). В случае атипичного течения у 11,8% больных отмечено выделение мокроты без предшествующего кашля, одышка при физической нагрузке при классических приступах удушья и функционально подтвержденные признаки гиперчувствительности бронхов. У всех пациентов был выражен астено–вегетативный синдром, наблюдалось быстрая утомляемость, плаксивость нарушение сна.

При функциональном исследовании признаки обратимой бронхиальной обструкции выявлялись в 60,4% случаев у активных курильщиков, у остальных больных нарушений бронхиальной проходимости не было. У всех обследованных выявлены признаки гиперреактивности бронхов.

Как видно из приведенных данных, «кашель курильщика», наряду с обратимыми нарушениями бронхиальной проходимости достоверно чаще (83,0%) встречался в группе активно курящих больных бронхиальной астмой, несмотря на их молодой возраст. Можно сделать вывод, что эта категория больных является непосредственной группой риска по возникновению хронической обструктивной болезни легких.

Таблица 1

Сравнительная характеристика больных бронхиальной астмой – активных и пассивных курильщиков

Характер курения	Количество больных	«Кашель курильщика»	Отягощенная наследствен-ность	Более 4-х приступов удушья в сутки	Обратимые нарушения бронхиальной проходимости
Активное	106	88 (83,0%)*	54 (50,9%)*	36 (34,0%)	64 (60,4%)*
Пассивное	144	24 (15,6%)	122 (79,2%)	48 (31,2%)	16 (10,4%)

*Примечание. *- достоверные различия ($p<0,05$) между группой активных и пассивных курильщиков, страдающих бронхиальной астмой..*

Параметр пиковой скорости выдоха был достоверно выше у условно здоровых, по сравнению с пассивными курильщиками ($p<0,0001$), а также по сравнению с активными курильщиками ($p<0,0005$). У активных курильщиков с симптомами бронхиальной астмы параметр пиковой скорости выдоха был также достоверно ниже, чем у курящих, не имеющих нарушений бронхиальной проходимости.

Специфические противовоспалительные препараты принимали лишь 25% больных молодого возраста, остальные прибегали к симптоматической бронхолитической терапии (препараты из группы теофиллинов, симпатомиметики), практически никто не принимал отхаркивающие средства.

Выводы.

1. Лица молодого возраста, страдающие бронхиальной астмой, чаще являются пассивными курильщиками, при этом для них характерна отягощенная наследственность .
2. Тяжесть течения бронхиальной астмы у лиц молодого возраста зависит от характера курения. Категория активно курящих больных бронхиальной астмой является непосредственной группой риска по возникновению хронической обструктивной болезни легких.
3. Косвенные признаки хронического бронхита – симптомы обратимой бронхиальной обструкции, «кашель курильщика», достоверно чаще встречались в группе активных курильщиков, у которых отмечалось снижение пиковой скорости выдоха.

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SECTION 2. Applied mathematics. Mathematical modeling.

ADVANCED MODEL OF TRANSFER PROCESS AND DIFFUSION OF HARMFUL SUBSTANCES IN THE ATMOSPHERIC BOUNDARY LAYER

Abstract: *This work considers the actual problem related to solving the problem of forecasting and environmental monitoring of air pool of industrial regions, where there is an imbalance of sanitary environmental standards due to the large number of emissions of harmful substances and active fine aerosol particles, and carbon dioxide gases into the atmosphere. In the article for solving the above mentioned problem there is a full mathematical model developed to conduct a comprehensive study of the process of transfer and diffusion of pollutants released into the environment from production facilities, which is described by a system of differential equations in partial derivatives with appropriate initial and boundary conditions. To derive a mathematical model of the object there were used the basic laws of mechanics and hydro thermodynamic (conservation equations of mass, energy, balance of power, the state, etc..), Taking into account the main parameters that play a significant role in the process of transport and diffusion of pollutants in the atmosphere: the wind speed and its directions; terrain; absorption coefficient of harmful aerosol fine particles in the atmosphere, etc. We obtain the differential equation for calculating the rate of deposition of fine and aerosol particles, propagating in the boundary layer of the atmosphere, when the principal parameters are considered, which affect the rate of particle deposition: the mass and radius of aerosol particles, density of the atmosphere, air resistance force.*

Key words: *mathematical model, transfer and diffusion of pollutants, climatic factor, mechanics, hydro thermodynamics.*

Language: *English*

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Introduction

The rapid development of spheres of production, mining and development of oil, gas and ore deposits, processing of raw materials and general-purpose products, construction of production facilities and settlement blocks has set humankind acute problem – protection of the environment. As a result of a sharp increase of harmful emissions in the industrial regions, the concentration of harmful substances in the atmosphere exceeded the maximum allowable by health norms. Problems related to coal mining, nonferrous metals and other minerals have led to soil erosion and contamination of vast areas of secondary materials and waste production that are a source of pollution of the air-water areas of cities and regions.

It also should be noted that emitted by thermal power stations, factories and production facilities, gas impurities undergo complex chemical reactions, as a result of which new, more toxic substances arise, which did not exist in the original emissions. These inorganic substances are especially harmful emissions of nitrogen oxides and sulfur oxides and carbon dioxide, etc. As we know, all thrown out harmful substances from industrial production objects in the environment (the ground layer of the atmosphere) end up as a material substance is deposited on the surface of the earth, and the heavy precipitated mainly by the gravitational field, and the light - a result of the diffusion process.

The growth of human impact on the environment caused by the intensive use of natural resources, production of energy from the bowels of the earth, as well as the development of material production, has led to the disruption of ecological balance as a locally - in particular areas of the globe, as well as globally - across the planet as a whole. This is especially evident

in countries with rapid growth in the productive capacity of production facilities and primary processing of raw materials, as an example in the countries of India, China, North Korea, Singapore, etc.

In the reports of ITAR-TASS for December 2016 in China, France, Mongolia, the Balkans and other regions have been declared critical levels of air pollution. In particular, in Beijing the measures for the elimination of environmental threats to measures included stopping for a few days of the industrial facilities, lessons in schools, childcare institutions, and restrictions on the movement of vehicles inside the megalopolis.

As a result of ecology imbalance in the globe, cancer, asthma, and other allergic diseases began to grow sharply, the reduction of many species of fauna and flora occurred.

It is necessary to emphasize that in order to study, forecast and monitor the state of the atmospheric pool of industrial regions, as well as to assess the impact of anthropogenic factors it is necessary to develop a tool which can be used to solve the above mentioned problems. One of the most effective and constructive methods and tools for solving the problems is - mathematical modeling and computing experiments on a computer, with which you can give a qualitative and quantitative assessment of the ecological state of the environment of the region.

Review of Literature

The problems of mathematical modeling of the transfer processes, diffusion and transport of harmful substances (carbon dioxide gases, fine aerosol active and passive particles) were taught in the schools created under the direction of G.I. Marchuk, V.V. Penenko, A.E. Aloyana, L.T. Matveeva, V.P. Dymnikova I.E. Naatsa, E.A. Zakarin, I.A. Kibel, L.N. Gutmann, F.B. Abutalieva, as well as foreign scientists W.J. Layton, J.H. Ferziger, J.W. Deardorff. M. Germano., U. Piomelli., L.C. Berselli, G.S. Winckelmans, W.C. Reynolds, H. Zidisk, K.A. Velds, K.I. Nappo, J. Gotaas, M. Mullioland, S. Trap, M. Maties, V. Edelman etc.

To solve the urgent global problems there are established science centers and schools under the guidance of leading specialists in various branches of science dealing with problems of environmental protection, protection of water resources from external technological factors, the impact of the transformations in the ecosystem, etc. Scientific schools and centers obtained significant results of theoretical and applied character. The literature review shows that the list of urgent problems to be solved with the help of mathematical modeling, environmental issues occupies a special place.

Korchagin P.V. and others [1-3] developed a kinematic model of spreading of the reactant particles in the cloud, which describes by a system of quasi-linear partial differential equations of parabolic type, axisymmetric jet, typical for cumulonimbus clouds, which takes into account transfer processes, diffusion, generation and dissipation of turbulence on the development and investigated the behavior of the approximate solution depending on the selected grid

Lisanov M.V. [4] considered the problem of modeling the scattering of hazardous gaseous emissions in the atmosphere. Three main approaches are noted for modeling of the process: Gaussian dispersion model called dispersion models; The model is based on the integral conservation laws of substance; models based on the numerical solution of a system of conservation equations - numerical simulation.

In this work, there is developed a mathematical model, which describes the following processes: the cloud movement at variable wind speed vertical; gravitational spreading; scattering cloud in the vertical direction due to atmospheric turbulence; heating or cooling of the cloud due to air mixing; heat exchange cloud with the underlying surface.

The Authors at the study of the process of transfer and diffusion of harmful particles in the atmosphere took into account the changes in the mass and the internal energy of the cloud and its physical characteristics and equalized the results of model calculations with experimental data. According to the results of the numerical calculations the following conclusions were drawn: standard methods, based on Gaussian models cannot predict with sufficient precision the spread of harmful substances (heavy gas) as a multiple rocket launcher, as well as from the permanent sources of harmful substance emissions in the atmosphere.

The article [5] presents the main approaches to the creation of computer models of atmospheric phenomena. The current models of the distribution of the substance in the atmosphere, dust and pollen filters were reviewed and the advantage of the Finnish Meteorological Institute's SILAM model was showed. The physical side of the problem is related to the analysis of emission, the spread and absorption of pollutants are considered in this work.

Berlyand M.E. [6] showed the significant factors affecting the process of transfer and diffusion of harmful substances: the atmospheric circulation regime, its thermal stability; atmospheric pressure, humidity, temperature mode; temperature inversions, their frequency and duration; wind speed, repeatability of air stagnation and weak winds (speeds of up to 1 m/s); duration of fog; topography, geology and hydrogeology of the area; soil and vegetation conditions (soil type, water permeability, porosity, particle size distribution of soils, vegetation state, the composition of species, age, site class); background values of indicators of pollution of natural

components of the atmosphere; condition of the animal world.

Volkov V.Yu, [7] developed a distributed automated system through the use of modern information technologies allowing to increase the efficiency of research and forecasting the spread of pollutants emitted by chemical-technological enterprises in the atmosphere of the industrial region.

The papers [8-9] are devoted to a critical analysis of the applicability of physical and mathematical models of atmospheric diffusion for studies of air pollution with harmful emissions of road transport. We consider the specific characteristics of the exhaust gas composition, patterns of migration and metabolism in a stratified atmosphere. Air pollution monitoring map is demonstrated using the ring road of St. Petersburg as an example.

Belosludtsev A.A. [10] constructed a mathematical model to describe the non-stationary three-dimensional dynamics of pollution, including from non-stationary sources for a particular specified by the physical state of the atmosphere. In the proposed approach it is used a direct numerical integration of the exact equations impurity transport in the atmosphere, taking into account the main physical factors that approximates this method to conduct computational experiments. On the basis of the developed mathematical model it is created an information system for computer modeling of the process of pollution spreading from industrial sources located on the territory of the enterprise.

The adequacy of the model to the process is verified using the current detection algorithms.

Chernyavskiy S. [11] conducted analytical research of processes of emissions enterprises' dissemination in the atmosphere. The carbon dioxide (CO2) is considered as a major atmospheric pollutant. In the work is presented the Green's function for the problem of one-off instant of emission of harmful impurities in the standard atmospheric boundary layer with a given wind field and an expression is derived for the concentration of impurities in a stationary case and by continuously operating sources of pollution. The levels of equal pollution of atmosphere are built and their transformation by the change of the source's parameters are analyzed.

In paper [12] the task of modelling of gaseous impurities' emissions in the atmosphere is considered in a new mathematical formulation, which allows to take into account the mutual influence of various dynamic processes occurring by the implementation of the production cycles or as a result of accidents at industrial enterprises.

Smirnov E.A. [13] created an information system for mathematical modeling of the process of transfer and diffusion of pollutants in the atmosphere with the use of software applications «ArcGIS», which reflects the real state of the air in the regions. But here it should be noted that under this system the results can be obtained only at certain areas, and they cannot give an adequate picture of the air state in the rest of the territory.

Aloyan A.E. [14] devoted his research to the development of mathematical models of the dynamics and kinetics of the process of transfer and diffusion of gas and aerosol impurities in the atmosphere. In the work is shown the model of multicomponent impurities' transfer taking in to account of photochemical transformation and formation of aerosols in the troposphere of the northern hemisphere, taking into account the kinetic processes of enucleation, condensation and coagulation.

Chub A.I. in paper [15] presented the software of the process of inflammable objects' placement and their optimization taking into account the terrain and spatial form.

Sukhinov A.I. [16] developed computer model for research, forecasting and monitoring of transport of hazardous substances from motor vehicles into the environment. It is shown numerical realization of the model on a computer using the finite volume method based on distributed algorithm developed for computing.

The modeling of the field of wind flows based on Navier-Stokes equations' system taking into account the compressibility and turbulence of the air environment, the terrain is offered in [17], and SIMPLE-algorithm is used as a numerical method.

Kordzadze A. [18] conducted the research based on developed regional models of the process of diffusion of substances described hydro-thermodynamic equation, namely the equation of molecular heat conduction in the active layer of soil, taking into account the heat balance of the underlying surface (water, earth). Developed by researcher a comprehensive mathematical model is made up of individual blocks, each of which represents a mathematical model describing the hydro-thermodynamic processes in separate environmental objects. The authors investigate the environmental problems associated with the distribution of pollutants from the known sources and determine the probable location of the source in an aqueous medium.

The process of transfer and diffusion of pollutants in the atmosphere taking into account different climatic factors and external disturbers is considered in [19]. The work deals with the transfer of pollutants from the source based on the advection of pollutants from the average air flow, mixing polluting atmospheric turbulence and mass diffusion. In addition, it gives the study process under various physical and mathematical aspects related to the transport and diffusion of pollutants in the atmospheric boundary layer by weak and strong winds.

Here it should be emphasized, that the question of mathematical modeling of pollutant's spread transported by water is of considerable interest.

In article [20] the problem related to the process of dissemination of harmful substances in the environment is considered and it is modeled as a set of four simple models: overland water flow, seepage, migration of pollutants runoff and pollutant deposition (accumulation) on the ground. The model is based on the diffusion equation with additional terms on the right side. In the developed mathematical model of the process are taken into account the influence of topography, lithologic structure of the territory and the intensity of the pollution from the absorption rate of the earth surface. The shape, the boundaries and the topology of problem solving varies with the time depending on the appearance of dry "islands" surrounded by water.

Khan Y. [21] devoted the work to the dispersion and diffusion process of reactive primary pollutants emitted from elevated line sources in a stable boundary layer of the atmosphere with the generalized wind speed and the quadratic function of the vertical height. For this setting, an exact solution was found with the help Laplace's transform for linear sources in the atmospheric boundary layer. It takes into account the chemical reaction that occurs as a result of interaction with the air mass, as well as the conversion of gaseous pollutants in the solid particles and their deposition on the surface of the considerable area.

In the papers [22-26] a mathematical software for solving the problem of motion of multicomponent air environment, taking into account the transfer and diffusion of pollutants in the atmosphere, the changes in the thermal regime of the atmosphere, phase transition, as well as the influence of vegetation.

The work [27] is devoted to the transfer of hazardous substances in the air flow of the atmosphere's surface layer over long and medium distances.

Analysis of these sources showed, that in the studies of the authors is not considered a process of transfer and diffusion of multi-component pollutants in the atmosphere, where the a significant role play the main factors: the rate of deposition of the gel particles, depending on the line size and weight; speed of the air mass of the atmosphere in three directions, u, v and w; terrain of the considered industrial region; heat transfer between the liquid and gaseous phases; the changes of the density state and their temperature etc. which vary in the day and time of year.

It should also be noted that by the mathematical modeling of the process of dissemination of harmful substances in the atmosphere in the works of many authors assumed that the spread of harmful substances emitted from the sources does not reach the boundaries of the area under consideration for solving the problem and there is no inflow and outflow of harmful substances through them.

During this study of the process of transfer and diffusion of harmful substances in the atmosphere, there were made the efforts to fill this gap.

Based on the foregoing, the aim of this work is to develop mathematical models and numerical algorithms for solving the problem of transfer and diffusion of aerosol emissions in the boundary layer of the atmosphere.

Problem Statement

To simulate the process of transfer and diffusion of pollutants in the atmosphere, based on the basic laws of hydro thermodynamics and hydromechanics of the process we obtain the equations of pollutant's transfer in the atmosphere:

$$\begin{aligned}&\frac{\partial\theta}{\partial t}+u\frac{\partial h\theta}{\partial x}+v\frac{\partial h\theta}{\partial y}+\\&+\left(w-w_g\right)\frac{\partial h\theta}{\partial z}+h\sigma\theta=\\&=\frac{\partial}{\partial x}\left(\mu h\frac{\partial\theta}{\partial x}\right)+\frac{\partial}{\partial y}\left(\mu h\frac{\partial\theta}{\partial y}\right)+\\&+\frac{\partial}{\partial z}\left(\eta h\frac{\partial\theta}{\partial z}\right)+\delta_{i,j,k}I,\end{aligned}\qquad(1)$$

which takes into account the air mass velocities, terrain, and the coefficient of diffusion and turbulence, the speed of deposition of harmful substances on the earth's surface, the absorption coefficient of harmful substances in the atmosphere.

Taking into account aggregation state of harmful compounds emitted into the atmosphere, we can write the equation describing the transition of water from liquid to gaseous state and vice versa [1-2]:

- when the source is supplied with gas

$$\begin{aligned}&\frac{\partial\theta_1}{\partial t}+u\frac{\partial h\theta_1}{\partial x}+v\frac{\partial h\theta_1}{\partial y}+w\frac{\partial h\theta_1}{\partial z}=\\&=\frac{\partial}{\partial x}\left(\mu h\frac{\partial\theta_1}{\partial x}\right)+\frac{\partial}{\partial y}\left(\mu h\frac{\partial\theta_1}{\partial y}\right)+\\&+\frac{\partial}{\partial z}\left(\eta h\frac{\partial\theta_1}{\partial z}\right)+\delta_{i,j,k}I_1;\end{aligned}\qquad(2)$$

- when the source is supplied with water in gaseous state

$$\begin{aligned}&\frac{\partial\theta_2}{\partial t}+u\frac{\partial h\theta_2}{\partial x}+v\frac{\partial h\theta_2}{\partial y}+w\frac{\partial h\theta_2}{\partial z}=\\&=\frac{\partial}{\partial x}\left(\mu h\frac{\partial\theta_2}{\partial x}\right)+\frac{\partial}{\partial y}\left(\mu h\frac{\partial\theta_2}{\partial y}\right)+\\&+\frac{\partial}{\partial z}\left(\eta h\frac{\partial\theta_2}{\partial z}\right)+\delta_{i,j,k}I_2+\frac{v_g}{\rho_p};\end{aligned}\qquad(3)$$

- when the source is supplied with water

$$\frac{\partial \theta_3}{\partial t}+u\frac{\partial h\theta_3}{\partial x}+v\frac{\partial h\theta_3}{\partial y}+$$
$$+\left(w-w_g\right)\frac{\partial h\theta_3}{\partial z}+h\sigma_1\theta_3=$$
$$=\frac{\partial}{\partial x}\left(\mu h\frac{\partial \theta_3}{\partial x}\right)+\frac{\partial}{\partial y}\left(\mu h\frac{\partial \theta_3}{\partial y}\right)+ \quad (4)$$
$$+\frac{\partial}{\partial z}\left(\eta h\frac{\partial \theta_3}{\partial z}\right)+\delta_{i,j,k}I_3-\frac{v_g}{\rho_p};$$

- when the source is supplied with soot

$$\frac{\partial \theta_4}{\partial t}+u\frac{\partial h\theta_4}{\partial x}+v\frac{\partial h\theta_4}{\partial y}+$$
$$+\left(w-w_g\right)\frac{\partial h\theta_4}{\partial z}+h\sigma_2\theta_4=$$
$$=\frac{\partial}{\partial x}\left(\mu h\frac{\partial \theta_4}{\partial x}\right)+\frac{\partial}{\partial y}\left(\mu h\frac{\partial \theta_4}{\partial y}\right)+ \quad (5)$$
$$+\frac{\partial}{\partial z}\left(\eta h\frac{\partial \theta_4}{\partial z}\right)+\delta_{i,j,k}I_4.$$

To determine the concentration of harmful substances in the atmosphere, depending on the orography of the terrain and weather climatic factors necessary to set initial and boundary conditions:

$$\left.\begin{array}{l}\theta_i\left(x,y,z\right)=\theta_{i,H}\left(x,y,z\right)\ \text{при}\ t=0,\\ \mu\dfrac{\partial \theta_i}{\partial x}\Big|_{x=0}=\left(\theta_i-\theta_{i,H}\right),\mu\dfrac{\partial \theta_i}{\partial x}\Big|_{x=L_x}=\left(\theta_i-\theta_{i,H}\right),\\ \mu\dfrac{\partial \theta_i}{\partial y}\Big|_{y=0}=\left(\theta_i-\theta_{i,H}\right),\mu\dfrac{\partial \theta_i}{\partial y}\Big|_{y=L_y}=\left(\theta_i-\theta_{i,H}\right),\\ \dfrac{\partial \theta_i}{\partial z}\Big|_{z=0}=\xi\theta_i-\tilde{f},\ \dfrac{\partial \theta_i}{\partial z}\Big|_{z=L_z}=0,\end{array}\right\} \quad (7)$$

where: i=1, 2, 3, 4.

Here, - θ_1, θ_2, θ_3, θ_4,$\theta_{i,H}$ respectively the concentration of harmful substances emitted in water form in a gaseous state, gas in the source, liquid water, soot and their original value in the atmosphere; u, v, w - wind speed in three directions; $v_g=f\left(\rho_n-\rho_1\right)$ - mass evaporation rate; ρ_n - the density of the saturated vapor; μ - the diffusion coefficient; η - the coefficient of turbulence; ξ - interaction coefficient with the underlying ground surface; h - function describing the orographic surface of the earth; I_1, I_2, I_3, I_4 - power of emission sources respectively for harmful gas, water in a gaseous form, liquid water and soot; $\tilde{f}$ - A source of emission of harmful substances from the settling surface of the earth; σ_1, σ_2 - coefficient of absorption of harmful substances in the atmosphere (water in liquid form, and soot); $\delta_{i,j,k}$ - Dirac function; w_g - deposition rate of harmful particles.

Solution Method

The statement of the problem (1) - (7) implies, that for its numerical integration, it is necessary to calculate of the velocity of the air mass of the atmosphere in three directions respectively in u, v and w.

To determine the rates of movement of air masses in the atmosphere in three directions u, v and w consider the hydrodynamic equations by Navier-Stokes:

$$\frac{\partial u}{\partial t}+u\frac{\partial u}{\partial x}+v\frac{\partial u}{\partial y}+w\frac{\partial u}{\partial z}=$$
$$=\frac{1}{\rho}\frac{\partial P}{\partial x}+\frac{\partial}{\partial x}\left(\mu\frac{\partial u}{\partial x}\right)+ \quad (8)$$
$$+\frac{\partial}{\partial y}\left(\mu\frac{\partial u}{\partial y}\right)+\frac{\partial}{\partial z}\left(\eta\frac{\partial u}{\partial z}\right)-g_x,$$
$$\frac{\partial v}{\partial t}+u\frac{\partial v}{\partial x}+v\frac{\partial v}{\partial y}+w\frac{\partial v}{\partial z}=$$
$$=\frac{1}{\rho}\frac{\partial P}{\partial x}+\frac{\partial}{\partial x}\left(\mu\frac{\partial v}{\partial x}\right)+ \quad (9)$$
$$+\frac{\partial}{\partial y}\left(\mu\frac{\partial v}{\partial y}\right)+\frac{\partial}{\partial z}\left(\eta\frac{\partial v}{\partial z}\right)-g_y,$$
$$\frac{\partial w}{\partial t}+u\frac{\partial w}{\partial x}+v\frac{\partial w}{\partial y}+w\frac{\partial w}{\partial z}=$$
$$=\frac{1}{\rho}\frac{\partial P}{\partial x}+\frac{\partial}{\partial x}\left(\mu\frac{\partial w}{\partial x}\right)+ \quad (10)$$
$$+\frac{\partial}{\partial y}\left(\mu\frac{\partial w}{\partial y}\right)+\frac{\partial}{\partial z}\left(\eta\frac{\partial w}{\partial z}\right)-g_z,$$
$$\frac{\partial w_g}{\partial t}+u\frac{\partial w_g}{\partial x}+v\frac{\partial w_g}{\partial y}+w\frac{\partial w_g}{\partial z}=$$
$$=\frac{1}{\rho}\frac{\partial P}{\partial x}+\frac{\partial}{\partial x}\left(\mu\frac{\partial w_g}{\partial x}\right)+ \quad (11)$$
$$+\frac{\partial}{\partial y}\left(\mu\frac{\partial w_g}{\partial y}\right)+\frac{\partial}{\partial z}\left(\eta\frac{\partial w_g}{\partial z}\right)-G_z-R_s,$$

with initial and boundary conditions

$$\left.\begin{array}{l}u\left(x,y,z,0\right)=\dot{u}\left(x,y,z\right);\\ v\left(x,y,z,0\right)=\dot{v}\left(x,y,z\right);\\ w\left(x,y,z,0\right)=\dot{w}\left(x,y,z\right);\\ w_g\left(x,y,z,0\right)=\dot{w}_g\left(x,y,z\right).\end{array}\right\} \quad (12)$$

$$\left.\begin{aligned}
&\mu\frac{\partial u}{\partial x}\Big|_{x=0} = (u-\dot{u}_0), \mu\frac{\partial u}{\partial x}\Big|_{x=L_x} = (u-\dot{u}_0),\\
&\mu\frac{\partial v}{\partial y}\Big|_{y=0} = (v-\dot{v}_0), \mu\frac{\partial v}{\partial y}\Big|_{y=L_y} = (v-\dot{v}_0),\\
&\eta\frac{\partial w_g}{\partial z}\Big|_{z=h_v} = \varphi(x,y,h_v,t),\\
&\eta\frac{\partial w_g}{\partial z}\Big|_{x=L_z} = 0, \eta\frac{\partial w}{\partial z}\Big|_{z=0} = 0,\\
&\eta\frac{\partial w}{\partial z}\Big|_{x=L_z} = 0.
\end{aligned}\right\} \quad (13)$$

Here P - pressure; $g_{(x,y,z)}$ -the projection of the components of the gravitational acceleration, $R_s = w_g(6\pi kr - 1/2 * c\rho_a S w_g)$ - the power of the air resistance, m - particle mass, *r*-radius of the particles, *S* - cross sectional area of the particles, ρ_a - atmospheric density, c - dimensionless quantity equal to 0.5.

To calculate the density of emitted substances into the atmosphere, taking into account the mass conservation law for fluid flowing through the fixed volume, the continuity equation will be obtained.

$$\begin{aligned}
&\frac{\partial\rho}{\partial t} + \frac{\partial(\rho u)}{\partial x} + \frac{\partial(\rho v)}{\partial y} + \frac{\partial(\rho w)}{\partial z} =\\
&= \frac{\partial}{\partial x}\left(\mu\frac{\partial\rho}{\partial x}\right) + \frac{\partial}{\partial y}\left(\mu\frac{\partial\rho}{\partial y}\right) +\\
&+ \frac{\partial}{\partial z}\left(\eta\frac{\partial\rho}{\partial z}\right) + I_g
\end{aligned} \quad (14)$$

with appropriate initial and boundary conditions:

$$\rho(x,y,z)\big|_{t=0} = \rho_c,$$

$$\left.\begin{aligned}
&\mu\frac{\partial\rho}{\partial x}\Big|_{x=0} = (\rho-\rho_0), \mu\frac{\partial\rho}{\partial x}\Big|_{x=L_x} = (\rho-\rho_0),\\
&\mu\frac{\partial\rho}{\partial y}\Big|_{y=0} = (\rho-\rho_0), \mu\frac{\partial\rho}{\partial y}\Big|_{y=L_y} = (\rho-\rho_0),\\
&\frac{\partial\rho}{\partial z}\Big|_{z=0} = 0, \frac{\partial\rho}{\partial z}\Big|_{z=L_z} = 0.
\end{aligned}\right\} \quad (15)$$

Since impurities emitted into the environment have a certain temperature, which plays a significant role in the spread of harmful substances into the atmosphere, consideration of this factor is necessary. The equation describing processes of transfer and heat diffusion and heat exchange with the environment is as follows:

$$\begin{aligned}
&\frac{\partial\Phi}{\partial t} + u\frac{\partial\Phi}{\partial x} + v\frac{\partial\Phi}{\partial y} - w_g\frac{\partial\Phi}{\partial z} =\\
&= \frac{\partial}{\partial x}\left(\mu\frac{\partial\Phi}{\partial x}\right) + \frac{\partial}{\partial y}\left(\mu\frac{\partial\Phi}{\partial y}\right) +\\
&+ \frac{\partial}{\partial z}\left(\eta\frac{\partial\Phi}{\partial z}\right) + \frac{\partial}{\partial x}\left(\lambda\frac{\partial T}{\partial x}\right) + \frac{\partial}{\partial y}\left(\lambda\frac{\partial T}{\partial y}\right) +\\
&+ \frac{\partial}{\partial z}\left(\lambda\frac{\partial T}{\partial z}\right) + \delta_{i,j,k} I_T.
\end{aligned} \quad (16)$$

Here Φ - the thermal energy; w_g - The rate of deposition of suspended particles; λ - coefficient of thermal conductivity; I_T - Function describing the distribution and power of the heat source. Since we consider the propagation of a multi-component environment, then for the coefficient of thermal conductivity and thermal energy is a fairly relation

$$\Phi = \sum_{i=1}^{L}\Phi_i\theta_i = \sum_{i=1}^{L}\rho_i c_i\theta_i T_i.$$

In our formulation for heat transfer problem in a multi-component environment can be considered the cases:

- Heat transfer for gas

$$\begin{aligned}
&R_1\frac{\partial T}{\partial t} = \frac{\partial}{\partial x}\left(R_2\frac{\partial T}{\partial x}\right) + \frac{\partial}{\partial y}\left(R_2\frac{\partial T}{\partial y}\right) +\\
&+ \frac{\partial}{\partial z}\left(R_2\frac{\partial T}{\partial z}\right) + \bar{q}_2 v_g - \alpha_v(T - T_s),
\end{aligned} \quad (17)$$

where $R_1 = \sum_{i=1}^{2}\rho_i c_\rho\theta_i$; $R_2 = \sum_{i=1}^{2}(\rho_i c_\rho\mu + \lambda_i)\theta_i$; v_g - the mass evaporation rate; ρ, c_ρ - density and heat capacity of gas phase; $\bar{q}$ - Specific heat of transformation, T, T_s - the temperature of the gas and condensed phases; α_v - heat transfer coefficient;

- Transfer of heat to the condensate

$$\begin{aligned}
&R_3\left(\frac{\partial T}{\partial t} - w_0\frac{\partial T_s}{\partial z}\right) =\\
&= \frac{\partial}{\partial x}\left((R_3\mu)\frac{\partial T_s}{\partial x}\right) + \frac{\partial}{\partial y}\left((R_3\mu)\frac{\partial T_s}{\partial y}\right) +\\
&+ \frac{\partial}{\partial z}\left((R_3\mu)\frac{\partial T_s}{\partial z}\right) - \alpha_v(T - T_s),
\end{aligned} \quad (18)$$

where $R_3 = \sum_{i=3}^{4}(\rho_i c_{\rho_i}\theta_i)$; c_{ρ_i}, θ_i, ρ_i - specific heat capacity, volume fractions i-th phase and the true density; T, T_s - the temperature of the gas and condensed phases.

To solve (17) - (18) we give initial and boundary conditions:

$$T(x,y,z) = T_0(x,y,z); \quad (19)$$

$$\left.\begin{aligned}
&\lambda\frac{\partial T}{\partial x}\Big|_{x=0}=(T-T_0),\lambda\frac{\partial T}{\partial x}\Big|_{x=L_x}=(T-T_0),\\
&\lambda\frac{\partial T}{\partial y}\Big|_{y=0}=(T-T_0),\lambda\frac{\partial T}{\partial y}\Big|_{y=L_y}=(T-T_0),\\
&\lambda\frac{\partial T}{\partial z}\Big|_{z=0}=(T-T_0),\lambda\frac{\partial T}{\partial z}\Big|_{z=L_z}=(T-T_0).
\end{aligned}\right\} \quad (20)$$

To determine the vapor pressure in terms of temperature, we use the equation of Mendeleev-Clapeyron and through differentiation obtain

$$\frac{\rho}{P}\frac{\partial P}{\partial t}=\frac{\partial\rho}{\partial t}+\frac{\rho}{T}\frac{\partial T}{\partial t}. \quad (21)$$

Here ρ_i, R, M - density, universal gas constant, molar mass; k_1 - coefficient of thermal conductivity.

To solve equation (8) - (12) we split by the physical parameters and obtain the three tasks, the first one can be written in the difference analogue:

$$\left.\begin{aligned}
&\frac{u^{n+1/3}-u^n}{\Delta t/3}+\left(u\frac{\partial u}{\partial x}\right)^{n+1/3}+\\
&+\left(v\frac{\partial u}{\partial y}\right)^{n+1/3}+\left(w\frac{\partial u}{\partial z}\right)^{n+1/3}=-G_x,\\
&\frac{v^{n+1/3}-v^n}{\Delta t/3}+\left(u\frac{\partial v}{\partial x}\right)^{n+1/3}+\\
&+\left(v\frac{\partial v}{\partial y}\right)^{n+1/3}+\left(w\frac{\partial v}{\partial z}\right)^{n+1/3}=-G_y,\\
&\frac{w^{n+1/3}-w^n}{\Delta t/3}+\left(u\frac{\partial w}{\partial x}\right)^{n+1/3}+\\
&+\left(v\frac{\partial w}{\partial y}\right)^{n+1/3}+\left(w\frac{\partial w}{\partial z}\right)^{n+1/3}=-G_z,\\
&\frac{w_g{}^{n+1/3}-w_g{}^n}{\Delta t/3}+\left(u\frac{\partial w_g}{\partial x}\right)^{n+1/3}+\\
&+\left(v\frac{\partial w_g}{\partial y}\right)^{n+1/3}+\left(w\frac{\partial w_g}{\partial z}\right)^{n+1/3}=-G_z-R_s,
\end{aligned}\right\} \quad (22)$$

the second one:

$$\left.\begin{aligned}
&\frac{u^{n+2/3}-u^{n+1/3}}{\Delta t/3}=\frac{\partial}{\partial x}\left(\mu\frac{\partial u}{\partial x}\right)^{n+2/3}+\\
&+\frac{\partial}{\partial y}\left(\mu\frac{\partial u}{\partial y}\right)^{n+2/3}+\frac{\partial}{\partial z}\left(\eta\frac{\partial u}{\partial z}\right)^{n+2/3},\\
&\frac{v^{n+2/3}-v^{n+1/3}}{\Delta t/3}=\frac{\partial}{\partial x}\left(\mu\frac{\partial v}{\partial x}\right)^{n+2/3}+\\
&+\frac{\partial}{\partial y}\left(\mu\frac{\partial v}{\partial y}\right)^{n+2/3}+\frac{\partial}{\partial z}\left(\eta\frac{\partial v}{\partial z}\right)^{n+2/3},\\
&\frac{w^{n+2/3}-w^{n+1/3}}{\Delta t/3}=\frac{\partial}{\partial x}\left(\mu\frac{\partial w}{\partial x}\right)^{n+2/3}+\\
&+\frac{\partial}{\partial y}\left(\mu\frac{\partial w}{\partial y}\right)^{n+2/3}+\frac{\partial}{\partial z}\left(\eta\frac{\partial w}{\partial z}\right)^{n+2/3},\\
&\frac{w_g{}^{n+2/3}-w_g{}^{n+1/3}}{\Delta t/3}=\frac{\partial}{\partial x}\left(\mu\frac{\partial w_g}{\partial x}\right)^{n+2/3}+\\
&+\frac{\partial}{\partial y}\left(\mu\frac{\partial w_g}{\partial y}\right)^{n+2/3}+\frac{\partial}{\partial z}\left(\eta\frac{\partial w_g}{\partial z}\right)^{n+2/3},
\end{aligned}\right\} \quad (23)$$

and the third one:

$$\left.\begin{aligned}
&\frac{u^{n+1}-u^{n+2/3}}{\Delta t/3}=-\frac{1}{\rho}\frac{\partial P}{\partial x},\\
&\frac{v^{n+1}-v^{n+2/3}}{\Delta t/3}=-\frac{1}{\rho}\frac{\partial P}{\partial y},\\
&\frac{w^{n+1}-w^{n+2/3}}{\Delta t/3}=-\frac{1}{\rho}\frac{\partial P}{\partial z}.\\
&\frac{w^{n+1}-w^{n+2/3}}{\Delta t/3}=-\frac{1}{\rho}\frac{\partial P}{\partial z}.
\end{aligned}\right\} \quad (24)$$

Here η - coefficient of turbulent exchange.

Next, multiplying the system of equations (24) by $\rho\Delta t/3$ and differentiating with respect to the variables x, y, z, respectively, at the end we get

$$\left.\begin{aligned}
&\left(\rho\frac{\partial u}{\partial x}\right)^{n+1}=\left(\rho\frac{\partial u}{\partial x}\right)^{n+2/3}-\Delta t/3\frac{\partial^2 P}{\partial x^2},\\
&\left(\rho\frac{\partial v}{\partial y}\right)^{n+1}=\left(\rho\frac{\partial v}{\partial y}\right)^{n+2/3}-\Delta t/3\frac{\partial^2 P}{\partial y^2},\\
&\left(\rho\frac{\partial w}{\partial z}\right)^{n+1}=\left(\rho\frac{\partial w}{\partial z}\right)^{n+2/3}-\Delta t/3\frac{\partial^2 P}{\partial z^2},\\
&\left(\rho\frac{\partial w_g}{\partial z}\right)^{n+1}=\left(\rho\frac{\partial w_g}{\partial z}\right)^{n+2/3}-\Delta t/3\frac{\partial^2 P}{\partial z^2}.
\end{aligned}\right\} \quad (25)$$

Substituting system (25) into (13) we get the following:

$$\frac{\partial \rho}{\partial t}+\left(\frac{\partial(\rho u)}{\partial x}\right)^{n+2/3}-\Delta t/3\frac{\partial^2 P}{\partial x^2}+$$
$$+\left(\frac{\partial(\rho v)}{\partial y}\right)^{n+2/3}-\Delta t/3\frac{\partial^2 P}{\partial y^2}+$$
$$+\left(\frac{\partial(\rho w)}{\partial z}\right)^{n+2/3}-\Delta t/3\frac{\partial^2 P}{\partial z^2}= \quad (26)$$
$$=\left(\mu\frac{\partial^2\rho}{\partial x^2}\right)+\left(\mu\frac{\partial^2\rho}{\partial y^2}\right)+\left(k_0\frac{\partial^2\rho}{\partial z^2}\right)+I_g.$$

Using equation of state (26) we obtain an equation for calculating the pressure field:

$$\left(\frac{\rho}{P}\frac{\partial P}{\partial t}\right)=\Delta t/3\frac{\partial^2 P}{\partial x^2}+\Delta t/3\frac{\partial^2 P}{\partial y^2}+$$
$$+\Delta t/3\frac{\partial^2 P}{\partial z^2}-\frac{\rho}{T}\frac{\partial T}{\partial t}-\left(\rho\frac{\partial u}{\partial x}\right)^{n+2/3}-$$
$$-\left(\rho\frac{\partial v}{\partial y}\right)^{n+2/3}-\left(\rho\frac{\partial w}{\partial z}\right)^{n+2/3}+ \quad (27)$$
$$+\left(\mu\frac{\partial^2\rho}{\partial x^2}\right)+\left(\mu\frac{\partial^2\rho}{\partial y^2}\right)+\left(k_0\frac{\partial^2\rho}{\partial z^2}\right)+I_g.$$

With the help of the equation (27) we got, we can calculate the field of pressure distribution in the considered layer of the atmosphere.

Thus, we developed a three-dimensional mathematical model of the process of the spread of harmful substances in the atmospheric boundary layer, taking into account the terrain and the characteristics of the underlying surface.

During the development of this model there were used: the equation of motion of a multicomponent air environment, model of pressure calculation, model of heat flow, which is described by the equations of heat conduction and gas condensate.

With the help of the given model you can calculate the key indicators and parameters that affect the process of transfer and diffusion of harmful multicomponent compound emitted from industrial facilities, construction areas and drained parts of seas and lakes.

Conclusion

Mathematical models of transfer and diffusion of pollutants in the form of water, gas and soot in a multicomponent air environment, which take into account such factors as the transition of water from a liquid to a gaseous state, a turbulent exchange, convective motion, precipitation of substances, heat transfer between the liquid and gaseous states, and variable density and temperature, as well as consideration of the terrain that greatly affects the dynamically changing state of the object of study.

An equation was derived to calculate the rate of deposition of the gel particles in the process of transfer and diffusion of the gel particles, depending on the line size and mass, the speed of movement of the air mass of the atmosphere in three directions and force of air resistance.

While developing a mathematical model of process of harmful substances' spread in the atmosphere, an equation for calculating the pressure field was derived, which takes into account the compressibility of the medium, the thermal expansion, the turbulent mixing of the air mass of the atmosphere.

The peculiarity of the developed mathematical models of transfer and diffusion of harmful substances in the boundary layer of the atmosphere and the movement of the air environment is connected with the account of turbulent compound in the equation of continuity of the environment, as well as consideration of the effect of orographic surface of the ground vegetation on the distribution of aerosol particles in the atmosphere.

In the developed mathematical model of the process is taken into account the transfer and diffusion of harmful components through borders of solving problems' section, with the help of the boundary condition of the third kind, which corresponds to the actual physical nature of the considered process.

The developed mathematical model, taking into account the above factors more adequately describes the process as compared to other known models offered by other authors.

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SECTION 8. Architecture and construction.

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PECULIARITIES OF FLEXIBLE PAVEMENT CONSTRUCTION WITH CONSIDERATION OF EXISTING CLIMATIC CONDITIONS IN GEORGIA

Abstract: *Presented work considers peculiarities of flexible composite pavement construction, under existing climatic conditions in Georgia.*

Simultaneously, technological characteristics of construction of flexible composite pavements with positive aspects are clearly illustrated. Examples are given to demonstrate advantages of operational characteristics of flexible composite pavements.

Key words: *Road surface, Bitumen, Asphalt*

Language: *English*

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Introduction

Principal pavement material used throughout Georgia for road network furnishing is an asphalt. That is determined by the geographic location and simplicity of arranging this type of material as a surface layer. Via accounting for climatic conditions of Georgia we would like to introduce our approach regarding construction of flexible pavements.

The road structure contains a roadbed and a road dress. The crucial part of the structure is the road dress or pavement that is durable surface material laid down on an area to tended to sustain vehicular traffic. It is the most sensitive to the impact from nature and climatic conditions.

Materials and Methods

Constructing the road dress with strengthening includes the selection of material, used for arranging construction layers, as well as tentative designation of their thickness. During constructing the pavements, due considerations shall be given to the requirements for operational quality of roads, reduction of material consumption and labor-output ratio with reference to the quality of underlying structure.

Three layers might be distinguished in road pavements: wearing course, main course of surface layer and the base. The wearing course should have required roughness, evenness and shear strength. The mentioned course might be executed as a separate element (surface treatment or special protective layers) of pavement structure or otherwise, it might be the upper layer of pavement. In separate occasions, especially while paving asphalt concrete with a low content of binder, the wearing course can bear the functions of water-protecting layer. The

thickness of wearing course is not high, thus, this layer does not bear impact on strength or strain capacity of underlying layers. The mentioned also entails the lower heat-resistant properties of the layer.

The surface layer of flexible pavement incurs the horizontal and vertical tensions and strain from the impact by vehicular loads. Contrary to the widespread opinion, the stress from horizontal loads diminishes in accordance with the rules applied to the vertical loads and not faster, as it was accepted earlier. The surface layer distributes loads that will transfer to the base. Distribution properties of surface layer are as higher, as thicker it is and higher is its resilient modulus.

The surface layer also has the water and heat-protective properties. Under the impact of heating and cooling, in surface and base layers, the temperature tensions occur that increase due to increased differences in temperature. The highest sensitivity is observed under the daily and monthly differences in temperatures. In surface layers the temperature gradient is highest, that is why the temperature range in the base is lower than in surface layers, and i.e. the surface layers bear the heat-protective functions.

The base of the road dress distributes the loads on soil. The tensions and strain in this layer rapidly decrease. It should be underlined that, in base layers, there are less impact from temperature, than in surface layers.

The inter-relations between the surface layer and the base (i.e. bond) represent one of the components of the road pavement strength.

In case there is no sufficient bond and the layers move horizontally relative to each other, interactions diminish and slip of layer material is possible. The temperature strain of one of the layers does not impact the other. At the same time the risk of dislodgement and raveling under the vehicle load vibrations increases.

In case the bond between the surface and base layers are sound, the layers are deformed simultaneously, hereto the tensions and strain in less rigid layer increases, while in more rigid layer - decreases.

Harder the upper layer, the less tensions and strain transfers to the base layer. In this case, on the contact line of two layers the tensions are accrued creating the highest danger for base. Heat-transfer properties of surface layer and a base are different. According to surveys, in contact line zone, between layers, the sharp changes in temperature were observed entailing considerable temperature gradients that might result in gradual destruction of contact zone.

For construction of pavement base course, various rock and binding materials are used. There are two criteria for selecting: the first includes strengthening of base layers with binding agents in order to increase the bearing capacity in unfavorable soil. and climatic conditions, the second implies use of tire rate. Less the strain capacity of road dress (larger resilient modulus) lesser is resistance to rolling. In a number of cases, the properties of such layers are subject to time-change (crushability, soaking values) that is crucial to consider while calculating and constructing.

Construction layers of the base of road dress with asphalt concrete surfacing shall meet some requirements as follows:

Base shall represent the flexible, seamless slab that works only in resilient phase;

Heat-transfer and mechanical properties of the base and asphalt concrete layers shall not differ considerably. Apart from this, it is crucial that the freeze-resistance and resilient modulus of the base should be less than that of surface layer, while water-resistance, strain capacity and linear expansion is desirable to be equal.

Noncompliance with these requirements diminishes the strength of existing pavement and should be taken into consideration while strengthening.

Roadbed is a foundation of road pavement and it determines the mode of deformation of entire road pavement structure. Properties of roadbed soils are less stable than that of road dress, thus entailing the wider variations of structural-and-mechanical properties under the impact from loads and water-and-heat factors, than that of road pavement.

In case of weakness of base soil, the road structure stability might be provided by increasing hardness or thickness of road dress pavement layers. The mentioned results in considerably increased expenditures.

The soil base properties alters within annual cycle, under influence of water and heat. These factors cause the moisture migration within the road bed, namely, it moves from warmer to cooler strata. Moisture migration is possible in both, in liquid phase (film or capillary moisture) as well as in vapor phase.

In winter, in a majority of climatic zones, the moisture migrates from lower layers of roadbed to upper – to the road pavement base - where moisture accumulates and freezes resulting in some degree of ground decomposition, because of water expansion after freezing.

In a rated period - springtime - the most moistened part of a roadbed is an upper layer - the base of road dress since it is characterized with the largest temperature gradients with fluctuations. The values of the mentioned gradients and their fluctuation depend on heat-shielding properties of road dress.

Since the road pavement strengthening tend to change the physical-mechanical properties of

existing pavement, the mentioned conditions should be taken care of during strengthening and improvements of road dress.

During calculations of layers, the rational distribution of material to thickness is to be ensured, as well as reducing of layer costs with increasing depth. To put it down otherwise, the hardness of material shall decrease from top courses to down layers, i.e. in accordance with a decreasing of tensions caused by live loads. The most expedient ratio of resilient moduli of contiguous layers is between 1, 5÷3. Such distribution of construction layers to depths is wide-spread, though not always optimal. In designing practice, oftentimes, especially during reconstruction of road pavement, the harder layers are placed not only in upper but also lower positions. The hard foundation concentrates the tension in upper layer and this should be taken into consideration while strengthening.

Conclusion

During strengthening of existing flexible pavement the following shall be accounted for:

Strengthening layer should provide for required operation properties of road dress en masse, i. e. stability, level, skid resistance, durability, while ensuring compliance with requirements for material consumption and labor input in structure constructions;

The durability of strengthening layer, and a structure as a whole, might be ensured with sound bond between the strengthening and existing base – old road dress. The mentioned requires rejecting of regulating layers constructed with unbonded material (gravel, crushed rock) while strengthening. Quasi economy of expenditures by reducing material that are processed with organic bonding agents results in faster decomposition of structures under traffic, entailing considerable, additional expenses;

In order to provide for minimal labor input, the number of layers during strengthening should be minimal. Hence, in a number of cases, it is advisable to replace two-layer asphalt concrete structures with one thickened layer. Since, while paving the thickened asphalt concrete layers are subject to slower cooling, they are consolidating under higher temperature. The bulk weight and strength of material in such layers are higher than in ordinary layers. That is why the replacement of two-course strengthening layers with one thickened layer provides for economy of organic bonding agents. One more advantage of thickened layer: during improvement of old road pavement with cracks - by constructing the thinner strengthening asphalt concrete layer - the cracks reappear on a new pavement;

During constructing of strengthening layers, the requirements for diminishing material consumption shall be taken into consideration. For this purpose, it is applicable to use the local materials, as well as asphalt concrete with lower bonding agents. Expedience of using such materials should be verified using technical-and-economical calculations;

Heat-transfer properties of strengthening layer material should be as closer as possible to the heat-transfer properties of old pavement material, in order to avoid differences in temperature deformations and creation of corresponding temperature tensions;

During constructing the strengthening layers, due attention should be given to the fact that they change the operational conditions and water-and-thermal regime of entire underlying structure. The strengthening layer bears heat-insulating and distribution properties, thus improving the same properties of lower layers. The old structure improves by getting harder. All the mentioned shall be taken into consideration during performing calculations;

In the old road dress structure, the upper layer is the most vulnerable – it is usually out-of-repair and partially destroyed – this also should be paid attention to.

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SECTION 6. Metallurgy and energy.

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LASER TREATMENT EFFECTS ON GEOMETRIC DIMENSIONS OF MELTING AND HEAT AFFECTED ZONES AT PROCESSING OF SINTERED POROUS IRON

Abstract: *The article considers the laser radiation effects on the formation of the melting zone and the heat-affected zone of the porous sintered iron with using the method of mathematical planning experiments. You can see the results of influence of factors, their double and triple interaction on the geometric characteristics of the melting and the heat-affected zones. It is analyzed the role of the energy flux density (interaction of laser power density and displacement speed of the laser beam on the surface), the porosity and their triple interaction - structurally energy parameter at processing porous iron.*

Key words: *the melting zone, the heat-affected zone, laser treatment, the processing mode, the power density, the speed of movement of the beam, the energy flux density, the mathematical planning experiment*

Language: *Russian*

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ВЛИЯНИЕ ЛАЗЕРНОЙ ОБРАБОТКИ НА ГЕОМЕТРИЧЕСКИЕ РАЗМЕРЫ ЗОН ПЛАВЛЕНИЯ И ТЕРМИЧЕСКОГО ВЛИЯНИЯ ПРИ ОБРАБОТКЕ СПЕЧЕННОГО ПОРИСТОГО ЖЕЛЕЗА

Аннотация: *В работе рассмотрено воздействие лазерного излучения на формирование зоны плавления и зоны термического влияния пористого спеченного железа с применением метода математического планирования экспериментов. Показаны влияния факторов, их двойных и тройных взаимодействий на геометрические характеристики зон плавления и термического влияния. Рассмотрена роль плотности потока энергии (взаимодействие плотности мощности лазерного излучения и скорости перемещения лазерного луча по поверхности), пористости и их тройного взаимодействия - структурно-энергетического параметра обработки пористого железа.*

Ключевые слова: *зона плавления, зона термического влияния, лазерная обработка, режим обработки, плотность мощности, скорость перемещения луча, плотность потока энергии, математическое планирование эксперимента*

Введение

Пористые материалы имеют равномерную объемнораспределенную пористость, которая является важнейшей эксплуатационной характеристикой и структурной составляющей таких материалов. Наличие пористости определяет направление применения таких материалов в технике, приборостроении и т.д.[1].

Объем пор в пористом материале определяет его назначение: 10...13% - фрикционные материалы; 15...35% - антифрикционные материалы; 20...50% - фильтры; 50...98% - высокопористые или пеноматериалы [1]. Увеличение объемной доли пор в материале приводит к изменению теплофизических [1-3] (теплопроводность, температуропроводность), оптических [4] (коэффициенты отражения и поглощения), электрических [2, 3] (удельная проводимость, удельное электросопротивление) и механических [1-3] свойств материалов. Пористость снижает все механические свойства по сравнению с аналогичным по химическому составу беспористым материалом [1-3].

Воздействие на поверхность пористого тела лазерного излучения инициирует развитие усадочных процессов приводящих к снижению пористости [5-9]. Динамика перехода от открытой к закрытой пористости, уменьшения размеров пор и их количества зависят от энергетического режима лазерной обработки [6-9]. Очевидно, что уменьшение пористости на поверхности приведет к росту ее физико-механических свойств. Однако локальное и значительное снижение пористости в пористом теле вызывает значительные напряжения, обусловленные протекающими усадочными процессами. В [6-9] установлено наличие «зоны пониженной прочности» в зоне перехода от литой сварочной ванны к пористому материалу после воздействия лазерного излучения.

В свете вышеизложенного изучение воздействия лазерного излучения на поверхность пористых материалов является актуальной научно-практической задачей, решение которой позволит с помощью лазерной обработки формировать структуру и управлять свойствами пористых материалов.

Целью данного исследования является изучение воздействия лазерного излучения на поверхность спеченных пористых образцов на основе порошка железа, полученных методами порошковой металлургии.

Материалы и оборудование

Образцы для лазерной обработки поверхности изготовлены методом порошковой металлургии (прессование + спекание). Прессовки изготовлены из порошка восстановленного карбонильного железа марки ВК-1 (ТУ 2436- 005-74439740-14). Гранулометрический и химический состав порошка представлен в табл. 1, морфология частиц порошка показана на рисунке 1.

Прессование проводили в закрытой пресс-форме с проставкой, ограничивающей ход пуансона, обеспечивающей получение неспеченных прессовок диаметром 15 мм и высотой 15 мм. Изменением массы навески производилось регулирование пористости неспеченных прессовок. Спекание производили в атмосфере осушенного водорода при температуре 1100ºС в течении 120 минут. После спекания получены три вида образцов с различной пористостью соответственно 22, 30 и 38%.

Выбор порошка железа марки ВК-1 для проведения исследований обусловлен его высокой дисперсностью, низким содержанием углерода и других примесей, что позволит рассмотреть влияние лазерной обработки на пористое тело в отсутствии мартенситного превращения.

Обработку поверхности выполняли с помощью установки «Латус-31» представляющей собой молекулярный газовый CO_2 лазер (длина волны излучения λ=10,6 мкм) на основе компактного конвективного оптического квантового генератора «Карат». На поверхность обрабатываемых образцов наносилось поглощающее покрытие - художественная гуашь с желтым железноокисным пигментом Ж-1 ГОСТ 18172-80.

Просмотр микроструктуры и измерения параметров отклика выполнены на цифровом микроскопе *Keyence VHX-1000*.

Таблица 1

Гранулометрический и химический состав порошка ВК-1

Гранулометрический состав, мкм, не более			Массовая доля химических элементов, не более				
X10	X50	X90	*Fe*, %	*C*, %	*N*, %	*O*, %	*S*, %
4	8	18	основа	0,02–0,1	0,02	0,3	0,005

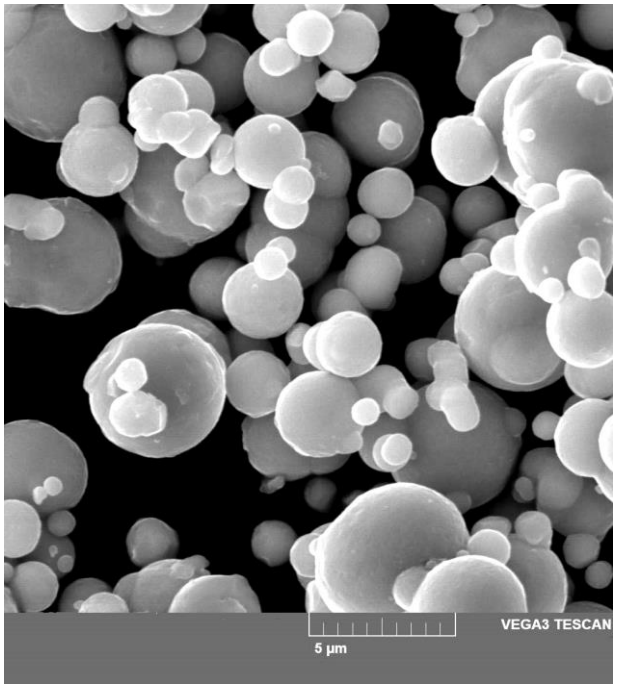


Рисунок 1 - Морфология частиц порошка карбонильного железа ВК-1.

Планирование эксперимента и разработка регрессионных моделей

Для разработки матрицы планирования экспериментов были выбраны три изменяемых фактора:

x_1 – плотность мощности лазерного излучения, Вт/см^2;

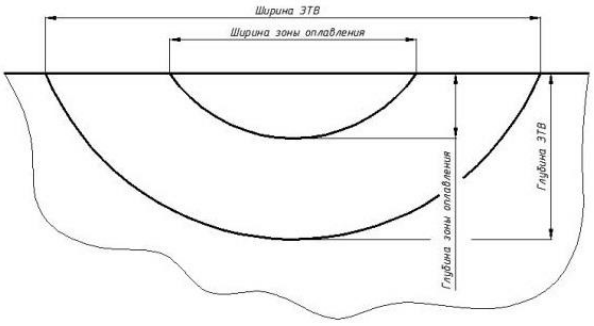
x_2 – скорость перемещения лазерного излучения, мм/с;

x_3 – пористость материала, %.

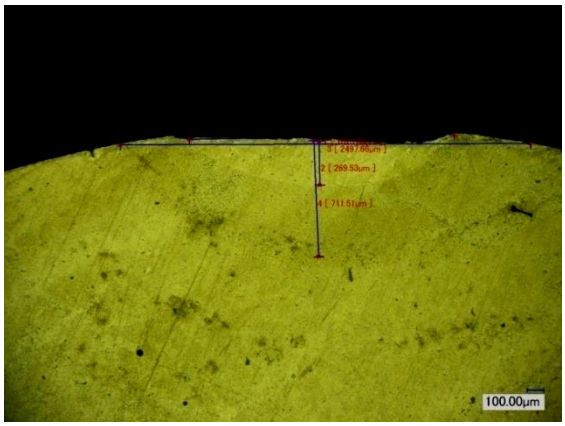
Три фактора позволяют построить план $N=2^K$, где K число факторов, 2 - число уровней (верхний «+1» и нижний «-1»). План 2^3 содержит $N=2^3=8$ - опытов на верхнем и нижнем уровне и дополнительные три параллельных опыта на основном уровне. Параллельные опыты позволяют оценить точность построенной модели и ее линейность за счет введения в матрицу фиктивного фактора «Центр».

На основном уровне факторы имеют следующие натуральные значения: x_1 – $1\cdot10^4$ Вт/см^2, x_2 – 15 мм/с, x_3 – 30 %. Интервалы изменения факторов в натуральном масштабе: Δx_1 – ± $0{,}2\cdot10^4$ Вт/см^2, Δx_2 – ± 5 мм/с, Δx_3 – ± 8 %.

В качестве параметров отклика системы были приняты ширина, глубина зоны плавления и зоны термического влияния (ЗТВ). Схема измерений и микроструктура зоны термического влияния показана на рисунке 2.



а)



б)

Рисунок 2 - Схема измерений параметров отклика (а) и микроструктура зоны термического влияния (б, П=22%, х100)

Матрица планирования и результаты измерений представлены в таблице 2.

Разработанные регрессионные уравнения в кодовом масштабе имеют вид:

$$y_1 = 2459{,}2 - 1218{,}7x_Ц + 830{,}9x_1 - 741{,}3x_2 + 468{,}6x_3 - 338x_1x_2 + 427{,}6x_1x_2x_3 \quad (1)$$

$$y_2 = 311{,}3 - 165{,}9x_Ц + 78x_1 - 71{,}1x_2 + 91{,}3x_3 + 50{,}4x_1x_2x_3 \quad (2)$$

$$y_3 = 3330{,}4 - 444{,}1x_Ц + 255{,}2x_1 - 150{,}8x_2 + 238{,}3x_3 - 418{,}6x_1x_2 + 57x_2x_3 - 47{,}8x_1x_2x_3 \quad (3)$$

$$y_4 = 679{,}4 + 149{,}2x_3 - 139{,}9x_1x_2 \quad (4)$$

Таблица 2

Матрица планирования экспериментов и результаты измерений

№ опыта *i*	Значения факторов							Параметры отклика системы			
	«Центр»	x_1*		x_2		x_3		y_1 - ширина зоны оплавления, мкм	y_2 - глубина зоны оплавления, мкм	y_3 - ширина ЗТВ, мкм	y_4 - глубина ЗТВ, мкм
	код.	код.	нат.,%	код.	нат.,%	код.	нат.,%				
Опыты на верхнем и нижнем уровне											
1	1	1	$1{,}2\cdot10^4$	1	20	1	38	1971,75	297,09	2818,85	647,72
2	1	-1	$0{,}8\cdot10^4$	1	20	1	38	0,00000	0,0000	3242,76	1037,69
3	1	1	$1{,}2\cdot10^4$	-1	10	1	38	3226,57	379,94	3939,16	908,26
4	1	-1	$0{,}8\cdot10^4$	-1	10	1	38	1613,03	269,53	2497,66	711,51
5	1	1	$1{,}2\cdot10^4$	1	20	-1	22	0,00000	0,0000	2325,45	368,15
6	1	-1	$0{,}8\cdot10^4$	1	20	-1	22	0,00000	0,0000	2554,97	651,64
7	1	1	$1{,}2\cdot10^4$	-1	10	-1	22	3062,26	216,54	3482,78	670,57
8	1	-1	$0{,}8\cdot10^4$	-1	10	-1	22	0,00000	0,0000	2228,89	421,21
Параллельные опыты на основном уровне											
9	0	0	$1\cdot10^4$	0	15	1	30	2325,79	265,29	3300,18	645,52
10	0	0	$1\cdot10^4$	0	15	1	30	2559,34	367,17	3361,36	810,76
11	0	0	$1\cdot10^4$	0	15	1	30	2473,57	301,36	3329,57	600,65
* - диаметр луча, сфокусированного на обрабатываемой поверхности, лазерного излучения $d_Л$ =*const*= 3 мм											

В полученные уравнения 1-4 вошли коэффициенты уровень значимости *p* менее 0,05. Уровень значимости *p* вычислен на основании критерия Фишера. Скорректированный коэффициент детерминации R^2 полученных уравнений 1-4 не ниже 0,88. После выполнения соответствующих расчетов выяснилось, что гипотеза о статистической значимости фиктивного фактора «Центр» не отвергается в регрессионных уравнениях по параметрам оптимизации y_1, y_2 и y_3. Статистическая значимость фиктивного фактора «Центр» свидетельствует о нелинейном характере регрессионных уравнений 1-3. В данном случае фактор «Центр» линейно возрастает от значения «0» к «1» при движении от центра плана к его краям.

Наглядно демонстрируют влияния различных факторов и их взаимодействий на параметры оптимизации y_1, - y_4 карты стандартизированных эффектов Парето, представленные на рисунках 3-6.

Обсуждение полученных результатов

Строение зоны лазерного воздействия в выполненных опытах №№1-8 различно, в опытах №№2, 5, 6, 8 отсутствует зона плавления, а ЗТВ присутствует. В остальных опытах имеется и зона плавления и ЗТВ.

На ширину зоны плавления сильно влияет плотность мощности лазерного излучения и скорость обработки, т.е. фактически время воздействия лазерного излучения на поверхность материала:

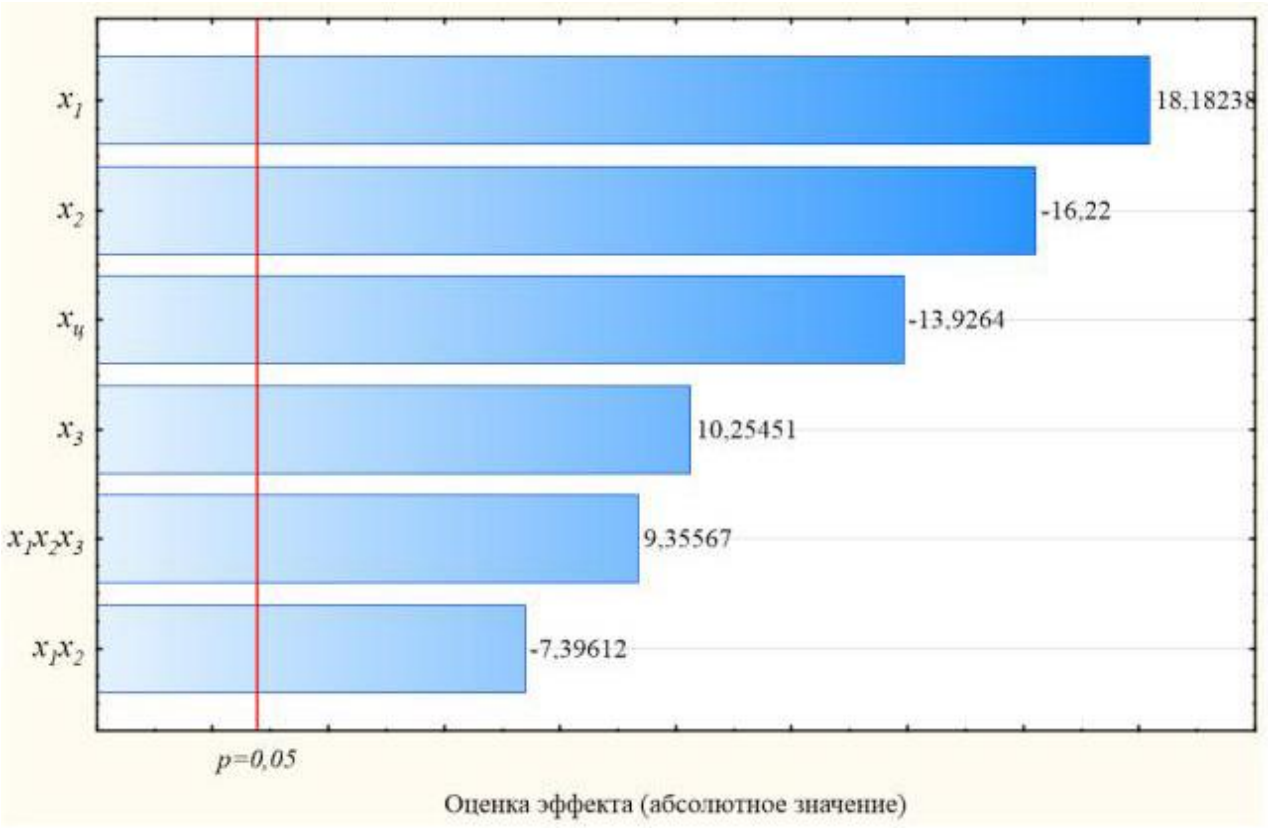


Рисунок 3 - Карта стандартизированных эффектов Парето по параметру оптимизации «Ширина зоны оплавления»

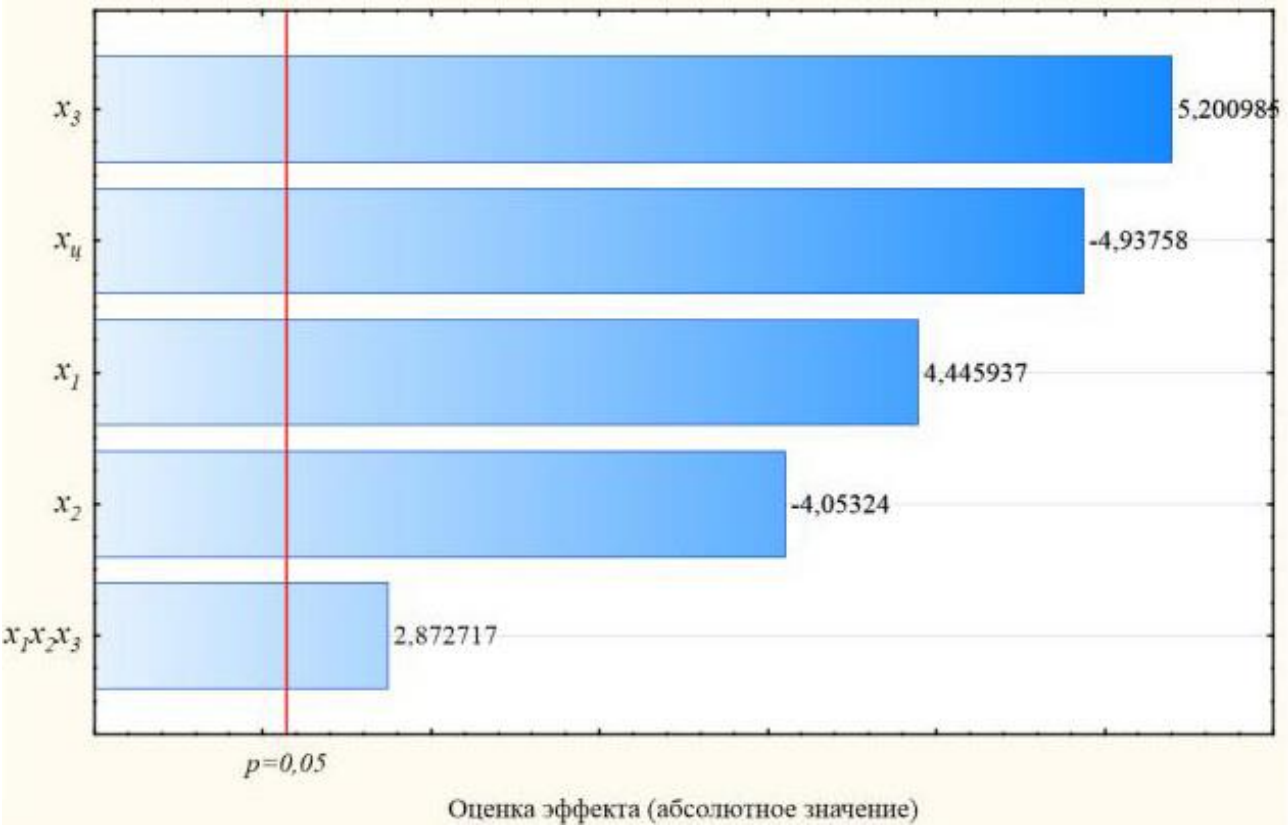


Рисунок 4 - Карта стандартизированных эффектов Парето по параметру оптимизации «Глубина зоны оплавления»

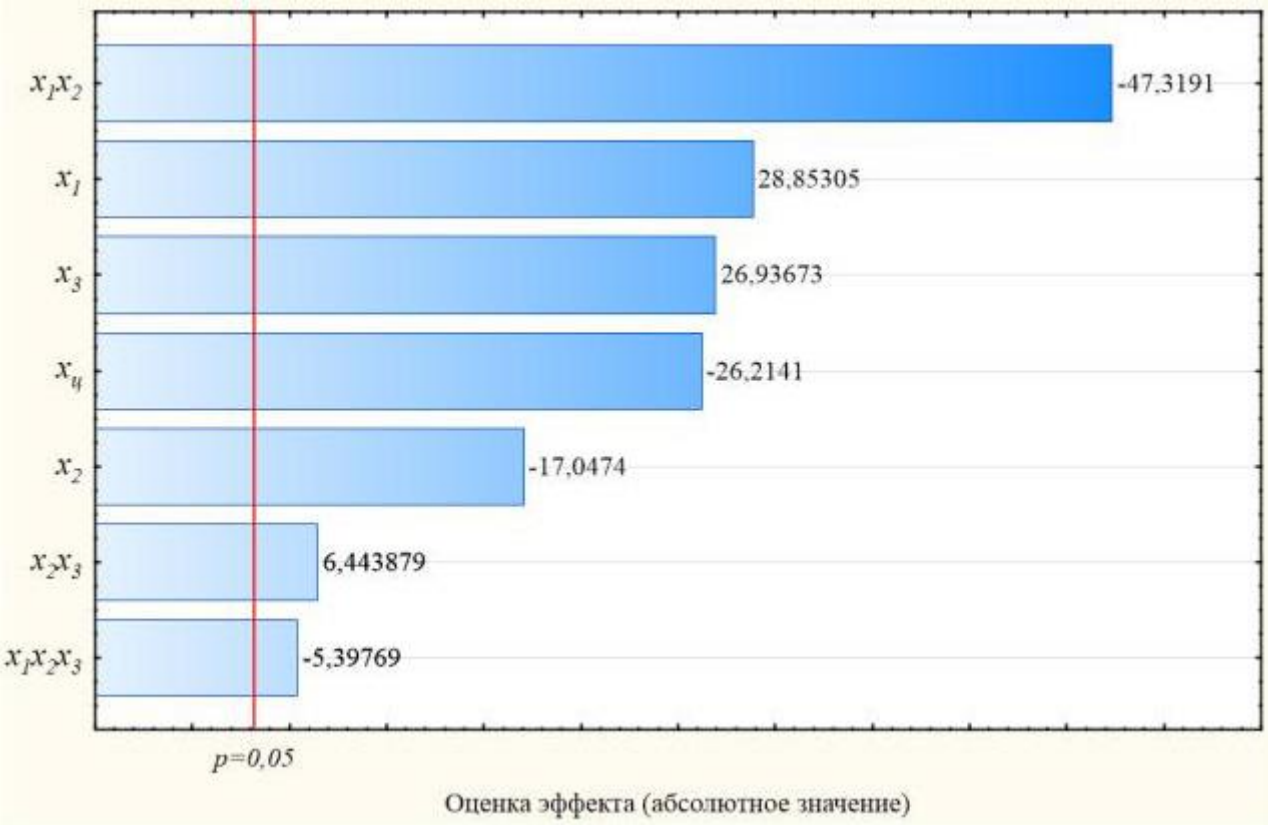


Рисунок 5 - Карта стандартизированных эффектов Парето по параметру оптимизации «Ширина ЗТВ»

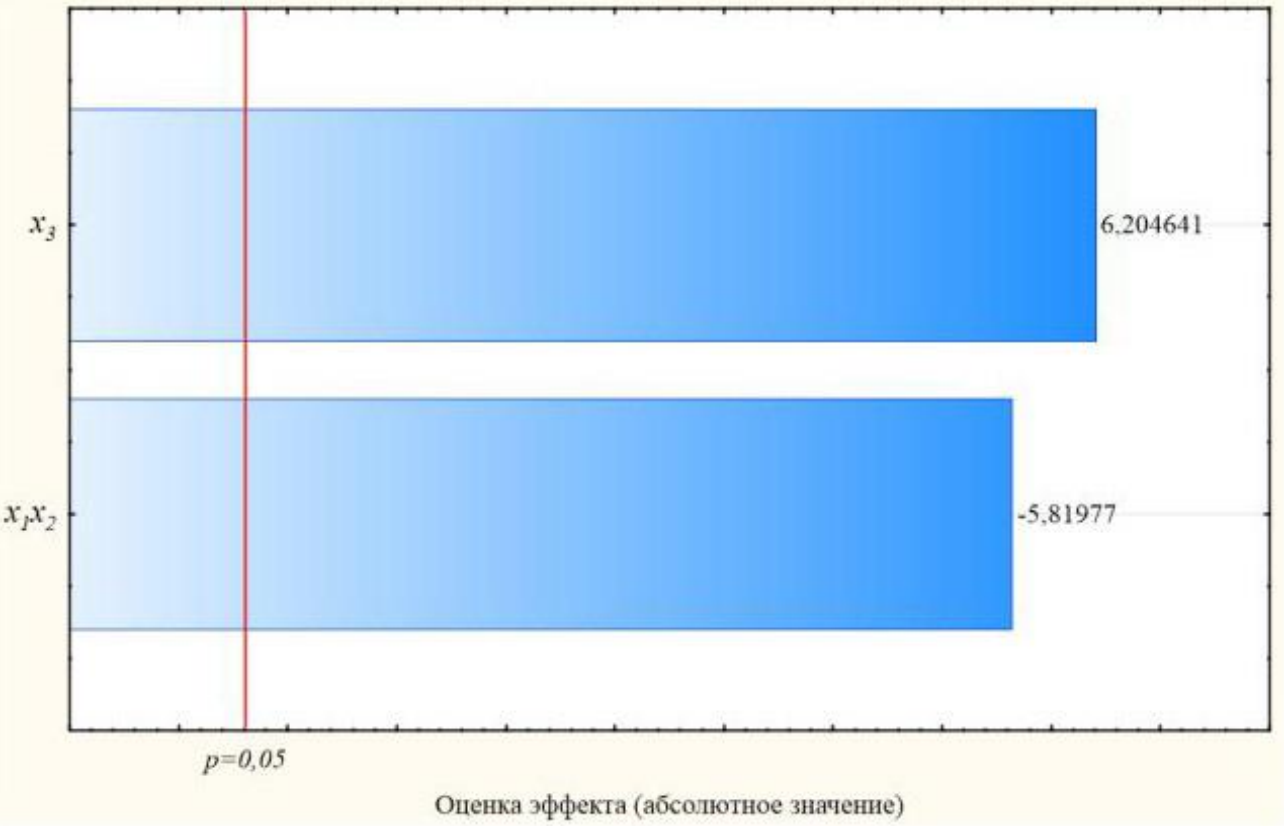


Рисунок 6 - Карта стандартизированных эффектов Парето по параметру оптимизации «Глубина ЗТВ»

$$\tau = d/v \quad (5)$$

где τ - время обработки, с;

d - диаметр «лазерного пятна» на обрабатываемой поверхности, мм;

v - скорость перемещения лазерного пятна по поверхности, мм/с.

С ростом плотности мощности и времени воздействия лазерного излучения на поверхность (с уменьшением скорости обработки) ширина зоны плавления увеличивается (уравнение 1), что хорошо согласуется с результатами [10] для беспористых материалов.

Коэффициент взаимодействия плотности мощности и скорости обработки имеет отрицательный знак и соответственно уменьшает ширину зоны плавления (уравнение 1).

Размерность парного взаимодействия плотности мощности и скорости обработки через время воздействия лазерного излучения на поверхность можно представить как:

$$x_1 \cdot x_2 = \left[\frac{Вт}{см^2}\right] \cdot \left[\frac{с}{1}\right] = \left[\frac{Дж \cdot с}{с \cdot см^2}\right] = \left[\frac{Дж}{см^2}\right] \quad (6)$$

Таким образом, с ростом времени воздействия лазерного излучения на поверхность (т.е. скорость обработки становится ниже) плотность потока энергии увеличивается, что ведет к снижению глубины оплавленного слоя. Такое явление можно объяснить развитием на поверхности плазменных процессов [10, 11]. На рисунке 7 представлены изолинии ширины оплавленной зоны в координатах плотность мощности - скорость обработки.

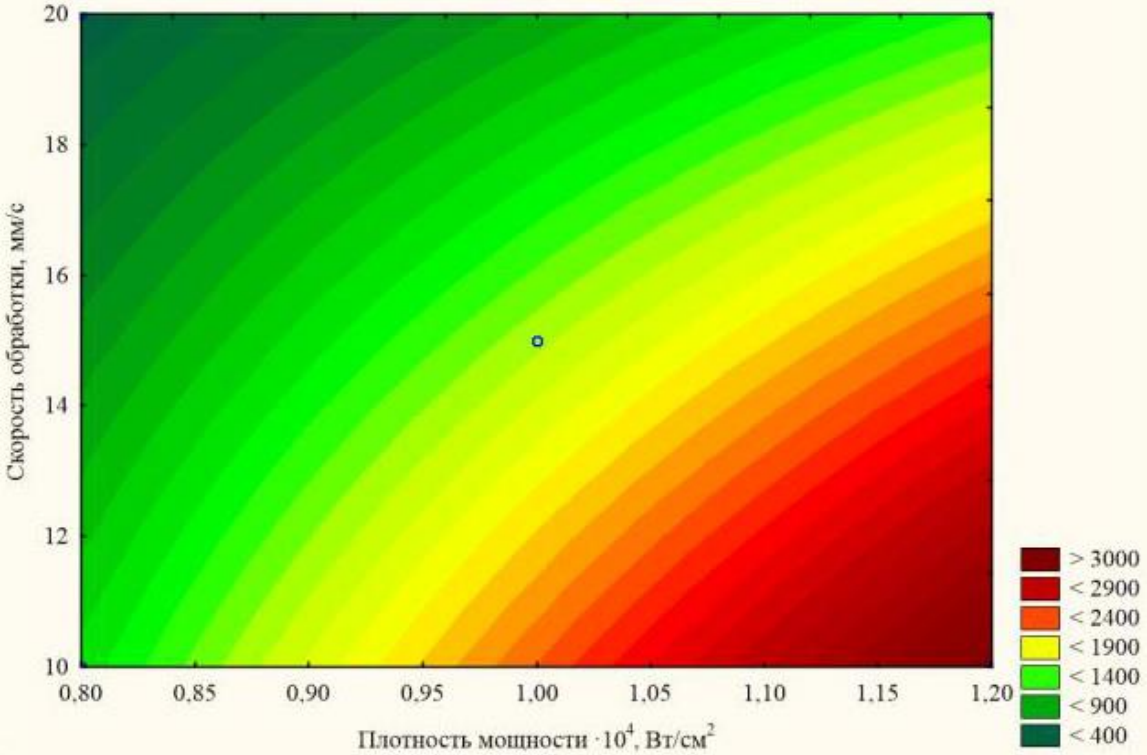


Рисунок 7 - Проекции изолиний ширины оплавленной зоны на плоскость ($x_ц$=0,73, П=30%)

Коэффициент, отражающий влияние пористости прессовок на процесс формирования оплавленной зоны при лазерном облучении поверхности, имеет положительный знак (уравнение 1), т.е. с ростом пористости ширина зоны плавления увеличивается, что согласуется с данными [5].

Пористость существенно снижает теплопроводность материала. Оценить теплопроводность пористого материала, возможно используя следующее соотношение [2, 3]:

$$\lambda_П = \lambda_K (1 - 1{,}5П) \quad (7)$$

где $\lambda_п$ - теплопроводность пористого материала, Вт/м·К;

$\lambda_к$ - теплопроводность компактного материала аналогичного химического состава, Вт/м·К;

П - пористость в долях единицы (объемная доля).

Теплопроводность железа составляет 81 Вт/м·К (при 293,15 К) [2, 3] и расчет по формуле 7 дает численные значения теплопроводности в зависимости от пористости железных прессовок участвующих в матрице планирования (таблица 2):

$$\lambda_{П\text{-}22\%} = 54{,}3;\ \lambda_{П\text{-}30\%} = 44{,}55;\ \lambda_{П\text{-}38\%} = 34{,}8.$$

Как известно с ростом температуры коэффициент теплопроводности так же уменьшается. Расчетные данные по формуле 7 объясняют наличие зоны плавления на образцах с пористостью П=38% при плотности мощности не ниже $0{,}8\cdot10^4$ Вт/см^2 и отсутствие зоны оплавления на образцах с пористостью П=22% в интервале плотности мощности $0{,}8\text{-}1{,}2\cdot10^4$ Вт/см^2 и скорости обработки выше 10 мм/с. Снижение коэффициента теплопроводности с увеличением объемной доли пор способствует изоляции теплоты переданной поверхности лазерным излучением и приводит к плавлению материала.

Тройное взаимодействие факторов представляют собой некий структурно-энергетический параметр лазерной обработки пористых материалов (уравнение 1). Взаимодействие плотности потока энергии лазерного излучения и пористости увеличивает ширину оплавленной зоны, очевидно, в основном за счет влияния пористости на теплопроводность материала. На рисунке 8 представлены проекции изолиний ширины оплавленной зоны в координатах плотность мощности - пористость.

Рассматривая изменение глубины оплавленной зоны (уравнение 2), необходимо заметить, что коэффициент парного взаимодействия плотности мощности и скорости обработки оказывается статистически не значимым. На распространение фронта плавления вглубь материала от действия лазерного излучения плазменные процессы, развивающиеся с увеличением плотности потока энергии, протекающие на поверхности, не оказывают заметного влияния.

В отдельности коэффициенты регрессионного уравнения 2, отражающие влияние плотности мощности лазерного излучения и скорости обработки, оказывают аналогичное качественное влияние, что и на ширину зоны плавления (уравнение 1).

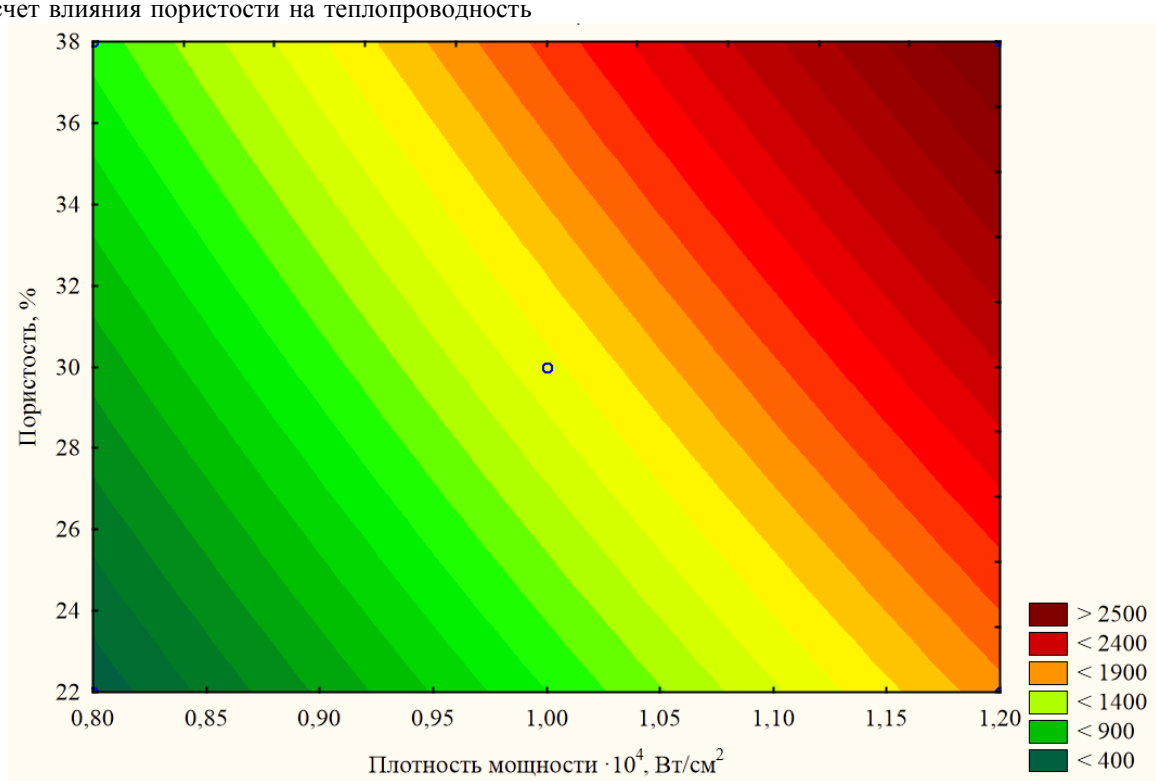


Рисунок 8 - Проекции изолиний ширины оплавленной зоны на плоскость ($x_ц$=0,73, скорость обработки 15 мм/с)

Определяющее значение на глубину зоны плавления (уравнение 2) оказывает пористость, с увеличением которой глубина зоны плавления увеличивается, очевидно, по причинам рассмотренным выше. Проекции изолиний ширины оплавленной зоны в координатах плотность мощности - пористость представлены на рисунке 9.

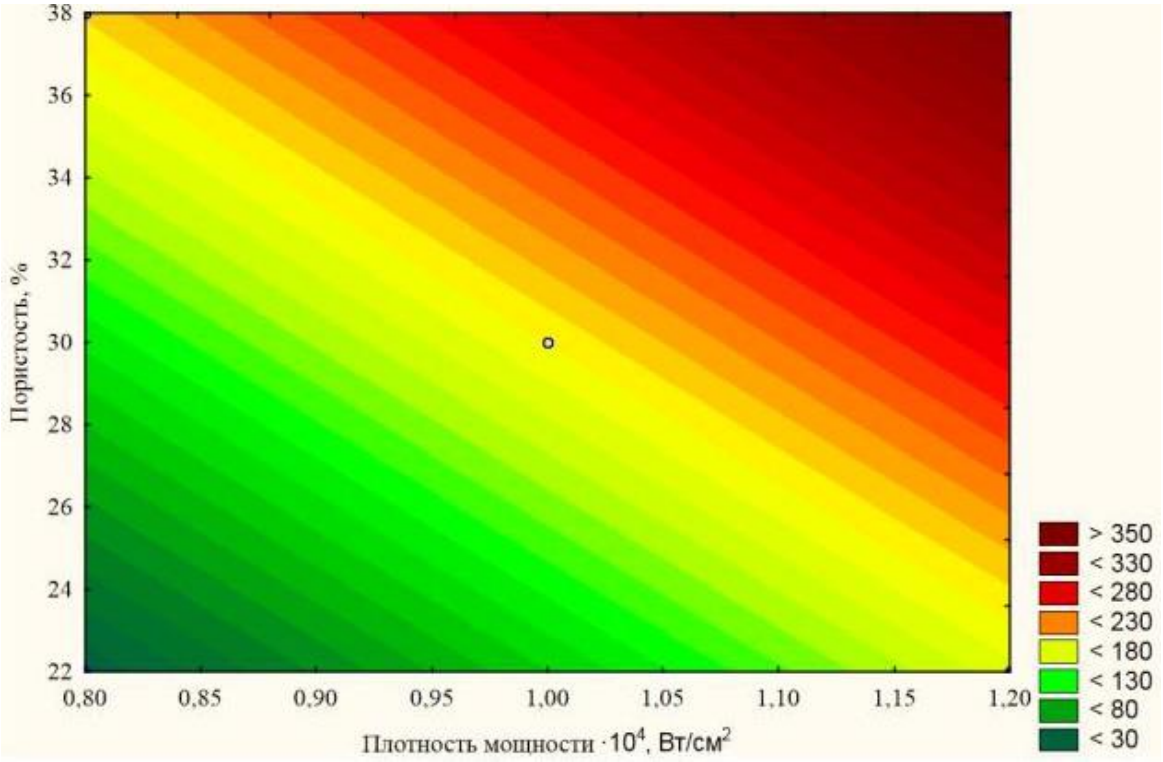


Рисунок 9 - Проекции изолиний глубины оплавленной зоны на плоскость ($x_ц$=0,73, скорость обработки 15 мм/с)

Зона термического влияния образуется под действием лазерного излучения при всех энергетических и структурных параметрах в проведенных опытах, в том числе и в отсутствие зоны плавления. Большие размеры ЗТВ по сравнению с зоной плавления и наличие ЗТВ во всех проведенных опытах, очевидно, связано со значительно меньшим энерговкладом, требующимся для ее образования.

Наиболее ощутимое влияние на ширину ЗТВ оказывает коэффициент парного взаимодействия плотности мощности и скорости обработки уменьшающий ширину ЗТВ, что, как указано выше, связано с плазменными процессами на поверхности при лазерной обработке.

Коэффициенты уравнения регрессии 3, отражающие отдельное влияние плотности мощности, скорости обработки и пористости, проявляют аналогичное с зоной плавления качественное воздействие на ширину ЗТВ.

Тройное взаимодействие плотности мощности, скорости обработки и пористости уменьшают ширину ЗТВ (уравнение 3). Пористость препятствует распространению теплоты в материале, проявляя изолирующее для теплоты точечного источника действие в твердой фазе.

Небольшое влияние на рост ширины ЗТВ имеет парное взаимодействие скорости обработки и пористости, также представляющее собой структурно-энергетический фактор процесса формирования ЗТВ в условиях действия точечного источника теплоты. Также, как и указано выше, определяющее значение в рассматриваемом парном взаимодействии, очевидно, проявляет пористость. На рисунке 10 представлено изменение ширины ЗТВ в координатах плотность мощности - скорость обработки.

На глубину ЗТВ так же влияют все структурно-энергетические характеристики в рассматриваемой матрице планирования экспериментов (уравнение 4). Наибольшее влияние на глубину ЗТВ, как и на глубину зоны оплавления, оказывает пористость, увеличивая глубину ЗТВ. Парное взаимодействие плотности мощности и скорости обработки уменьшает глубину ЗТВ. При этом влияние пористости по модулю немного больше, чем парное взаимодействие плотности мощности и скорости обработки. Очевидно, что плазменные процессы,

развивающиеся на поверхности, оказывают достаточно сильное влияние на глубину ЗТВ в отличие от глубины оплавленной зоны, где этот фактор оказывается статистически незначимым.

На рисунке 11 представлено изменение глубины ЗТВ в координатах плотность мощности - пористость.

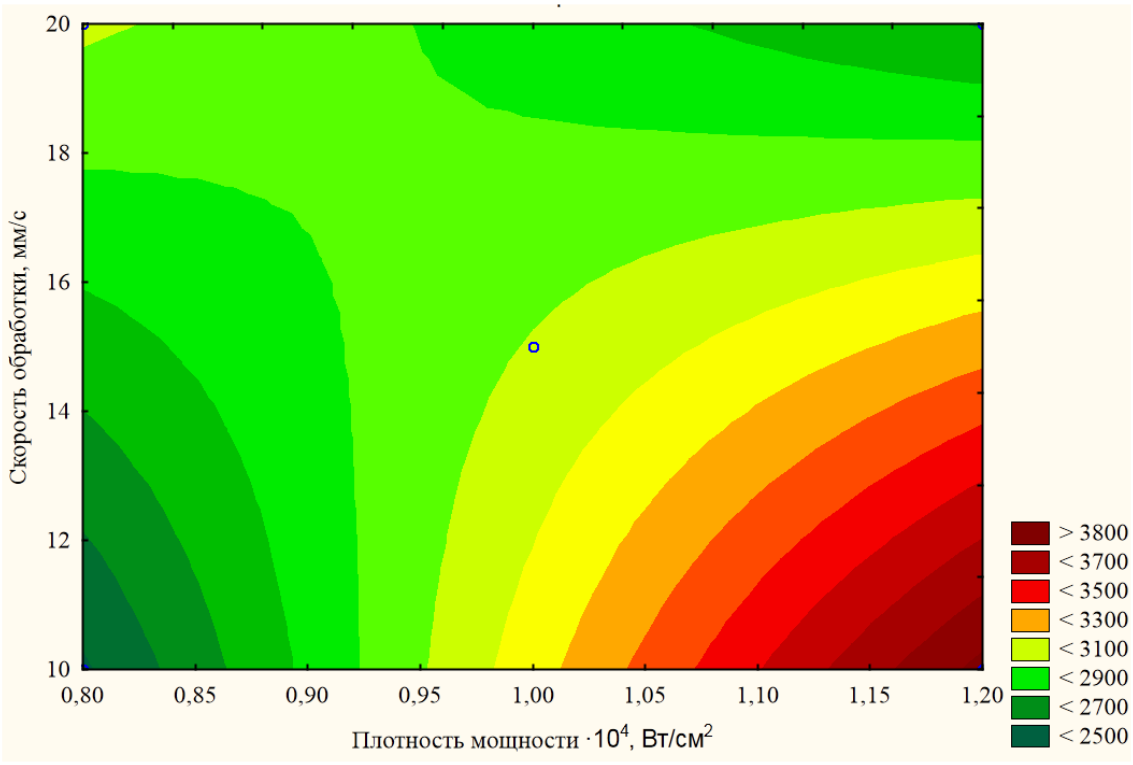


Рисунок 10 - Проекции изолиний ширины ЗТВ на плоскость ($x_ц$=0,73, П=30%)

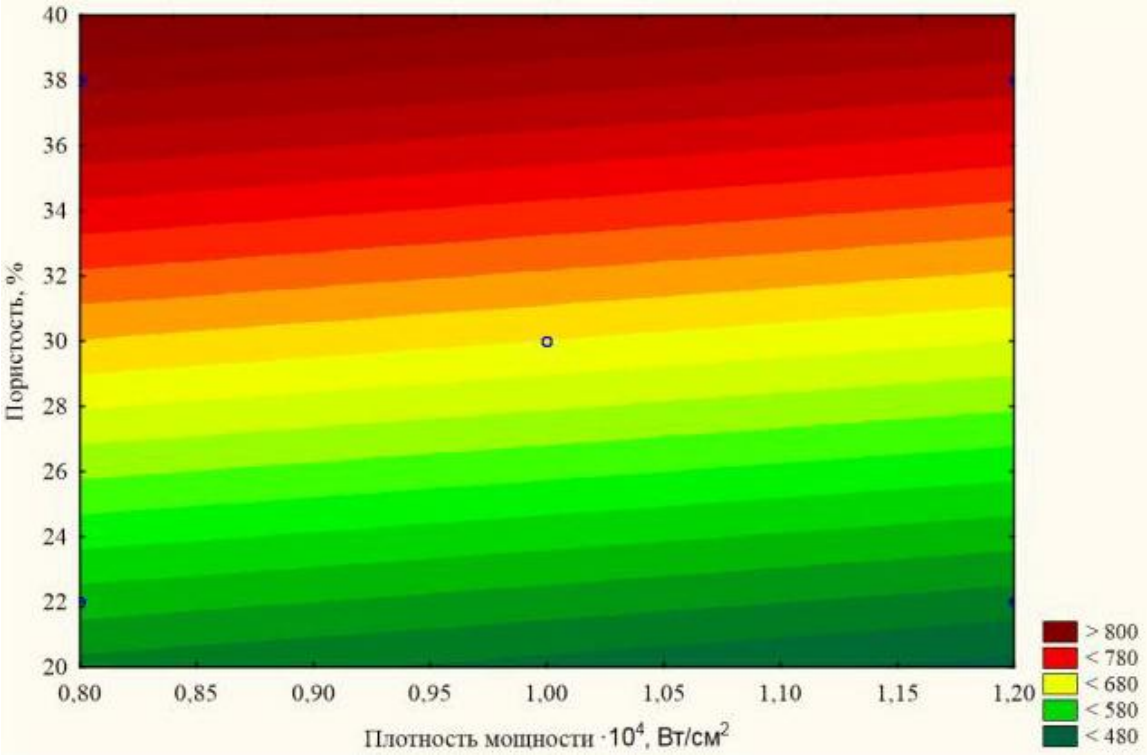


Рисунок 11 - Проекции изолиний ширины ЗТВ на плоскость ($x_ц$=0,73, скорость обработки 15 мм/с)

Выводы:

1. Детально рассмотрено влияние энергетических и структурных факторов на формирование зоны оплавления и ЗТВ при обработке лазерным излучением пористых спеченных материалов из восстановленного карбонильного железа.
2. Установлено, что структурно-энергетические параметры обработки нелинейно воздействуют на размеры оплавленной зоны и ширину ЗТВ.
3. Отдельное влияние плотности мощности и скорости обработки хорошо согласуются с ранее проведенными исследованиями для компактных материалов. Плотность мощности прямопропорционально увеличивает, а скорость обработки уменьшает размеры зоны оплавления и ЗТВ.
4. Пористость увеличивает размеры зоны плавления и ЗТВ, что связано с ее влиянием на теплофизические характеристики материалов, в частности, пористость снижает коэффициент теплопроводности и способствует концентрации теплоты в небольшом объеме от точечного источника.
5. Парное взаимодействие плотности мощности и скорости обработки, представляющее собой плотность потока энергии, уменьшает размеры зоны плавления и ЗТВ, особенно сильное влияние это парное взаимодействие оказывает на ширину ЗТВ. Такое воздействие плотности потока энергии связывается с плазменными процессами, возникающими на поверхности обрабатываемого материала под действием лазерного излучения.
6. Парное взаимодействие скорости обработки и пористости является структурно-энергетическим параметром в условиях воздействия лазерного излучения, оказывается статистически значимым лишь для ширины ЗТВ, имеет небольшое воздействие, увеличивая ее.
7. Тройное взаимодействие плотности мощности, скорости обработки и пористости увеличивает размеры зоны оплавления и уменьшает ширину ЗТВ. На указанные параметры отклика системы тройное взаимодействие имеет небольшое влияние. Изменение качественного характера воздействия на параметры отклика, очевидно, связано с влиянием пористости с присутствием или отсутствием жидкой фазы в системе.

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SECTION 6. Metallurgy and energy.

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THE INFLUENCE OF MICRO - AND NANO-SIZED DIAMOND FILLERS ON POWDER ROLLING PHYSICAL AND MECHANICAL PROPERTIES

Abstract: *It is analyzed the influence of micro- and nano-sized diamond filler on the physico-mechanical properties of diamond-containing powder rolling. It was established a strong softening effect of nanodiamond filler on the basis of the softening coefficient* $k_p = \sigma_c / \sigma_{ac}$ *with relatively low concentration of conventional K = 40%. Nanodiamond filler strong softening effect conditioned by its metal bond allocation. Limited conditional concentration of nanodiamond filler K = 3,96% in rolling on the basis of copper powder ПМС-1 is installed by calculation method. Given recommendations about using polycrystalline diamond brand RDDM 0-0,5.*

Key words: *the powder metallurgy, the diamond-containing rolling, the tensile strength, the softening coefficient, the microstructure of diamond-containing rolling.*

Language: *Russian*

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ВЛИЯНИЕ МИКРО - И НАНОРАЗМЕРНОГО АЛМАЗНОГО НАПОЛНИТЕЛЯ НА ФИЗИКО-МЕХАНИЧЕСКИЕ СВОЙСТВА ПОРОШКОВОГО ПРОКАТА

Аннотация: *Выполнен анализ влияния микро- и наноразмерного алмазного наполнителя на физико-механические свойства порошкового алмазосодержащего проката. Установлено сильное разупрочняющее действие наноалмазного наполнителя при относительно малой условной концентрации K=40% на основании коэффициента разупрочнения* $k_p = \sigma_c / \sigma_{ac}$. *Сильное разупрочняющее действие наноалмазного наполнителя обусловлено его распределением в металлической связке. Расчетным способом установлена предельная условная концентрация наноалмазного наполнителя K=3,96% в прокате на основе порошка меди ПМС-1. Даны рекомендации по применению поликристаллических алмазов марки RDDM 0-0,5.*

Ключевые слова: *порошковая металлургия, алмазосодержащий прокат, предел прочности, коэффициент разупрочнения, микроструктура алмазосодержащего проката.*

Введение

Развитие промышленности требует разработки новых и совершенствования ранее разработанных материалов. Постоянно возрастают требования к эксплуатационным и технологическим характеристикам материалов. Композиты во многом соответствуют сложившейся тенденции повышения требований к материалам. Свойства композитов формируются по принципу аддитивности в соответствии с долями входящих в состав компонентов, тем самым обеспечивая требуемые свойства. Производство композиционных материалов на металлической матрице обеспечивается технологиями порошковой металлургии [1-6].

Данная работа посвящена изучению порошковых двух объемных композитов с микро- и наноразмерным алмазным наполнителем. Ранее выполнены обширные, всесторонние исследования порошковых, листовых, абразивных материалов с микрометрическим алмазным наполнителем для нужд электронной промышленности [1-3]. Алмазные наполнители обладают абразивной способностью и с успехом применяются при изготовлении инструментальных металлоалмазных композиций [1-3, 6, 7].

Нанометрические алмазы имеют округлую форму частиц, что существенно влияет на их свойства. Синтетические наноразмерные алмазы не обладают режущей способностью и являются твердой смазкой, наличие твердой смазки в порошковом листовом абразивном алмазосодержащем материале позволяет повысить качество разделения компонентов электронной техники, т.е. уменьшить количество сколов и износ инструмента.

В работе проведено обобщение влияния алмазного наполнителя микро- и наноразмерности на прочность листового алмазосодержащего материала на основе оловянно-никелевой бронзы и меди.

Материалы и оборудование

Алмазосодержащие материалы изготавливались методом порошковой металлургии (прокатка + спекание + уплотняющая прокатка) [1, 2]. Прокатка порошковой шихты осуществлялась в прокатном стане дуо с горизонтально расположенными валками. Образцы после прокатки имели пористость ~35% и различную толщину. После спекания проката его подвергали четырем циклам механо-термической обработке с промежуточными отжигами. Толщина неспеченного порошкового проката выбрана таким образом, чтобы после механо-термической обработки со степенью обжатия ε =30%, получить необходимую толщину готового алмазосодержащего проката.

На основе оловянно-никелевой бронзы изготавливались материалы с микрометрическим наполнителем, а на основе порошка меди с нанометрическим. Шихта оловянно-никелевой бронзы содержит 6,5 масс. % олова и 4,0 масс. % никеля. При составлении шихты использовались следующие порошки:

- порошок меди ПМС-1, ГОСТ 4960-2009;
- порошок никеля ПНК-УТ3, ГОСТ 9722-97;
- порошок олова ПО-1, ГОСТ 9723-73;
- порошок синтетических алмазов, ГОСТ 9206-80;
- порошок поликристаллических алмазов, RDDM 0-0,5.

Смешивание шихты на основе оловянно-никелевой бронзы и микрометрического алмазного наполнителя проводили в лабораторном баночном смесителе в течение 120 минут. Смешивание шихты, состоящей из порошка меди ПМС-1 и наноалмазного наполнителя марки RUDDM 0-0,5, проводили в шаровой мельнице в течение 10 часов. Частицы наноалмазов в шихте за счет довольно длительного вращения равномерно распределяются по поверхности частиц порошка ПМС-1 (рисунок 1).

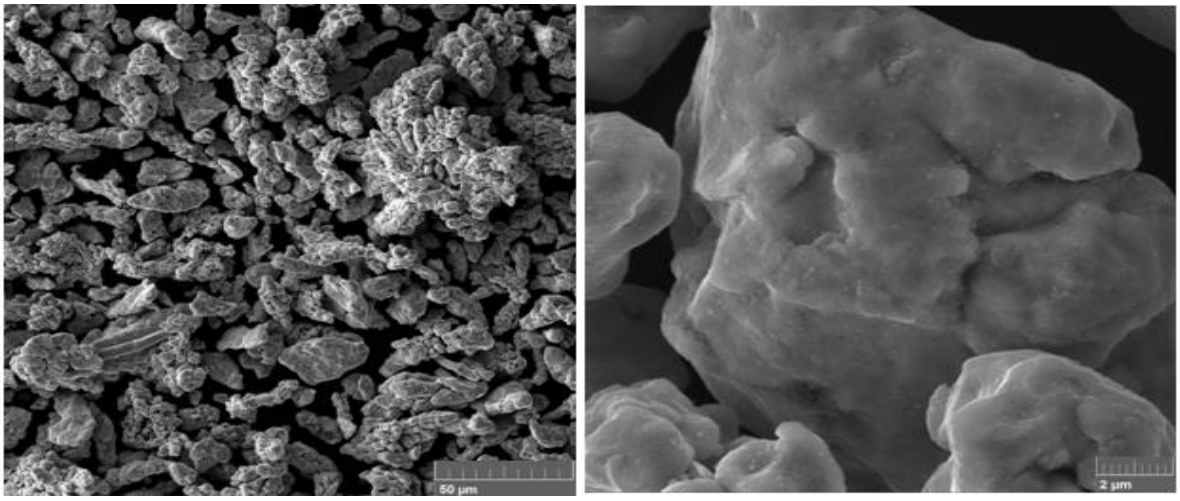
В опытах варьировали величиной средней зернистости, условной концентрацией алмазного наполнителя и толщиной проката после всех циклов механо-термической обработки. В таблице 1 приведены уровни варьирования факторами, а также прочность алмазосодержащего проката, прочность связки полученной методом порошковой металлургии и коэффициент разупрочнения. Коэффициент разупрочнения, представленный в таблице 1, вычисляли по формуле:

$$k_p = \frac{\sigma_c}{\sigma_{ac}} \qquad (1)$$

где σ_c - предел прочности металлической связки (безалмазного порошкового проката);

σ_{ac} - предел прочности алмазосодержащего порошкового проката на металлической связке с пределом прочности σ_c.

В общем случае введение неметаллического наполнителя в металлическую связку приводит к снижению прочности материала по сравнению с исходной металлической связкой [1, 9-10]. Коэффициент разупрочнения принят за меру влияния алмазного наполнителя на предел прочности металлической связки.



а б

а - разрешение 50 мкм, б - разрешение 2 мкм.

Рисунок 1 - Снимки РЭМ шихты с концентрацией 0,8% наноалмазов.

Таблица 1

Уровни варьирования факторами в натуральном масштабе и результаты экспериментов

№ опыта	Средняя величина зерна алмазного порошка, мкм	Условная концентрация алмазного порошка *K*, %	Толщина ленты, мкм	Предел прочности σ_{ac}, МПа	Предел прочности σ_{c}, МПа	Коэффициент разупрочнения k_p
	x_1	x_2	x_3	-	-	y
1	8	50	40	322,6	735,5	2,3
2	16	50	40	264,8		2,8
3	8	100	40	239,3		3,1
4	16	100	40	161,8		4,5
5	8	50	80	449,1		1,6
6	16	50	80	353,0		2,1
7	8	100	80	246,1		3
8	16	100	80	259,9		2,8
9	12	75	60	259,9		2,8
10	12	75	60	274,6		2,7
11	12	75	60	262,8		2,8
12	12	75	60	260,9		2,8
13	0,25	40	600	15,50	352,4	22,7
14	0,25	24	600	29,20		12,1
15	0,25	8	600	125,9		2,8
Примечание: Опыты №№1-12 - связка оловянно-никелевая бронза 6,5 масс. % олова и 4,0 масс. % никеля; Опыты №№13-15 связка - медь						

В таблице 1 нетрудно заметить, что опыты 1-12 представляют собой полный факторный эксперимент по плану 2^3 с четырьмя параллельными опытами на основном уровне. № 13-15 представляют собой одномерные опыты с изменением только концентрации порошка RUDDM 0-0,5 в медной матрице.

Разработка регрессионной модели

Данные (таблица 1) можно обобщить с помощью полиномиальной квадратичной модели. После выполнения соответствующих расчетов имеем уравнение регрессии:

$$y = - 3{,}409 - 4{,}684x_1 + 0{,}882x_2 + 0{,}199x_1^2 - 0{,}0057x_2^2 \quad (2)$$

Все коэффициенты, вошедшие в уравнение регрессии, имеют уровень значимости *p*, вычисленный по критерию Фишера, менее 0,05. Скорректированный коэффициент детерминации модели R^2 = 0,98. Значение остатков по модулю не более 1,452. Остатки хорошо описываются теоретической кривой нормального распределения Гаусса. Нормально-вероятностный график остатков и ожидаемых нормальных значений не имеет существенных систематических отклонений от теоретической прямой. Остатки и предсказанные моделью значения распределены бессистемно. Дисперсионный анализ полученного уравнения регрессии в целом показывает уровень значимости *p* менее 0,05. Выполненный комплексный статистический анализ свидетельствует о пригодности полученной модели.

На рисунке 2 представлена карта стандартизированных эффектов Парето, наглядно демонстрирующая влияние линейных и квадратичных членов уравнения 1 на значения коэффициента разупрочнения.

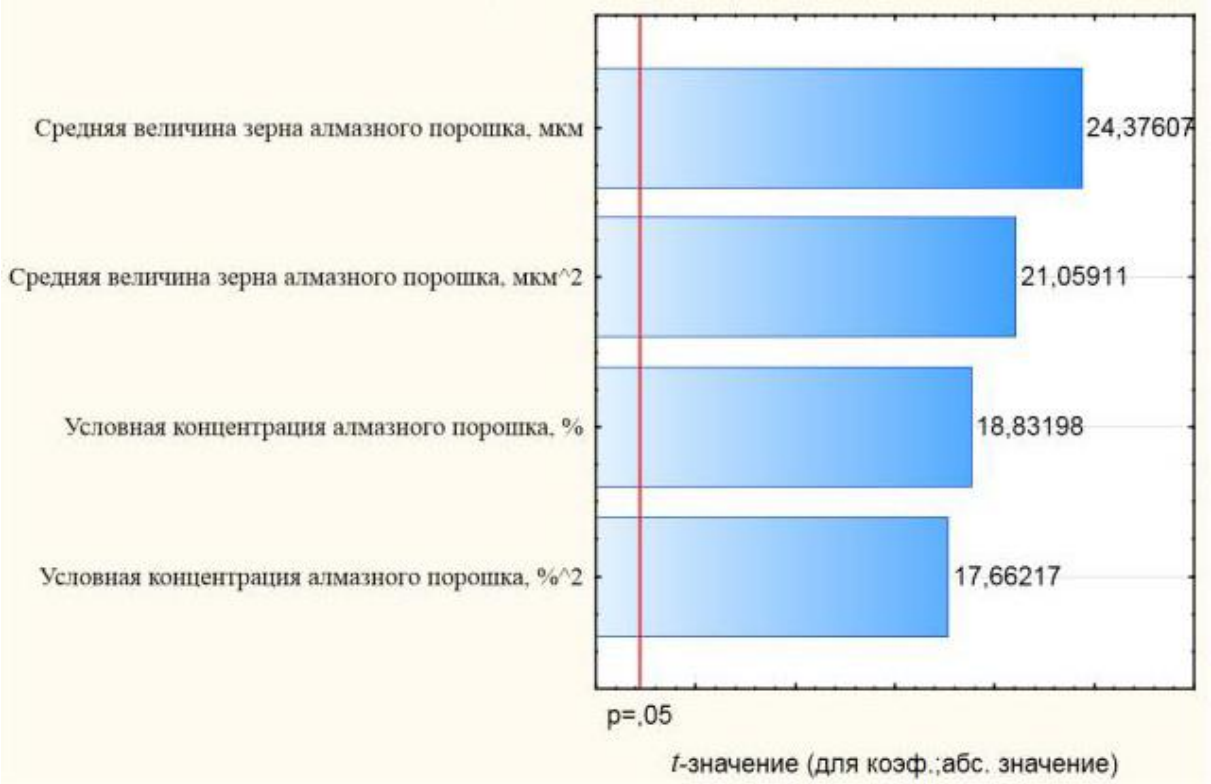


Рисунок 2 - Карта Парето стандартизированных эффектов

Полученные результаты и обсуждение

Влияние алмазного наполнителя микро- и наноразмерности на коэффициент разупрочнения имеет существенные различия. Так рост средней величины зерна микрометрического алмазного наполнителя от 8 до 16 мкм разупрочняет исходную металлическую связку в 2,8...4,5 раза при условной концентрации K=100%. Нанометрический алмазный наполнитель при условной концентрации K=40% разупрочняет исходную медную связку в 22,7 раза. На рисунке 3 показано изменение коэффициента разупрочнения от средней величины алмазного порошка и его условной концентрации.

Такое сильное влияние наноразмерного алмазного наполнителя по сравнению с микрометрическим объясняется отличиями их распределения в металлической связке (рисунок 4). Микрометрический алмазный наполнитель распределен в связке равномерно, размер зерен наполнителя соизмерим с размером частиц порошка металлической связки (рисунок 3, а). Нанометрический алмазный наполнитель распределяется по границам исходных частиц порошка (агрегатная структура дисперсноупрочненного материала), что изолирует частицы порошка металлической связки во время спекания [8].

Расчетным методом можно оценить изолирующее действие наноалмазного наполнителя на частицы медной металлической связки, сравнивая средние размеры зерна порошка меди и наноалмазов. Для реализации расчета были приняты допущения: частицы в

порошковой системе имеют идеальную сферическую форму; частицы порошков, входящих в смесь, имеют соответствующие одинаковые средние размеры; частицы наноалмазного наполнителя равномерно распределяются по поверхности частиц меди.

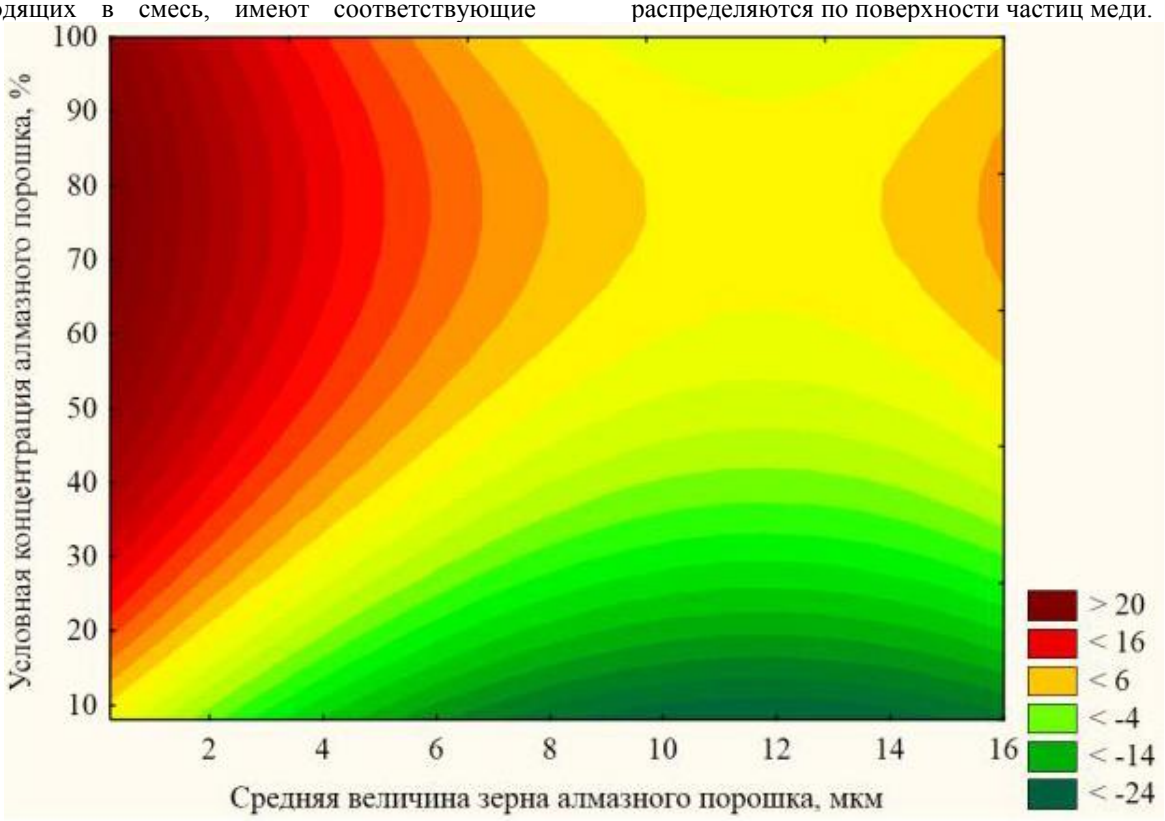
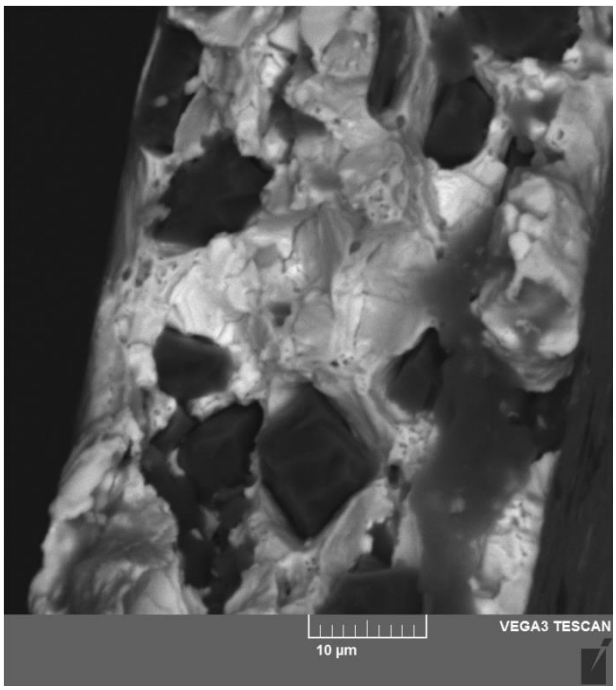
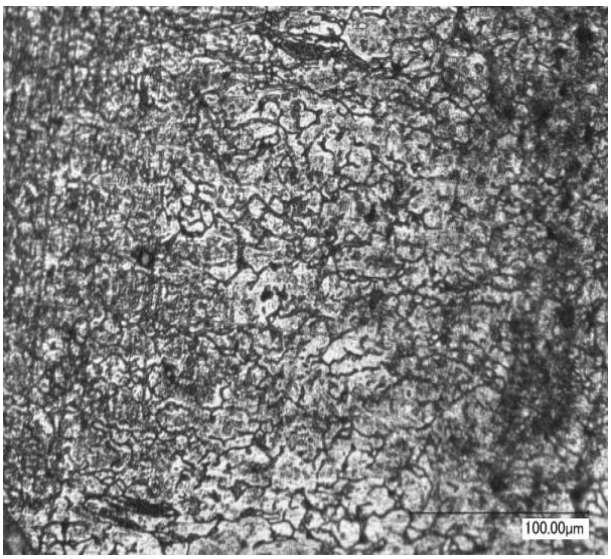


Рисунок 3 - Зависимость коэффициента разупрочнения от условной концентрации и средней величины зерна алмазного порошка.



а)



б)

а - К=100%; б - К=10%

Рисунок 4 - Микроструктура алмазосодержащего материала с микрометрическим (а) и нанометрическим (б) алмазным наполнителем

Соответственно частица меди - шар d=100 мкм, частица наноалмазного наполнителя - шар d=0,25 мкм. Количество наноразмерных частиц алмазного наполнителя, покрывающие частицу меди равномерно в один слой, можно рассчитать по формуле:

$$N = \frac{4D_{Cu}^2}{D_{H.A.}^2} \quad (3)$$

где D_{Cu} - средний диаметр частиц порошка меди, мкм;

$D_{H.A.}$ - средний диаметр частиц алмазного порошка, мкм.

Подставив средний диаметр частиц порошка меди и наноалмазов, получаем значение N=640000, т.е. на одну частицы порошка меди приходиться 640000 частиц порошка наноалмазов при равномерном однослойном покрытии частицы меди наноалмазами. В идеальных условиях при N=640000 во время спекания образование металлической связи между частицами порошка меди разделенных слоем наноалмазов толщиной h=2·0,25=0,5 мкм маловероятно.

Рассчитаем объемное процентное содержание наноалмазов в медной связке при соотношении частиц меди и наноамазного порошка 1:640000:

$$об.\%Н.А. = \frac{640000 \cdot D_{H.A.}^3 \cdot 100\%}{D_{Cu}^3 + 640000 \cdot D_{H.A.}^3} = 0{,}99\% \quad (4)$$

Объемное содержание наноалмазного порошка можно перевести в условную концентрацию K_P (K=100% соответствует 25 об. %) в соответствии с пропорцией:

$$K_P = \frac{об.\%Н.А \cdot 100\%}{25\%} = 3{,}96\% \quad (5)$$

Объемное содержание наноалмазного порошка также можно перевести в массовое:

$$масс.\%Н.А. = \frac{об.\%Н.А. \cdot \rho_{Н.А.} \cdot 100\%}{об.\%Н.А. \cdot \rho_{Н.А.} + (100 - об.\%Н.А.) \cdot \rho_{Cu}} = 0{,}39\% \quad (6)$$

где D_{Cu} - средний диаметр частиц порошка меди, мкм;

$D_{H.A.}$ - средний диаметр частиц алмазного порошка, мкм.

В таблице 2 приведены данные, связывающие условную концентрацию наноалмазного наполнителя в порошковом прокате на основе меди, расчетную условную концентрацию, при которой образование металлической связи при спекании между частицами медного порошка маловероятно, и предел прочности.

Таблица 2

Условная концентрация наноалмазного наполнителя и предел прочности проката

Условная концентрация наноалмазного наполнителя K, %	Расчетная концентрация наноалмазного наполнителя K_P, %	K/K_P	Предел прочности проката с наноалмазным наполнителем σ_B, МПа
8	3,96	2,020	125,9
24		6,061	29,20
40		10,10	15,50

Отношение K/K_P (таблица 2) характеризует степень изоляции частиц меди, распределенным по поверхности наноалмазным наполнителем, с ростом отношения степень изолированности повышается, а прочность проката существенно снижается.

Судя по значениям K/K_P (таблица 2) металлическая связь в прокате всех рассматриваемых условных концентраций образовываться не должна. Однако коэффициент разупрочнения, полученный в опыте №15 (таблица 1) соизмерим с коэффициентом разупрочнения при использовании алмазного наполнителя микрометрического размера с условной концентрации K=100%.

Очевидно, в процессе уплотняющей прокатки происходит сдвиг покрытых наноалмазным наполнителем частиц меди относительно друг друга, что приводит к нарушению целостности слоя наноалмазов у соседних частиц меди и образованию в процессе отжига металлической связи.

Также следует учитывать допущения, сделанные при расчете K_P. Частицы порока меди по своей форме существенно отличаются от идеальной сферической, при смешивании, возможно, не достигнуть равномерности покрытия частиц меди наноалмазами и покрытия всех входящих в порошковую систему частиц меди.

Для сравнения по формулам 3-5 рассчитаем условную концентрацию K_P для микрометрического алмазного наполнителя с d=16 мкм, имеем K_P=156%, т.е. отношение K/K_P в опытах №1-12 (таблица 1) менее 1 и максимальное значение коэффициента разупрочнения составляет k_p = 4,5 (опыт №4).

Выводы.

Влияние нано- и микрометрического алмазного наполнителя на прочность металлической матрицы имеет существенные различия, связанные с распределением частиц наполнителя в матрице.

Предложена методика оценки коэффициента разупрочнения металлической матрицы на основании расчетного значения условной концентрации алмазного наполнителя K_P. Для получения достаточно высоких прочностных свойств алмазосодержащего проката необходимо, чтобы отношение условной K и расчетной условной концентрации K_P алмазного наполнителя было менее 1. В этом случае образование металлической связи между частицами связки в процессе спекания и механо-термической обработки весьма вероятно.

В свою очередь K_P рассчитывается на основании геометрического сравнения частиц металлических и неметаллических порошков, входящих в шихту. При расчете K_P приняты допущения: частицы в порошковой системе имеют идеальную сферическую форму; частицы порошков, входящих в смесь, имеют соответствующие одинаковые средние размеры; частицы наноалмазного наполнителя равномерно распределяются по поверхности частиц меди.

Проведенные исследования позволяют рекомендовать применение наноалмазного наполнителя в условной концентрации K менее 8% при использовании порошка меди ПМС-1 ГОСТ 4960-75 в качестве основы шихты и порошка поликристаллических алмазов RUDDM 0-0,5 в качестве наполнителя. При увеличении условной концентрации наноалмазов происходит существенное снижение прочности алмазосодержащего проката.

Путь повышения прочности наноалмазного проката на основе медной металлической связки - снижение дисперсности частиц порошка меди в комплексе с высокоэнергетическим смешиванием шихты. Такой подход позволит уменьшить величину K/K_P и изменить агрегатную структуру материала на дисперсную.

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SECTION 7. Mechanics and machine construction.

DESIGNING AND MANUFACTURING OF THE TOOL OF THE SECOND ORDER

Abstract: *The article is presented the technology of manufacture of the tool electrode to machining the mold cavity with using the computer aided design Pro/ENGINEER.*

Key words: *a tool electrode, machining, a cutting tool, a CNC machine, a workpiece, a coordinate axis.*

Language: *English*

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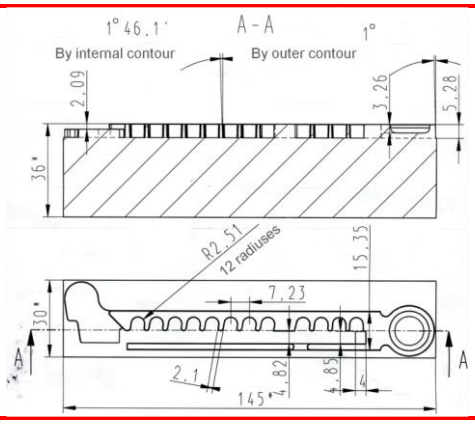
Introduction

The tool of the second order is the tool for manufacturing of the other tool.

The complex and accuracy surfaces of the technological tooling, such as injection mold [1], it is advisable to perform by the special tool for the physical-technical processing. On the working part of the tool electrode [2] it is performed a contoured surface identical by the contour of the machined surface of the workpiece. In dependence on the material of the workpiece the tool electrode can be manufactured from the graphite carbon, the copper, the aluminum alloys, the cast iron, the brass, and also extruded alloy of the copper and the tungsten. The tools electrodes are manufactured on the milling machines or in the case of machining of the hard alloy on the electrical discharge machines.

The stages of designing and subsequent manufacturing of the tools electrodes of the complex configuration are implemented with using of the modern computer-aided design of the technological processes by machining and the automated technological equipment.

Let us consider the each stage in more detail. The drawing which offered to manufacturing of the tool electrode is presented in Fig. 1.



The technical requirements on the manufacturing of the tool electrode:

1. The electric-spark gap of 0.2 mm to obtain by machining.
2. * The reference dimension.
3. The unspecified dimensions to perform according to the mathematical model.

Figure 1 – The drawing of the tool electrode.

As material of the workpiece for the manufacturing of the tool electrode it was used the copper mark M1 (GOST 5638-75) [3].

Designing of the tool

The movable die half is part of the mold for the injection molding of the range of parts. 3D solid model of the part is presented in Fig. 2.

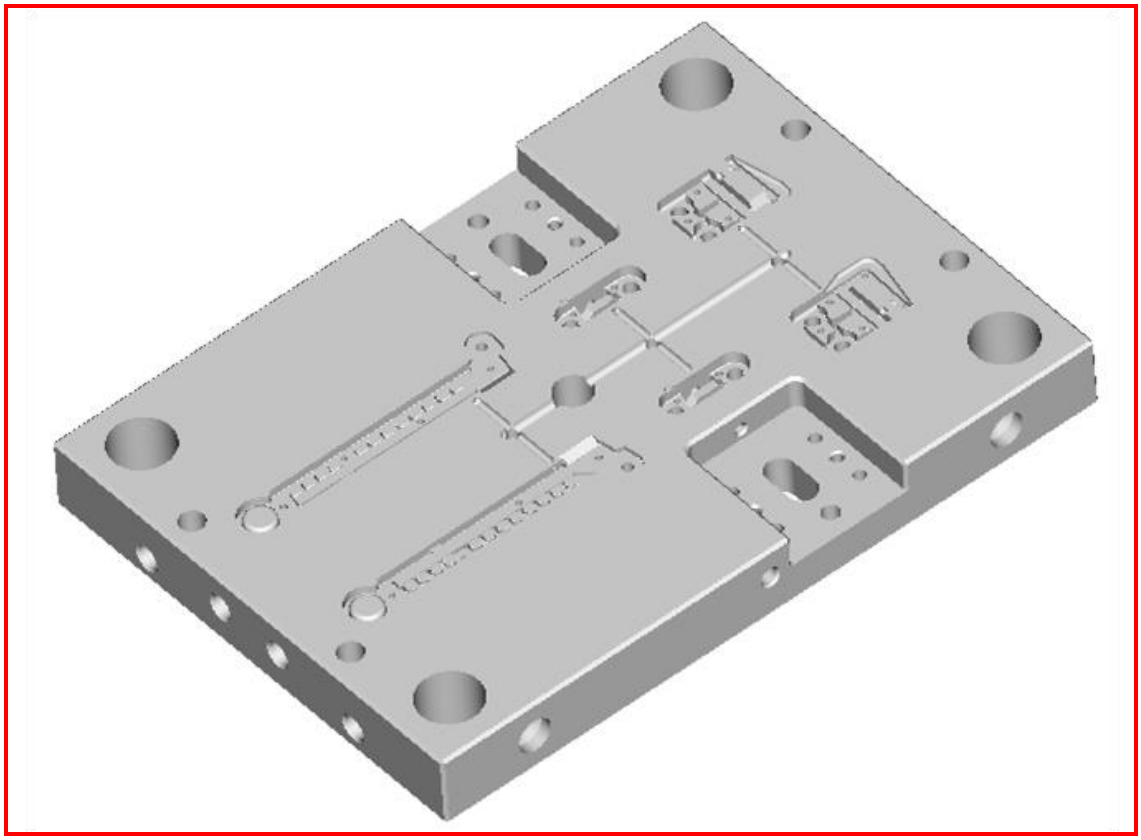


Figure 2 – Three-dimensional model of the part mold "Movable die half".

On the working surface die half it is required to manufacture one of the cavities for casting of the part "Comb". The configuration of the cavity is presented in Fig. 3. Due to the high technical requirements to machining accuracy, part geometry and the physical-mechanical properties of the material, machining of the workpiece it is advisable to perform on the machine with the computer numerical control (CNC). Straight angles in the grooves and the narrow grooves with a width of about 1 mm were detected when the detailed examination of the machined surfaces, to perform which is not possible on a CNC milling machine, as in them will remain the radius from the cutting tool. In such situations it is performed electrical discharge machining, which consists in the changing of the form, the dimensions, roughness and the properties of surface of the conductive workpiece under the action of electrical discharges occurring between the workpiece and the tool electrode [4].

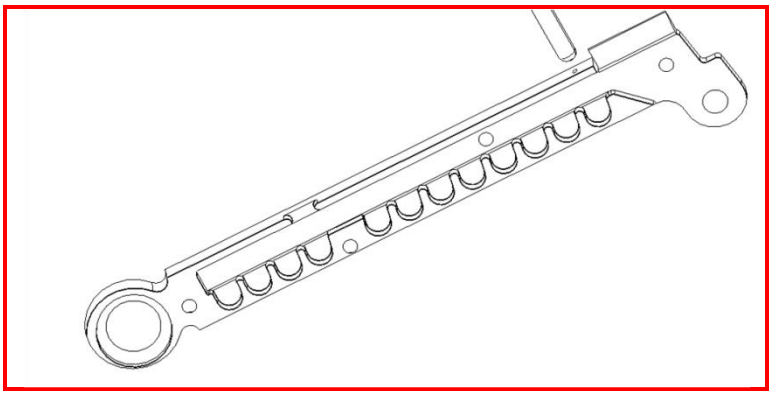


Figure 3 – The configuration of the mold cavity for casting of the part "Comb".

The tool of the second order was designed in the software product Pro/ENGINEER [5] in the section "Manufacturing Mold Cavity" (Fig. 4). In this section we can design the three-dimensional model of the electrode by filling a solid body the necessary surfaces in the machined cavity of the movable die half.

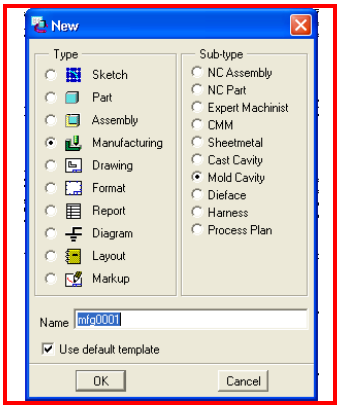


Figure 4 – The choice of the section "Manufacturing Mold Cavity" in the software environment Pro/ENGINEER to the creation of the model of the electrode.

First need to draw the contour of the cavity to the overall dimensions, indicated on the working drawing part of the mold. After this need to fill the cavity by solid body, the working departure to extend and the parts cut off which don't require of the electrical discharge machining. In the created three-dimensional solid model of the tool electrode has remained one difficult-to-cut place that is designed in the section for machining electric discharge cutting at last. The stages of the creation 3D model of the tool electrode are presented in Fig. 5.

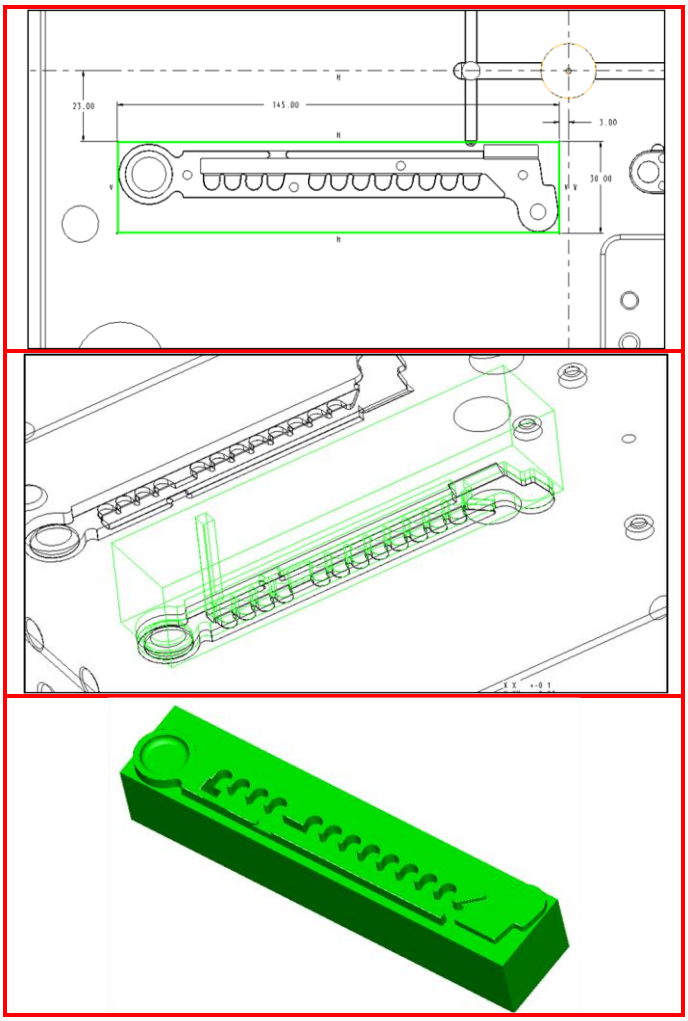


Figure 5 – The creation of the three-dimensional model of the tool electrode: a – a drawing of contour of the electrode; b – a filling of the solid body of surfaces of the cavity; c – a general view of the three-dimensional solid model of the electrode.

The simulation of the machining process of the tool

In the section "NC Manufacturing Part" was performed the simulation of the machining process of the tool electrode, the technological machining steps and the compilation of the numerical control (NC) program for the CNC milling machine.

One of the stages of simulation is the assignment of a reference point of coordinate system of the machine and the dimensions of the workpiece. In this case the dimensions of the workpiece will be equal to the overall dimensions of the model of the electrode. The compliance of the dimensions is provided by grinding of the workpiece with six sides (the dimensions on the working drawing).

The reference point of coordinate system of the CNC milling machine [6] is assigned. This point will be zero machining. X and Y coordinates are assigned in the geometric center of the workpiece, Z – on the top surface of the workpiece.

Machining of the tool electrode is comprised from six machining steps:

1. Pre-machining by the end mill.
2. Finish machining by the end mill.
3. Machining of the base planes for binding on the CNC electric discharge machine.
4. Finish machining of the unmachined places by the end mill.
5. Finish machining of the pocket with a fillet by the spherical milling cutter.
6. Drilling of the hole for entry of wire with a diameter of 2.5 mm.

The each cutting tool is given a serial number in the tool selection chart.

The end mill with a diameter of 8 mm and a length of 100 mm was selected to perform preliminary removal of volume of the material with allowance on the further finish machining. The machining options: the movements of the cutting tools, the cutting parameters, the settings of the machine spindle, supply and withdrawal of the tools were set. The following parameters of feed of the cutting tool were set for the first machining step: cut feed – 700 mm/min, free feed – 4000 mm/min, retract feed – 4000 mm/min, plunge feed – 50 mm/min, arc feed control – tool center.

The simulation of pre-machining of the workpiece is presented in Fig. 6.

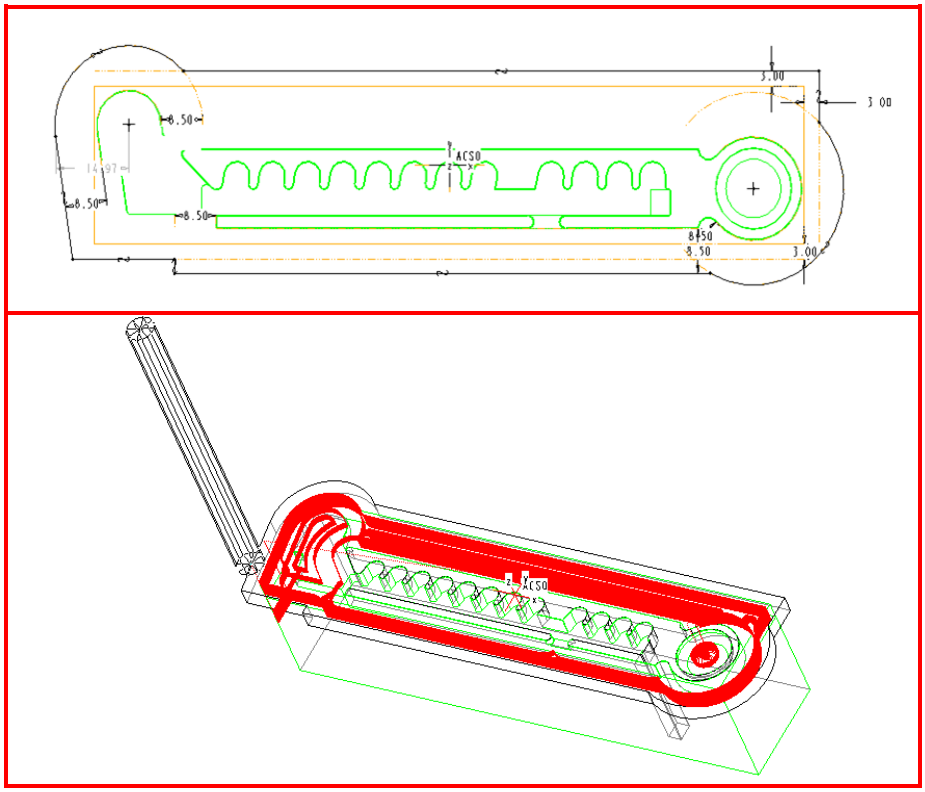


Figure 6 – The simulation of pre-machining of the workpiece: a – the setting of the amount of removed material; b – the trajectory of the cutting tool for the first machining step.

The volume of the material given of diameter of the cutting tool and the existing allowances was set. The program in the automatically mode calculates the optimal trajectory of the cutting tool in a specified volume.

To perform of finish machining it was selected the end mill with a diameter of 4 mm and a length of

100 mm. The simulation of finish machining of the workpiece is presented in Fig. 7.

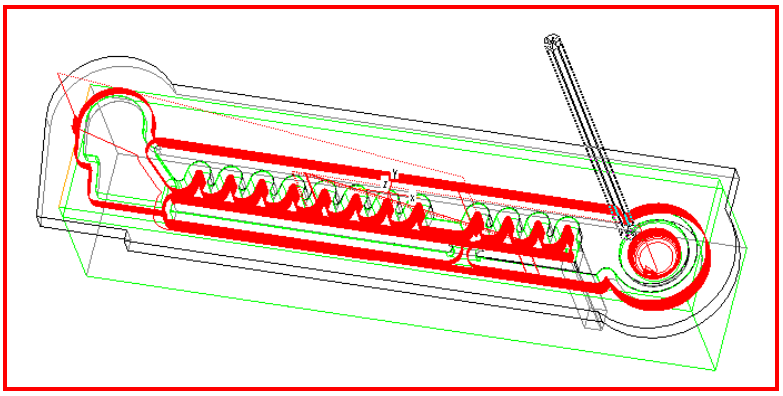


Figure 7 – The trajectory of the cutting tool for finish machining of the workpiece.

The volume of milling from pre-machining with the movement of the cutting tool only on profile of the part was used.

To perform of machining of the base planes it is used the cutting tool from the previous machining step. The simulation of machining of the base planes of the workpiece is presented in Fig. 8.

a)

b)

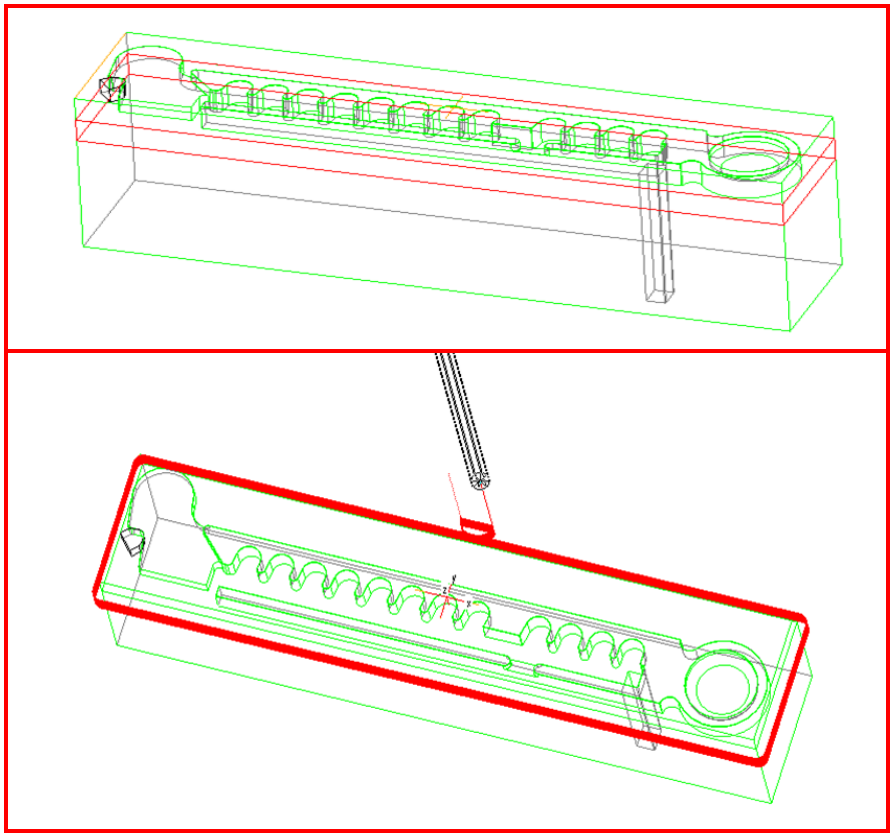


Figure 8 – The simulation of machining of the base surfaces: a – a choice of profile of the model; b – the trajectory of the cutting tool for the third machining step.

The profile of the model of the electrode by depth of 5 mm is selected. The program calculates the line-by-line movement of the end mill on the profile with the smooth entry and outlet of the cutting tool by the radius.

After the finish machining step of the end mill with a diameter of 4 mm remains allowance in places where the inner radius less than 2 mm. In this case a separated machining step is created. To perform of machining of the unmachined places of the workpiece (machining of smaller radiuses and narrow grooves) was selected the end mill with a diameter of 2 mm and a length of 100 mm. The

simulation of machining of the unmachined places of the workpiece is presented in Fig. 9.

Volumes were created in the unmachined surfaces of the workpiece. The program calculates the optimal trajectory of the cutting tool with the ramping at an angle.

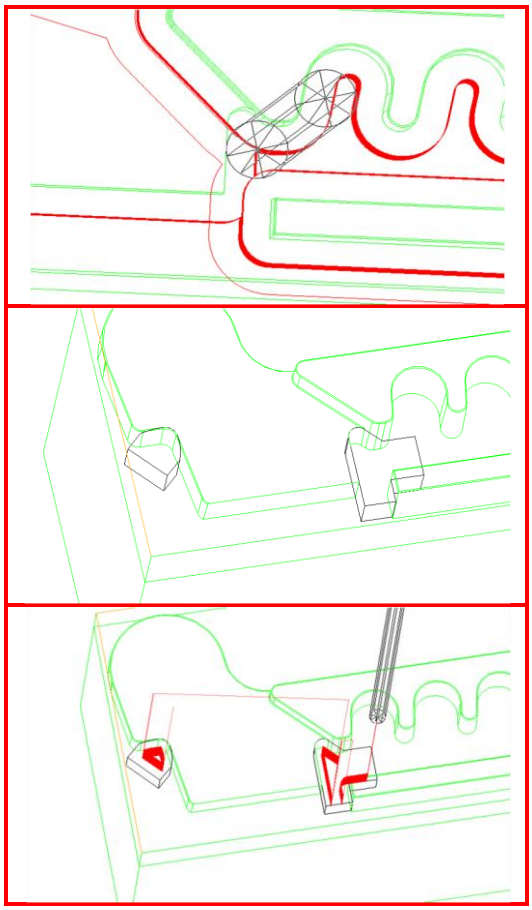


Figure 9 – The simulation of machining of the unmachined surfaces of the workpiece: a – allocation of the allowance for designing of a separate machining step; b – the creation of volumes in the unmachined surfaces; c – the trajectory of the cutting tool for the fourth machining step.

The spherical surface was machined by the spherical milling cutter with a diameter of 4 mm, a radius of 2 mm and a length of 100 mm. After selecting of the machined surface on the workpiece, the program calculates the optimal trajectory of the cutting tool with the ramping at an angle. The simulation of machining of the spherical surface is presented in Fig. 10.

Drilling of the hole was carried out by the drill with a diameter of 2.5 mm and a length of 100 mm. In the center of the window where it is necessary to drill the hole, was hold the axis AA_1. For drilling it is necessary to select the axis and the depth of machining through the entire part to indicate. The simulation of drilling of the through hole is presented in Fig. 11.

The trajectory of the cutting tool with the periodic output of the chip calculates by the program.

After the calculation of all machining steps, and the ordering them in accordance with the technological process of machining of the workpiece NC program is generated. NC program is displayed on the CNC milling machine by model 400 V [7] with the machine control panel SIEMENS SINUMERIK 802D sl [8] (Sterlitamak plant). For this a shared assembly of the subprogrammes is created and the machine identifier UNCX01.P12 is selected (Fig. 12).

a)

b)

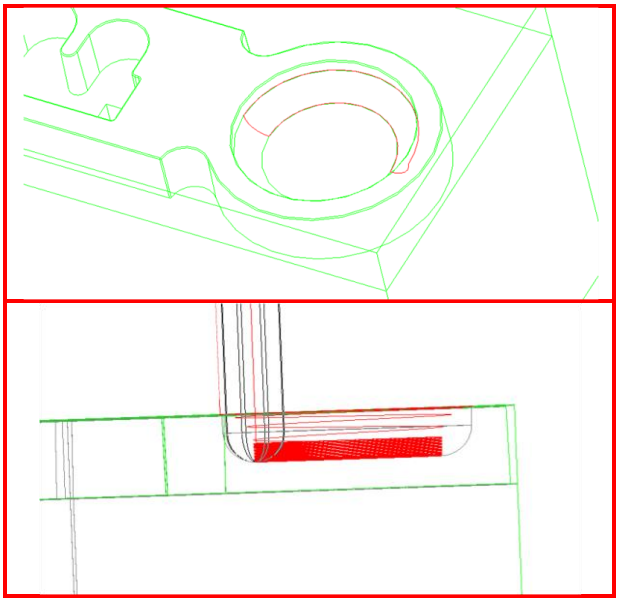


Figure 10 – The simulation of machining of a spherical surface: a – a choice of the machined surface; b – the trajectory of the cutting tool for the fifth machining step.

a)

b)

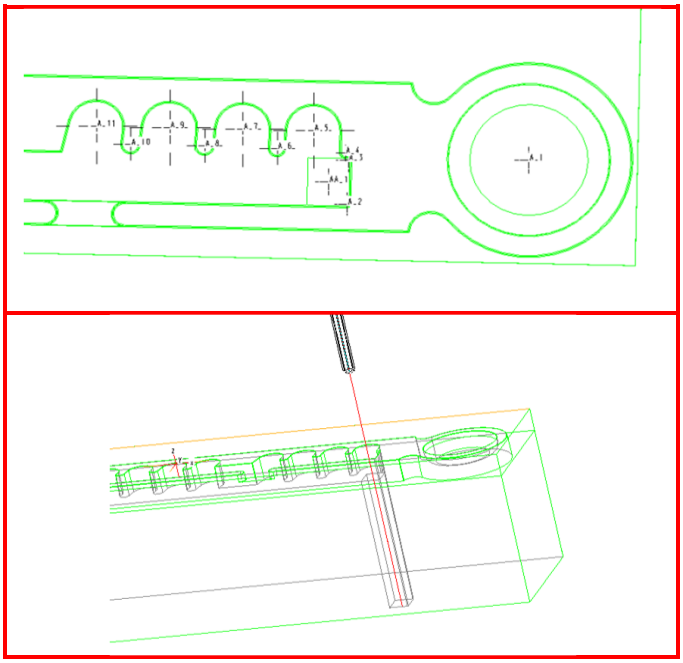


Figure 11 – The simulation of drilling hole in the workpiece: a – holding of the axis in the center of the workpiece; b – a choice the axis and the depth of drilling for execution of the sixth machining step.

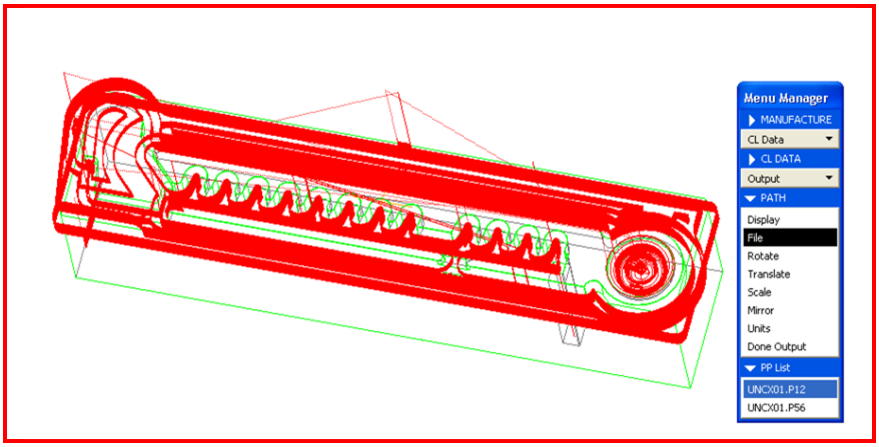


Figure 12 – The trajectories of the cutting tools for machining of the tool electrode and the selection of the machine identifier.

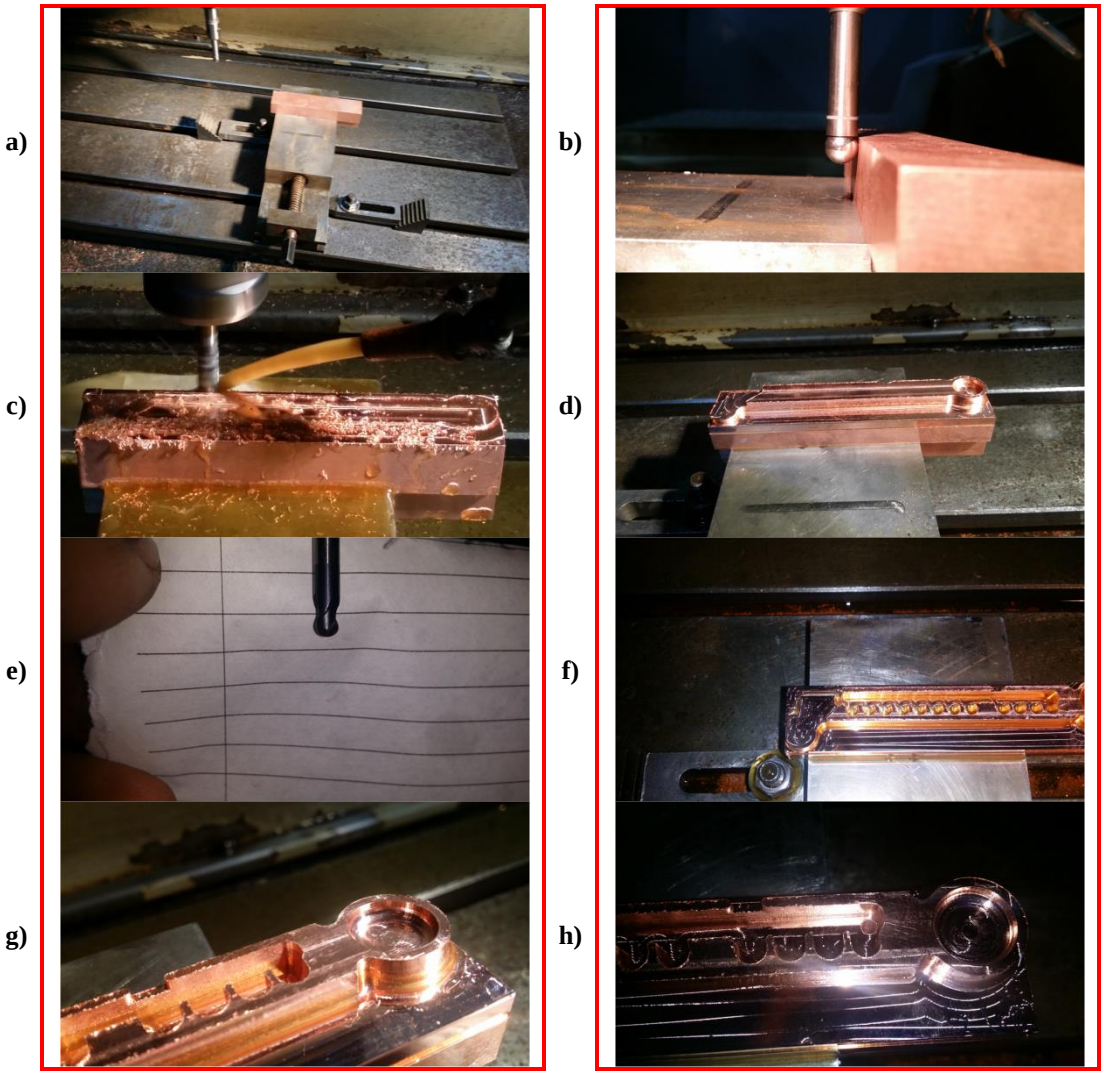


Figure 13 – Machining of the tool electrode on the CNC milling machine: a – a setting of the workpiece in the vise; b – an orientation (binding) of the workpiece by the coordinate axes X and Y by using a measuring probe; c – a cycle of pre-machining of the workpiece by the end mill; d – machined surfaces of the workpiece after the second and the third machining steps; e – a spherical milling cutter for execution of the fourth machining step; f – machined surfaces of the workpiece after the fourth machining step; g – machined surfaces of the workpiece after the fifth machining step; h – machined surfaces of the workpiece after the sixth machining step.

Machining of the workpiece on the CNC milling machine

The sequence of machining of the workpiece on the technological equipment is presented in Fig. 13.

According to the technological process, the fixing of the workpiece on the machine was carried out in a vice. The jaws vice on the CNC milling machine were oriented along the X-axis. It was necessary to orient of the workpiece, thus to bind it in the coordinates of the CNC machine. The geometric center of the workpiece and its top plane are by the frame of reference in the NC program. As a tool for orientation of the workpiece by the coordinate axes X and Y it was used measuring probe with the light and the sound indicators. The orientation of the workpiece along the X-axis was performed in the following sequence:

1. The movement of probe to the side surface of workpiece until the indication of touching.
2. Equating of coordinate of the workpiece towards zero.
3. The movement in the opposite direction of the workpiece and carrying out of the procedure of touching in accordance with items 1 and 2.
4. The division of value of the obtained coordinate (X-axis) into two for the movement of the zero coordinate of machine in the center of the workpiece.

The process of the orientation of the workpiece on the Y-axis executes similarly.

The orientation of the workpiece on the Z-axis is performed by the binding of the cutting tools. It is necessary to set in the chucks all cutting tools and to set them in the tool bank of the CNC milling machine in accordance with the tool selection chart (1, 2, 3, 4 and 5). Binding of the cutting tool is performed by means of the end measure by thickness of 3 mm. The end measure is set between the cutting tool and the top plane of the workpiece. The movement of the cutting tool along the Z-axis is performed before the touching its face cutting edges of the end measure. This sequence of the actions is performed for each cutting tool.

The machining cycle of the workpiece on the CNC milling machine is performed when NC program starts up of in menu of the program.

Conclusion

The control of the technological process of designing of the complex to configuration of the cutting tools and technological tooling allows to manufacture parts of high accuracy. In accordance with the presented sequence of designing stages in the software environment Pro/ENGINEER and machining of the workpiece on the CNC machine the labor intensity of the actions at observance the technical requirements on the manufacturing of finished products reduces.

The part "Comb" which was manufactured by the casting method is presented in Fig. 14.

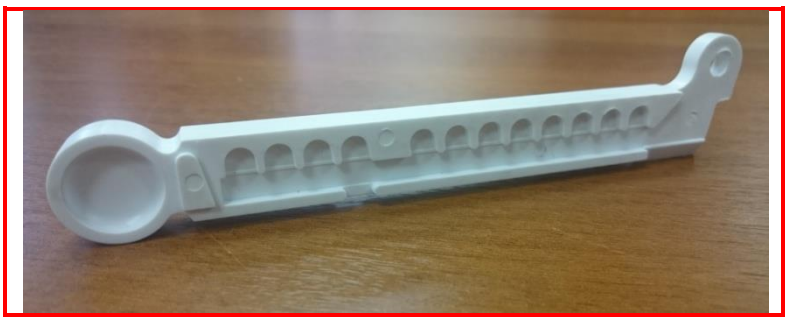


Figure 14 – The part "Comb".

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	JIF = 1.500	SJIF (Morocco) = 2.031	

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SECTION 30. Philosophy.

A PHILOSOPHIC VIEW OF THE SOCIAL-CULTURAL ROOTS FOR INTELLECTUAL PROPERTY'S INSTITUTIONALIZATION

Abstract: *The relevance of research for historically occurred social and cultural roots of intellectual property as a special phenomenon, as well as intellectual property legal protection mechanism's development, was determined by the necessity of tracing those key events, which are associated with the transformation process of various intellectual-legal relations into single holistic social institution. To answer the question – why in fact human civilization has come to awareness of the need for legal protection of intellectual property, i.e. what cultural, ideological and socio-economic conditions have led mankind to regulate these specific relations? – would mean our approaching to the answer, why now there are so much contradictions in the realm of intellectual property, as well as in the areas of protection and enforcement of the rights and interests associated with intellectual-legal relations. An analysis for the socio-cultural genesis of intellectual property (i.e. an array of various historical reasons of the origin and evolution of the intellectual property phenomenon) will give us a better understanding of the nature of intellectual property (as a social institution) and its basic social functions.*

Key words: *intellectual property, society, social institution.*

Language: *Russian*

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ФИЛОСОФСКИЙ ВЗГЛЯД НА СОЦИОКУЛЬТУРНЫЕ ИСТОКИ ИНСТИТУЦИАЛИЗАЦИИ ИНТЕЛЛЕКТУАЛЬНОЙ СОБСТВЕННОСТИ

Аннотация: *Актуальность исследования исторически сложившихся социальных и культурных корней интеллектуальной собственности как особого явления, а также истории становления механизма правовой охраны интеллектуальной собственности, определяется необходимостью проследить те ключевые события, с которыми связан процесс трансформации различных интеллектуально-правовых отношений в единый самостоятельный социальный институт. Ответить на вопрос – почему собственно человеческая цивилизация пришла к осознанию необходимости правовой охраны интеллектуальной собственности, т.е. какие духовно-культурные и социально-экономические предпосылки побудили человечество к упорядочению этих специфических отношений? – будет означать приближение к ответу, почему же ныне возникает множество противоречий в сфере использования интеллектуальных продуктов, а также в сферах охраны и защиты прав, связанных с реализацией интеллектуально-правовых отношений. Анализ социокультурного генезиса интеллектуальной собственности (т.е. того массива различных исторических оснований происхождения и эволюции феномена интеллектуальной собственности) даст лучшее понимание природы современного концепта социального института интеллектуальной собственности (и его основных социальных функций).*

Ключевые слова: *интеллектуальная собственность, общество, социальный институт.*

Introduction

Известный нам сегодня концепт интеллектуальной собственности – это продукт длительной социальной эволюции. Подобно тому, как государство и право возникают на определённой ступени общественной зрелости, так и феномен интеллектуальной собственности некогда выделился из системы отношений

собственности и постепенно оформился в специфический социальный институт, обретя известные нам очертания. Но как же это происходило? И каковы основные причины и закономерности процесса *институциализации* (т.е. преобразования из явления в общественный институт) для данного вида собственности? Наконец, какие функции присущи институту интеллектуальной собственности, т.е. какие главные задачи он выполняет в жизни социума? Попробуем ответить на все эти вопросы в данном исследовании (которое выполняется в рамках докторской диссертации, посвящённой социально-философским аспектам института интеллектуальной собственности).

Materials and Methods

Философские предпосылки формирования интеллектуальной собственности *как явления* складываются на заре западноевропейской цивилизации в период античности, когда была осуществлена рефлексия накопленного знания и возможных способов его бытия. Известно, что ещё в IV веке до н.э. Платон сформулировал концепцию, в которой обосновал различие материального мира (мира вещей) и нематериального (мира идей). Согласно Платону, «истинное бытие – это умопостигаемые бестелесные идеи», данные же ощущению эмпирические тела, вещи и явления – не истинны, поскольку вообще относятся не к «бытию», а к чему-то подвижному, к «становлению» [1].

Упомянутая концепция, естественно, не предполагала какого-либо индивидуального права собственности на идеи – поскольку идеи первичны, они принадлежат всем (а может, все находятся в их власти) в одинаковой степени. Поэтому в рамках платоновской концепции, где идея (эйдос) как таковая не может принадлежать одному человеку, говорить о наличии каких-то существенных признаков интеллектуальной собственности не имеет смысла. Возникновение этой проблематики относится к более позднему периоду.

А вот понятие гонорара как формы оплаты творческого труда (например, за изваяние из мрамора) были известны ещё римскому праву. Однако в целом юридическому оформлению экономической стороны творчества долгое время не придавалось особого значения, так как возможность торговать результатами интеллектуальной, творческой деятельности возникла сравнительно поздно. До этого продукция творчества распространялась «вне рынка», не являясь предметом экономического оборота, в отличие, например, от аграрной или ремесленной продукции. Стало быть, само наличие такого явления, как «гонорар», ещё не позволяет говорить о становлении *института* интеллектуальной собственности, поскольку на тот момент не были ещё созданы надлежащие законодательные предпосылки для его функционирования, а существовавшие тогда экономические предпосылки находились в зачаточном состоянии [2].

В эпоху, предшествовавшую изобретению печатного пресса (с подвижными литерами) И. Гутенбергом около 1440 года, положение произведений творческого труда, наиболее вероятно, регулировалось правом «вещной» собственности. Автор произведения (рукописи, скульптуры, картины) являлся собственником этого материального объекта и мог передать или продать его другому лицу. При этом формы воспроизводства интеллектуального потенциала общества базировались в основном на системе меценатства – творческих людей субсидировали правители, духовенство, иные влиятельные люди своего времени.

По мере роста влияния буржуазии и развития рыночных отношений, авторы начинают более активный поиск способов получения вознаграждения за своё творчество: система средневековых «привилегий» постепенно сменяется законами, признающими за авторами право на монопольное использование принадлежащих им произведений и технических новинок в течение установленного срока. Такое «право» изобретателей было впервые упомянуто в Венецианской республике, в тексте Венецианского Патентного Статута от 19 марта 1474 года – Venetian Statute on Industrial Brevets – в котором уже признавались их «моральное право» и исключительное право на использование своего изобретения в течение ограниченного периода времени. А первый из известных европейской истории патент был выдан ещё раньше: в 1421 году великий архитектор и скульптор Ф. Брунеллески, будучи обеспокоенным крайне медленной погрузкой мраморных плит для своей мастерской, придумал и установил на барже уникальный по конструкции поворотный корабельный кран. Это позволило значительно ускорить такелажные работы. По инициативе изобретателя в том же году городской управой Флоренции на имя Ф. Брунеллески был выдан патент (от лат. patens – открытый, ясный, очевидный), который удостоверил авторство и закрепил привилегии. Архитектор оказался весьма прозорлив, потому что вскоре германский торговый союз (Ганза) купил у него первую лицензию на использование этого изобретения. Через полвека был издан ранее упомянутый Венецианский Статут [3]. Однако полноценное законодательное воплощение идея защиты интеллектуальной собственности получила несколько веков спустя уже в Северной Европе.

Первые законы об интеллектуальной собственности появились в Англии только после распространения *книгопечатания*: этот механический процесс кардинально повысил интенсивность информационного обмена, в первую очередь, – тиражируемость литературных и иных письменных произведений. Технология книгопечатания вызвала к жизни особые профессии – печатников и книготорговцев, называемых в Англии «stationers» (торговцы печатной продукцией, книгоиздатели).

С ***социально-экономической*** точки зрения возникновение этих видов профессиональной деятельности стало первым поворотным моментом в развитии *социального института* интеллектуальной собственности. Ведь уже тогда книгоиздатели были первыми лоббистами в сфере интеллектуальной собственности, хотя до её современного понимания тогда было ещё очень далеко.

Книготорговцы инвестировали немалые суммы в покупку бумаги, в приобретение или изготовление печатных машин, а также тратили деньги на оплату труда рабочей силы. Всё это предусматривало авансирование средств, которые только по прошествии определённого времени могли быть возмещены поступлениями от реализации печатной продукции. Выражаясь современной терминологией, развитие нового для той эпохи издательского дела было связано с необходимостью т.н. венчурных инвестиций. В этой ситуации без какой-либо законной формы защиты от нечестной конкуренции (например, от изготовления и продажи незаконных копий) инвестирование в книгопечатание было достаточно рискованным предприятием, грозившим книготорговцам полным разорением [4].

С ***социально-философской*** точки зрения важно заметить, что на заре развития интеллектуальной собственности нашла свою реализацию следующая логичная культурно-экономическая тенденция: **1)** развитие духовной культуры находило объективацию (фиксацию) в таких материальных источниках, как книги; **2)** востребованность в распространении знаний и их носителей – книг – стимулировала развитие технической мысли, что, в конечном счёте, привело к технологическим инновациям (была изобретена технология книгопечатания, которая, по мере совершенствования, превратилась в целый комплекс производственных процессов – со всеми вытекающими социально-экономическими дивидендами); **3)** возникшая новая сфера деятельности стала той средой, в которой зародились новые социальные отношения, со своим специфическим субъектным составом – авторами (в широком смысле), издателями, книготорговцами, – каждый со своими далеко не совпадающими интересами; **4)** усложнение социально-экономических отношений в творческой, интеллектуальной среде потребовало соответствующего юридического регулирования, вызвало к жизни новые юридические принципы, механизмы, и сформировало новые правовые институты; **5)** изменение правового статуса творческих интеллектуалов, переосмысление ими своих возможностей, своего социокультурного и экономического значения – всё это повлияло на дальнейшее развитие цивилизации, привело к реинтерпретации *ценности информации* (и интеллектуальной собственности как особой разновидности информации, значение которой весьма актуально в постиндустриальную эпоху).

Иными словами, *интеллектуальная продукция* (вернее, социальная потребность в её тиражировании): ***а)*** простимулировала развитие *изобретательства* (как разновидности интеллектуальной деятельности) и *новой социально-экономической сферы* (издательского дела), ***б)*** явилась предпосылкой к обособлению *новой прослойки интеллектуалов* в тогдашней структуре социума (авторы, издатели, распространители), и ***в)*** сформировала социальный запрос на развитие нового *правового* института – права интеллектуальной собственности (которое в течение нескольких столетий эволюционировало вплоть до превращения в относительно самостоятельную частноправовую структуру, и теперь в большинстве правовых систем рассматривается в качестве подотрасли гражданского права).

Однако вернёмся к историческим истокам института интеллектуальной собственности. Риск значительных экономических убытков в сочетании с привлекательностью самого издательского бизнеса привёл к усилению лоббирования внесённого законопроекта об интеллектуальной собственности в английском парламенте, и к прессингу на монархическую верхушку с целью обеспечения правовой защиты от незаконного копирования. Первым британским документом, регламентирующим вопросы интеллектуальной собственности, считается Статут королевы Мэри I (Англия, 1557 г.), который закреплял за *издателем* монопольное право далее издавать однажды выпущенную им книгу (неважно, новую или давно известную) – при условии, что она одобрена официальной цензурой. Так возникла система т.н. «привилегий», которые суверен выдавал определённым издателям. Эта система привилегий использовалась верховной властью для цензуры массовой информации. С конца XV и до начала XVIII века история книгопечатания в основном связана с выдачей привилегий, закреплённых в королевских законах и указах. Нужно отметить,

что *права авторов* в Статуте Мэри I не упоминаются совсем.

На рубеже XVII - XVIII столетий старый порядок был поколеблен. На смену британской абсолютной монархии приходит система парламентаризма. Срок действия последнего закона, регулировавшего деятельность издателей, – Акта о лицензировании 1662 года, – истёк в 1695 году. Этот акт предоставлял издателям монополию на публикации, дабы облегчить королевским властям контроль над изданиями. По истечении срока его действия никакого специального закона, наделявшего издателей и книготорговцев эксклюзивным правом печатать и продавать книги, не осталось [5, с. 104].

В обстановке хаоса, вызванного крушением системы *королевских привилегий*, издатели и книготорговцы – в первую очередь, члены влиятельной издательской группы «Угорь», контролировавшей почти всю книготорговлю в Англии XVIII века, – стремясь сохранить ранее полученные ими эксклюзивные права, вновь усиливают лоббирование в парламенте. Они претендовали на вечное право контролировать «копирование» книг, однажды приобретенное у авторов. И нужно сказать, что им тогда удалось значительно продлить жизнь своей книгоиздательской монополии: в 1774 году, почти через 180 лет после написания Шекспиром «Ромео и Джульетты», исключительное право издания данного произведения в Англии всё ещё принадлежало правопреемникам Д. Тонсона в лондонской издательской группе «Угорь» [6]. Но всё это было позднее.

А ранее, в результате давления издательского лобби на монархическую верхушку, 11 января 1709 года в Палате общин был заслушан проект закона «О поощрении образования путём закрепления за авторами или приобретателями копий печатных книг прав на последние на время, устанавливаемое отныне». 10 апреля 1710 года проект стал законом, известным под названием «Статут королевы Анны» (Statute of Annae Reginae, или Copyright Act 1709). Это был первый в истории закон об авторском праве в современном понимании указанного термина, который впервые закрепил личное право на охрану опубликованного произведения [7].

До появления Статута Анны в 1709 году, как только произведение было написано и первый раз издано (выпущено в свет), автор утрачивал над его распространением всякую власть. Но это обстоятельство не было особенно значимым: ведь пока рынок довольствовался авторскими экземплярами произведений или услугами переписчиков – отношения между авторами, книготорговцами, читателями не носили комплексного экономического характера. В этой сфере было слишком мало денег, чтобы вызвать интерес у буржуазии и государства.

Однако с появлением технологической возможности тиражирования произведений посредством книгопечатания забрезжила перспектива превращения книгоиздания в индустрию, приносящую большие прибыли. Это привело к осознанию в обществе необходимости регламентации нового типа отношений, в частности, защиты прав «добросовестных» издателей (заключивших с автором договор и выплачивающих ему определённый процент с продаж, роялти) от подпольных издателей, занимающихся контрафакцией. То есть фигура автора, действительно получавшего некоторую защиту согласно Статуту Анны, была необходима для того, чтобы формализовать и чётко определить разницу между «добросовестным» издателем, у которого есть контракт с автором, и правонарушителем нового типа – нелегальным издателем, занимающимся продажей плодов чужой творческой деятельности без договора с автором.

В то же время, данный закон вывел на сцену и новые фигуры пострадавших – в первую очередь, автора, ставшего с этого момента для издателя неразлучным спутником. Т.е. в течение ближайших 14 лет с момента первой публикации автор «прикреплялся» к издателю, который приобрёл монополию печатать произведение. И хорошо, если издатель оказывался добросовестным и исправно платил роялти. Тем не менее, важным *социальным последствием* Статута Анны 1709 года можно считать то, что впервые на государственно-правовом уровне обозначилось принципиальное отличие интеллектуальной собственности от материальной. Отныне самого факта владения экземпляром книги стало недостаточно для того, чтобы делать с её содержанием всё, что заблагорассудится. Поскольку принципиальным становится вопрос: а есть ли договор с автором? Тиражирование (бывшее в то время единственным приносящим очевидную выгоду способом донесения мысли автора до большого количества людей), начиная с 1710 года, может легитимно производиться только с согласия автора и на определённых условиях [8, с. 53].

Несмотря на несовершенство раннего законодательства об интеллектуальной собственности, для авторов и издателей вскоре стало очевидным, что Статут 1710 г. открыл новый тип отношений, разделявший материальное воплощение произведения (вещное право) и право на использование уникального информационного содержания (авторское право). Именно вокруг последнего правообладатели и стали выстраивать поддерживаемую законом

монополию, действие которой, впрочем, было ограничено указанными выше сроками.

Постепенно возникает представление о том, что недостаточно наделить автора книги (или его издателя) одним правом на печатание и распространение произведения. Открытым оставался вопрос о публичных исполнениях (спустя время они стали объектом т.н. смежных прав), о картинах, о песнях и музыке, о произведениях в сфере хореографии, скульптуры и архитектуры, о репродукциях, переводах и т.д. Несколько лет спустя английский художник, иллюстратор, гравёр и теоретик искусства У. Хогарт, рисунки которого неоднократно подделывались, возглавил борьбу с целью узаконить охрану интересов «гравёров, рисовальщиков и живописцев». Эта борьба успешно завершилась в 1735 г. принятием «Закона о гравёрах». С этого момента законодательство об интеллектуальной собственности начинает экспансию в отношении объектов своего воздействия. И эти процессы происходили не только в Англии.

В США первые законы штатов об авторском праве появились ещё до французской и американской революций. Так, в Законе штата Массачусетс от 17 марта 1789 года указывалось, что «…нет собственности, принадлежащей человеку более, нежели та, которая является результатом его умственного труда». Вскоре и в США была осознана необходимость принять федеральный закон об авторском праве. Конституция Соединенных Штатов предоставила Конгрессу право «поощрять развитие наук и ремёсел», обеспечивая на определённый срок авторам и изобретателям исключительное право на их произведения (writings) и изобретения (inventions). В свете этой статьи Конституции в 1790 г. и был принят первый федеральный закон об охране книг, карт и схем. Более позднее законодательство распространило охрану также и на спектакли, фотографии, тексты песен и другие формы творчества [9, с. 62].

Наконец, украинское законодательство о «копирайте» нашло своё наиболее концентрированное выражение в Законе Украины «Об авторском праве и смежных правах» 1993 года [10], а также в Книге IV Гражданского кодекса Украины [11], который действует с 2003 г. Эти нормативно-правовые акты – в комплексе с законодательством о праве промышленной собственности, о торговых марках и коммерческих наименованиях, о селекционных достижениях и других результатах интеллектуальной, творческой деятельности – отражают правовую сторону функционирования, развития интеллектуальной собственности как *многогранного социального института*.

Учитывая формат данного исследования, приходится ограничиться изложенным выше анализом социокультурных истоков лишь одной из граней интеллектуальной собственности – авторского права (копирайта). Однако картина, полученная в процессе такого анализа, является достаточно иллюстративной. Принимая во внимание цель настоящего исследования – проследить ключевые социокультурные закономерности, реализация которых на определённом этапе общественного развития позволила интеллектуальной собственности из *явления* превратиться в целый *социальный институт* – мы видим возможным и необходимым сформулировать некоторые выводы.

Conclusions

Во-первых, технологические и социально-экономические *предпосылки* трансформации и институциализации интеллектуально-правовых отношений возможно проследить примерно с середины XV века, когда был изобретён печатный станок как средство ретрансляции произведений, а также выданы первые патентные грамоты как средства охраны изобретений.

Во-вторых, оформление специфического института интеллектуальной собственности (и в социологическом, и в экономическом, и в юридическом понимании) является вполне закономерным результатом культурного, технологического и социально-экономического развития общества. *Активное развитие* отношений интеллектуальной собственности *с переходом* этих отношений на новый уровень (то есть, собственно – *институциализация* в сфере интеллектуальной собственности, формирование нового социального института, а также международно-правовая унификация соответствующих общественных отношений) начались ещё в индустриальную эпоху, в течение XVIII - XIX столетий. Но если сравнивать социальную динамику развития интеллектуально-правовых отношений до середины XVIII ст., в «доиндустриальные» времена, и в последовавшую эпоху т.н. «первой» и особенно «второй промышленной революции» (когда были изобретены электричество, телеграф, конвейер, когда произошёл переход от угля к нефти и т.д.), то можно констатировать: до начала индустриальной эры наиболее активно развивался «копирайт», после – право промышленной собственности (в первую очередь, патентное). Собственно, первым международным правовым актом в сфере интеллектуальной собственности стала Парижская конвенция об охране промышленной собственности 1883 г.

Однако *наибольшую интенсивность* обозначенный процесс институциализации обрёл с переходом цивилизованного человечества в постиндустриальную эпоху, начало которой связано с т.н. «третьей промышленной революцией» – цифровой, в 1980-х. Она продолжается и сейчас. А это, в свою очередь, побуждает социальную философию к переосмыслению феномена интеллектуальной собственности, и к реинтерпретации отдельных аспектов института интеллектуальной собственности в новых социокультурных условиях.

Ведь именно сегодня интеллектуальная собственность – как особый вид информации – приобретает колоссальное социально-экономическое значение и наиболее весомый правовой статус за всю историю существования данного феномена. Следовательно, о *полноценной трансформации* интеллектуальной собственности *в социальный институт* можно говорить сейчас, в эпоху постиндустриальной экономики, когда возник новый класс людей, работающих исключительно в инновационной сфере и имеющих дело преимущественно с информационными технологиями. И поскольку именно в *постиндустриальном* обществе информация становится особенной сферой и особым предметом общественных отношений, то и интеллектуальная собственность становится одним из *ключевых* социальных институтов современности (когда в культурном плане человечество, вероятно, находится в состоянии перехода из Модерна в Постмодерн).

Проведенное в данной статье исследование культурно-исторических факторов развития интеллектуальной собственности позволяет утверждать, что она *в процессе своей институциализации* (т.е. по мере своего преобразования из феномена – в социальный институт) проходит ряд последовательных этапов, которые предметно описывались выше, а именно укладывается в следующую схему: 1. возникновение потребности, удовлетворение которой требует совместных организованных действий группы людей; 2. формирование общих для группы людей целей (тогда же возникает и соответствующее лобби); 3. появление в ходе стихийного социального взаимодействия (с людьми, не входящими в упомянутую группу) социальных норм и правил; 4. выработка процедур, связанных с реализацией норм и правил; 5. постепенное всеобщее восприятие норм и правил, и процедур их реализации, в процессе их практического применения; 6. установление системы санкций для поддержания норм и правил, и дифференцирование их применения в различных случаях; 7. создание системы статусов и ролей, охватывающих всех субъектов, принимающих участие (прямо или косвенно) в соответствующих отношениях, на которые распространяется данный социальный институт.

Наконец, рассматривая интеллектуальную собственность в качестве социального института, можно дать ей следующее определение: ***институт интеллектуальной собственности*** – это *специфический социальный механизм, представленный набором постоянно повторяющихся и воспроизводящихся общественных отношений в сфере создания, владения, использования, распоряжения, охраны и всех иных возможных социальных практик в отношении результатов интеллектуальной, творческой деятельности*.

Иными словами, институт интеллектуальной собственности – это система воспроизводства общественных взаимодействий в отношении интеллектуальной, творческой, инновационной продукции. Механизмы, лежащие в основе этой системы, функционируют с опорой как на официальные кодифицированные своды законов, так и на неформализованные правила (которые нередко обнаруживаются только при их нарушении).

Как и любому социальному институту, интеллектуальной собственности присущи свои социальные функции. Среди них: 1) *функция закрепления и воспроизводства общественных отношений* (т.е. складывается определённый алгоритм, который обеспечивает устойчивые модели социального взаимодействия касательно разных видов и форм интеллектуальной собственности); 2) *регулятивная функция* (выстраивает взаимоотношения между членами общества путём выработки образцов поведения, устанавливает рамки и обеспечивает порядок, при котором участники отношений в сфере интеллектуальной собственности в абсолютном большинстве демонстрируют предсказуемость и стандартное поведение, выполняют ролевые требования и ожидания); 3) *интегративная функция* (обеспечивает сплочённость, связь, детерминированность и взаимную ответственность участников интеллектуально-правовых отношений, с опорой на созданные социальные нормы, ценности, правила, систему ролей и санкций); 4) *транслирующая функция* (поскольку общество не может развиваться без передачи социального опыта, то, как и любой институт, интеллектуальная собственность для своего нормального функционирования нуждается в приходе новых людей, усвоивших общепринятые правила; таким образом, социальные границы института интеллектуальной собственности меняются по мере смены поколений, чем обеспечивается преемственность и дальнейшая социализация);

5) *коммуникативная функция* (реализуется через усвоение информации, произведенной в процессе функционирования института интеллектуальной собственности, и рассчитанной на потребление разными социальными группами). Конечно, это не исчерпывающий перечень социальных функций института интеллектуальной собственности, но их можно обозначить в качестве неотъемлемых – некогда обеспечивших его формирование (институциализацию), и поддерживающих его развитие (трансформацию, адаптацию и т.д.) и постоянное функционирование.

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SECTION 21. Pedagogy. Psychology. Innovation in Education.

DEVELOPMENT DATABASE OF PEDAGOGOMETRIC MODELS FORMED ERTSGAMMING ANALYSIS OF EDUCATIONAL FACILITIES

Abstract: *The basic directions of development database pedagogometric models Forming ertsgamming analysis of educational facilities in the formation of mathematical vogueley learning activities about the nature of achieving the criteria of life, cyclicness, consistency and phasing, which form the basic cell education space, as well as the use of the twelve pointed star Ertsgammy for the submission ertsgamming principle which determines the foundations pedagogometric through substantive shaping metodami hyperspace professional life, psychological and educational activity theory, psycho-pedagogical system analysis and the theory of the formation of mental dei Business Plan.*

Key words: *database, forming ertsgamming analysis, educational facility, pedagogometric, lifeactivity, recurrence, systemic, stages, star Ertsgammy.*

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УДК 372.851

РАЗВИТИЕ БАЗЫ ДАННЫХ ПЕДАГОГОМЕТРИЧЕСКИХ МОДЕЛЕЙ ФОРМИРУЮЩЕГО ЭРЦГАММНОГО АНАЛИЗА ОБРАЗОВАТЕЛЬНЫХ ОБЪЕКТОВ

Аннотация: *Рассмотрены основные направления развития базы данных педагогометрических моделей формирующего эрцгаммного анализа образовательных объектов при формировании математических моделей учебной деятельности относительно характера достижения критериев жизнедеятельности, цикличности, системности и этапности, которые образуют базисную ячейку образовательного пространства, а также применение двенадцати конечной звезды Эрцгаммы относительно представления принципа эрцгаммности, который определит основы педагогометрики через формообразование предметными методами гиперпространства профессиональной жизнедеятельности, психолого-педагогической теории деятельности, психолого-педагогического системного анализа и теории формирования умственных действий.*

Ключевые слова: *база данных, формирующий эрцгаммный анализ, образовательный объект, педагогометрика, жизнедеятельность, цикличность, системность, этапность, звезда Эрцгаммы.*

Introduction

Развитие формирования базы данных педагогометрических моделей формирующего эрцгаммного анализа образовательных объектов при формировании математических моделей учебной деятельности относительно характера достижения критериев жизнедеятельности, цикличности, системности и этапности, которые образуют базисную ячейку образовательного пространства. Это проявляется в организации развития базы данных математических моделей относительно уровня проявления в учебном процессе: базисной звезды Эрцгаммы гиперпространства жизнедеятельности (E1); базисного целостно-системного цикла жизнедеятельности (E2); базисной звезды

Эрцгаммы системного анализа (E3); базисного проявления двенадцати этапов и форм познавательного гиперпространства жизнедеятельности относительно образовательного процесса (E4).

Развитие каждой базы данных педагогометрических моделей формирующего эрцгаммного анализа образовательных объектов с признаком базисно-нормативной эрцгаммности, независимо от целевого назначения, выполняет собственную функцию психолого-математического представления, имеющего соответствующий показатель базисно-нормативного целостного развития относительно характеристик собственной значимости. Каждый базисно-нормативный глобальный объект (E1N, E2N, E3N, E4N) образовательного пространства выполняет синфазно три сравнительные функции: ориентировки, исполнения и контроля собственной фазы развития образовательного процесса относительно нормативной учебно-профессиональной деятельности эрцгаммного типа. Поэтому можно организовать развитие представления базы данных педагогометрических моделей формирующего эрцгаммного анализа образовательных объектов при эрцгаммном контроле педагогометрического исследования образовательных объектов, выражающего степень многофазного развития всех составляющих процессов формирования студентов. При этом можно представить шести-этапную модель базисного действия, состоящего из смыслообразование действия; принятие действия; ориентировочной части действия; исполнительной части действия; контрольная части действия и прогноза развития действия – представляющего инвариантную основу образовательной активности[10]. При этом решаются сорок восемь задач формирования целостно-системной личности. Процесс решения каждой задачи разворачивается относительно реализации базисной звезды Эрцгаммы гиперпространства жизнедеятельности (E1); базисного целостно-системного цикла жизнедеятельности (E2); базисной звезды Эрцгаммы системного анализа (E3); базисного проявления двенадцати этапов и форм познавательного гиперпространства жизнедеятельности относительно образовательного процесса (E4).

Materials and Methods

Развитие базы данных педагогометрических моделей формирующего эрцгаммного анализа образовательных объектов при формировании математических моделей учебной деятельности относительно способа достижения критериев эрцгаммности на различных целостно-системных представлениях о профессиональной практической деятельности связывается с различными информационными представлениями об ориентировочных, исполнительных и контрольных качествах технологических процессов [10].

Развитие базы данных педагогометрических моделей формирующего эрцгаммного анализа образовательных объектов относительно формирующего педагогометрического математического моделирования учебного процесса связывается с проблемой повышения эффективности управления учебной деятельности студентов на основе игрового автоматизированного обучающего комплекса. Динамизм изменения учебной обстановки, неопределенность и неполнота поступающих данных, сокращение времени на реагирование, многоплановость и многовариантность решения задач учебной деятедьност требуют поиска новых форм компьютерных обучающих программ, имитационных систем, тренажеров. При этом разрабатываются концептуальные положения и обобщенная функционально-структурная схема игрового автоматизированного обучающего комплекса (ИАОК). В результате происходит: разработка математических моделей представления данных в информационной базе ИАОК; формирование обобщенной модели гипермедийной информационной базы на основе нечетких когнитивных карт; использование теорий: управления в организационно-технических системах, нечетких множеств и логики, теории графов, системного анализа, синтеза баз данных, знаний, исследования операций. Математическая модель описания оперативных учебных ситуаций на основе нечетких когнитивных карт, позволяет применение статического нечеткого графа в случае представления в информационной базе стереотипных учебных ситуаций и нечеткого динамического графа, отражающего изменение оперативной или наличие нестереотипной ситуации учебной деятельности [1].

Развитие базисных формирующих педагогометрических математических моделей учебной деятельности также определяется проблемой разработки методов и алгоритмов оценки качества управления образовательным процессом и соответствующей учебной деятельностью. На основе системного и теоретико-множественного подхода решаются задачи с многоцелевых позиций и обеспечивается релевантность анализа, мониторинга и оценки качества управления. Выделены основные направления оценки качества управления учебной деятельностью: установление целей и нормативов учебной деятельности (ЦН), улучшение условий и технологий учебной деятельности (ТО), содержания образования

(СО), результаты образования (РО), потребности общества в результатах учебной деятельности (ПО). Модель качества образовательного процесса представлена в виде кортежа К=<$К_{ЦН}$, $К_{ТО}$, $К_{СО}$, $К_{РО}$, $К_{ПО}$>, где $К_{ЦН}$, $К_{ТО}$, $К_{СО}$, $К_{РО}$, $К_{ПО}$ - модели ЦН, ТО, СО, РО, ПО соответственно.

В основе построения структурной модели оценки качества управления учебной деятельностью используется системный подход, когда образовательный процесс рассматривается как совокупность компонентов и связей между ними. В качестве компонентов выделяются основные составляющие учебной деятельности. В результате декомпозиции модель представляется в виде кортежа <Ц, Ф, С, К, О>, где Ц – цель системы; Ф – функции системы; С – структура системы, которая реализует ее функции; К – компоновка перечисленных элементов системы; О – организация функционирования системы [2].

Развитие и структуирование базисных формирующих педагогометрических математических моделей учебной деятельности позволяет анализировать методы и средства управления образовательной траекторией в системах электронного обучения на основе теории измерения латентных переменных, теории нечетких множеств, теории управления, методах математической статистики. Формируется математическая модель конструкта - «зона ближайшего развития», основанная на объективной градуировке учебных материалов по уровню трудности. Строится модель измерения уровня текущих учебных достижений на основе методологии Г. Раша с расширенным набором наблюдаемых индикаторов учебной деятельности, в который наряду с результатами выполнения тестовых заданий включены метрики взаимодействия обучающихся с учебным контентом, а также обработки метрик немонотонного характера, что позволяет использовать их для измерения уровня подготовленности наряду с монотонными метриками. Выделяется метод управления индивидуальной траекторией обучения, основанный на идеях кибернетического подхода к обучению Л.А. Растригина, что позволяет производить адаптивное формирование блока объектов учебного контента на каждом шаге обучения, учитывая уровень подготовленности обучающегося. Устанавливается структурно-функциональная организация системы электронного обучения, особенностью которой является модуль принятия решений по ветвлению траектории обучения, использующий информацию об индивидуальной зоне ближайшего развития студента [3].

Развитие и анализ базисных формирующих педагогометрических математических моделей учебной деятельности связывается с математическим и программным обеспечением поддержки принятия решений в системе учебной подготовки студентов. При этом разработана технология формирования мультисоциометрической образовательной компоненты (показателя готовности) на современном рынке труда в виде мнемокода, отражающего уровень готовности специалистов на основе оценок уровня компетентности относительно теоретических и практических знаний. Сформирована математическая модель и методика комплексной оценки подготовки специалистов на основе теории нечётких множеств и алгоритма рейтинговой оценки, представленной на энтропийном подходе, его математическое и программное обеспечение, позволяющее автоматизировать поддержку принятия управленческих решений. Основные результаты исследования по обеспечениею поддержки принятия решений получены с использованием теории управления организационными системами, теории принятия решений, а также методов управления качеством, аппарата теории нечётких множеств, теории вероятностей и математической статистики, экспертных оценок, методов структурного программирования [4].

Развитие базисных формирующих педагогометрических математических моделей учебной деятельности также определяется проблемой разработки модели и алгоритмов управления тренажной подготовкой студентов на основе теории системного и математического анализов; имитационного и компьютерного моделирования; теории автоматического управления и принятия решений; теории вероятности и математической статистики; теории поэтапного формирования умственных действий и понятий. При этом предложена системная модель организации тренажной подготовки специалистов, которую можно представить в виде трёх взаимосвязанных уровней: функционально-ориентированного предметно-ориентированного и проблемно-ориентированного. Для оценки качества имитируемой модели по энтропийному значению вариации ее переменных вводится понятие показателя качества модели по переменной, определяемой относительно равномерного закона распределения вероятностей. Адекватность результатов имитационного моделирования реального объекта устанавливается метрической мерой близости между выходными сигналами объекта и соответствующими им выходными сигналами модели, отражающими предметно-деятельные характеристики обучения [5].

Развитие и структуирование базисных формирующих педагогометрических

математических моделей учебной деятельности позволяет анализировать модели и алгоритмы прогнозирования оценки качества объектов системы высшего образования на основе ретроспективной, текущей и экспертной информации. Разработан алгоритм получения критерия академической успешности, создания показателя академической успешности, на основе ретроспективной экспертной информации. Сформирован алгоритм создания текстовых индексов - трансформационных параметров текста и создана база данных параметров текста на основе ретроспективной текстовой информации. Представлены математические модели определения границы между уровнями качества подготовки специалистов, созданные с применением методов: регрессионного анализа и максимального правдоподобия, дающие прогнозировать оценку качества объектов образования через ретроспективную и текущую информацию [6].

Развитие и анализ базисных формирующих педагогометрических математических моделей учебной деятельности связывается с представлением модели и алгоритма управления подготовкой специалистов на основе интегрального мотивационного потенциала в условиях многопрофильного образования. На основе системного анализа, теории управления, системно-деятельностного подхода, многокритериального выбора, математической статистики, имитационного моделирования, теория алгоритмов, теории множеств, классифицирования, теории вероятностей: сформированы модель управления распределением времени студентов относительно системы бальных мотивационных контролирующих и воздействующих факторов, повышающих динамику усвоения учебного контента; введен интегральный мотивационный потенциал (ИМП), представляющий количественный показатель, который характеризует уровень мотивированности обучающихся; предложена модель совершенствования образовательного процесса на основе управления динамикой интегрального мотивационного потенциала при многопрофильном обучении [7] .

Развитие базисных формирующих педагогометрических математических моделей учебной деятельности также определяется проблемой разработки модели и алгоритма управления для нелинейной системы организации учебной деятельности. На основе моделирования организационных систем управления, системного анализа, теории игр, теории вероятности, теории принятия решений, использованием расплывчатых категорий: синтезирована модель системы управления учебным процессом позволяющая минимизировать возможность манипулирования информацией о типе кафедры; представлена задача построения оптимальной модели стимулирования профессиональной активности обеспечивающая повышение качества учебной деятельности; построен экспертный механизм для оценки сложности конкретного вида занятия из изучаемого тематического блока определяющий весовой коэффициент для построения системы расчета нагрузки учебной деятельности; разработана имитационная модель системы управления учебным процессом на основе трёх фазной Q-схемы с обратной связью оптимального взаимодействия [8].

Развитие и структуирование базисных формирующих педагогометрических математических моделей учебной деятельности позволяет моделировать и оптимизировать индивидуальную траекторию обучения студента (ИТОС) на основе методов системного анализа, интеллектуального анализа данных, предобработки данных, экспертных оценок, нейросетевого моделирования, динамического программирования, теории принятия решений. При этом проведён системный анализ существующих методов и алгоритмов оценки компетентности студента и моделирования ИТОС; разработана модель оценки компетентности с учетом результатов освоения основных образовательных программ, научно-исследовательской работы, индивидуальных особенностей студента и требований ФГОС; сформирован алгоритм оценки компетентности студента на основе использования гибридных экспертных систем и методов предобработки данных; спроектированы модели оптимизации ИТОС на основании критерия максимизации уровня сформированности компетентности [9].

Развитие и анализ базисных формирующих педагогометрических математических моделей учебной деятельности связывается с представлением модели и алгоритмов управления подготовкой магистров на основе методов системного анализа, системно-деятельностного подхода, многокритериального выбора, математической статистики, теории алгоритмов, теории множеств, классифицирования, математического моделирования, теории графов, теории сетевого планирования. При этом установлены модели и алгоритмы системы управления подготовкой магистров технического профиля на основе компетентностного подхода; представлена модель оценки важности и эффективности при формировании компетенций выпускника магистратуры вуза; определён алгоритм управления организацией обучения с позиции компетентностного подхода, с учетом процедуры измерения факторов и уровней формирования компетенций по видам

деятельности: проектно-конструкторская; сервисно-эксплуатационная; научно-исследовательская; организационно-управленческая; экспертная, надзорная и инспекционно-аудиторская с элементами математического моделирования компетенций [11].

Развитие формирующего педагогометрическое математическое моделирование учебного процесса отражает общее направление автоматизаци образовательных технологий, направленных на совершенствование циклической, базисной, фундаментальной и широкопрофильной подготовки специалистов, которые должны ориентироваться в общей структуре производства, совокупности методов его самоорганизации и этапах формирования профессионального мастерства.

Развитие формирования базы данных педагогометрических моделей формиирующего эрцгаммного анализа образовательных объектов при формировании математических моделей учебной деятельности относительно способа достижения критериев эрцгаммности максимально достигается при анализ базисных педагогометрических математических моделей учебной деятельности на основе психолого-педагогического системного анализа, психологической теории деятельности, теории формирования интеллекта, гиперпространства целостно-системных циклов жизнедеятельности эрцгамного формообразования. Целостно-системное учебное действие (ЦСУД) составляет базисную структурную основу целостно-системного цикла жизнедеятельности (ЦСЦЖ), состоящего из двенадцати компонентов звезды Эрцгаммы. Каждый элемент ЦСЦЖ можно представить методами системного анализа через двенадцать психолого-педагогических действий, которые в процессе интериоризации принимают двенадцать основных форм от ориентационной до внутренней и также имеют деятельностную основу. С учётом процессов коммуникативной деятельности дополнительно выделяются четыре целостно-системные учеб-ные действия. Существует сорок базисных ЦСУД, которые имеют предметно-деятельностную основу относительно ЦСЦЖ, психолого-педагогического системного анализа и процесса формирования интеллекта. Математическое моделирование целостно-системного учебного действия определяет базисную задачу педагогометрики [10].

Каждое целостно-системное учебное действие имеет три базисные компонента: ориентировочный, исполнительный и контрольный, которые определяют основные направления математического моделирования ЦСУД. Множество элементов учебного действия можно записать в виде набора последовательных элементов системных операций. Каждый элемент ЦСУД характеризуется конкретными свойствами, которые однозначно определяют его в данной системе. Совокупность всех свойств элемента учебного действия устанавливает его состояние. Между базисными компонентами ЦСУД констатируют связь - множество счётных зависимостей свойств между элементами системы учебного действия, составляющих ведущие компетенции. Это определяет собственную структуру развития каждой из сорока восьми задач формирования целостно-системной личности современного специалиста.

Conclusion

Поиск и анализ основных направлений развития формирования базы данных педагогометрических моделей формирующего эрцгаммного анализа образовательных объектов относительно формирующего педагогометрического математического моделирования учебного процесса связывается с процессами совершенствования программируемых математических моделей учебной деятельности относительно характера представления критериев жизнедеятельности, цикличности, системности и этапности, которые образуют базисную ячейку образовательного пространства, определяют условия развития абсолютного образовательного цикла, отражающего специфическую структуру подготовки широкопрофильных специалистов при реализации международных образовательных стандартов. При этом важно установить направление развитие и способы формирования уровня состояния основных базисных параметров всех основных четырёх структур целостно-системных звёзд Эрцгаммы, степень их взаимосвязи в направлении исследования шести-элементной структуры базисного целостно-системного действия. Каждая задача формирования целостно-системной личности задаётся критериями достижения уровней мультипликативного пространства широкопрофильной деятельности через реализацию многофазных предметно-деятельностых отношений скоростных формирующих схем.

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SECTION 24. Sociological research.

THE ROLE OF CIVIL SOCIETY INSTITUTIONS IN SPIRITUAL LIFE OF SOCIETY

Abstract*: In this article some aspects and interest moments of formation in system of civil society institution in spiritual and others spheres of society on example of the Republic of Uzbekistan are considered.*

Key words*: society, civil society, Uzbek model, spirituality, spheres of life, politics, NGO.*

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Introduction

Development of civil society in favor of historical prerequisite for the development of law. Without a mature civil society is impossible to build a democratic political system. Only conscious, free and politically active citizens capable of creating the most rational forms of collective life. On the other hand, the state has to provide conditions for realization of the rights and freedoms of individuals and groups.

The diversity of interests of citizens, their implementation by the various institutions, the range used at the same time the rights and freedoms constitute the main features of civil society.

Civil society institutions can be divided into three groups. This organization, in which the individual:

- receives funds to meet the vital needs for food, clothing, shelter and so on.. These means the individual can get into industrial organizations, consumer and trade unions etc .;

- meets the needs of procreation, fellowship, spiritual and physical perfection, and so on. D. This is facilitated by family, church, educational and scientific institutions, creative unions, sports clubs, and etc .;

- meets the needs in the management of the life of society. Here the interests are realized through participation in the functioning of political parties and movements.

The ability of individuals, various organizations of citizens to defend their personal interests, the ability to meet them at their own discretion, without violating other people's private and public interests, characterizes the maturity of civil society.

Materials and Methods

In modern conditions the civil society acts as a manifold is not mediated by the state of relations of free and equal individuals in the market conditions and the democratic rule of law. In contrast to the state structures in civil society not dominated by vertical (hierarchical) and horizontal communication - the relationship of competition and solidarity between legally free and equal partners.

In the economic sphere, the structural elements of civil society are non-state enterprises: cooperatives, partnerships, joint stock companies, companies, corporations, associations and other voluntary economic associations of citizens, they create on their own initiative.

Socio-political sphere of civil society include:

- defining the family as social unit of civil society, which intersect the individual and the public interest;

- social, political, political parties and movements, which express the diversity of interests of different groups of civil society;

- bodies of public self-government in the place of residence and work;

- identify the mechanism of formation and expression of public opinion, as well as the resolution of social conflicts;

- non-state media.

In this area develops the practice of institutionalization of interests that arise in society and express them in a non-violent, civilized manner, within the framework of the constitution and laws of the state.

Spiritual sphere of civil society presupposes freedom of thought, expression, real opportunities to express their views publicly; autonomy and independence of scientific, artistic and other associations from the state structures.

In general, civil society gives priority to human rights and freedoms, improving the quality of his life. This implies:

- recognition of the natural right to life, free activity and happiness;
- recognition of equality of citizens in the single framework for all laws;
- approval of the rule of law, subordinating its activities to the law;
- creation of equal opportunities for all economic, social and political activities.

Civil society is closely connected and interacts with the state of law, the main functions of which are as follows:

- develop a common strategy for social development;
- definition and justification of priorities, rates, proportions of the economic and social spheres of society;
- promotion of socially useful activity of citizens and protection of their rights, property and personal dignity;
- democratization of all spheres of society;
- defense of borders and public order.

Today in Uzbekistan there is a gradual process of formation of civil society. Civil society in modern conditions is an integral part of civilization and humanity. People of any state the right to decide their own destiny, to make responsible decisions and accomplish their tasks well. Then it will be achieved the highest goal of our people - peace and tranquility in the country, well-being and prosperity of the motherland. At the same time, to, form a civil society, need to be transformed and the public consciousness. This is to ensure that citizens fully get rid of the ideas of the old command-administrative system and were able to create an independent form of civil government with the help of civil society institutions.

The main purpose held in Uzbekistan from the first days of independence, large-scale complex transformation was the construction of a democratic state with steadily developing economy, the formation of an open civil society, in which the highest value is a man protected his rights, interests and freedoms, has created favorable conditions for the realization of its potential . The successes achieved by the country on the path of their own favorites are the result of the implementation of today received worldwide recognition of the "Uzbek model" of reforms, developed by President Islam Karimov stressed at the conference.

Within the framework of consistent implementation of the principle "From a strong state - a strong civil society" has all the necessary organizational, legal and material conditions for the formation and development of independent, stable, enjoying the support of the general public and with deep roots in the history of our people of diverse civil institutions.

The country has a strong legal framework, which guarantees freedom of activities of self-government, political parties, movements, trade unions, associations and foundations, NGOs, independent media, which, accounting for the institutional structure of civil society in Uzbekistan, promote the active participation of citizens in the implementation of the most important tasks of socio-economic development of the country.

The Constitution of the Republic of Uzbekistan enshrines the right of citizens to participate in managing the affairs of society, guarantee the rights and legitimate interests of civil institutions, the creation of equal legal opportunities. Adopted by more than 200 legal acts that serve a solid legal foundation for the sustainable development of civil society in the country.

The transformation of public consciousness is one of the most complex social processes. In Uzbekistan, the circumstances were such that it was necessary here since the early days of independence to decide the most acute problems that were inherited from the previous regime. Legacy of the past were deeply lopsided economy; colonial directed structure rich natural and mineral resources, distribution of productive forces, pricing, structure of consumption and others. There was a problem of self-determination of mechanisms and forms of transition from a command economy to a market system, and the need to search for the best options for entering into international economic relations.

Studying the rich experience of many countries with a market economy has prompted the need for Uzbekistan formation of socially oriented market economy. This choice was based on full consideration, not only international experience, but also the conditions of life, traditions, customs, and way of life of the population.

The process of formation of socially oriented economy in Uzbekistan is based on five key principles of the policy of the transition period set out by the President Islam Karimov [3]. They are as follows:

1. The economy must take precedence over the policy, be it internal content. Policy is a reflection of the economy and should serve as its further development. Economics and politics do not function separately. They are inextricably linked to each other

and form two sides of a single whole. In this relationship the priority is attached to the economy as the primary single system. This does not mean to override policy. Economic policy is designed to strengthen the economy, to determine the strategy of its development. Unreasoned, unreasonable, erroneous economic policy could cause the economy is not reparable impact, gain economies to failure and disruption of the ultimate goal. Economics and politics, in unity and in full compliance, should move in the direction of the main social goal - improvement of living standards and social protection of his.

2. The transition from one socio-economic system to another is full of contradictions and complexities. Overcoming them requires a strong government. It is the state acts as the initiator of reforms. It identifies priority areas of economic development, develops and implements the policy of radical transformations in the socio-economic and socio-political life of the country. The state is the main reformer during the transition period. This factor does not allow chaotic development processes of transformation of one socio-economic system to another; this process gives focus and consistency.

3. At the beginning of the transition period is necessary to lay the legal foundations of the future socially oriented economy. First of all, the very transitional period should be based on a legal basis. Only in a state of law is provided tangible results of economic and social transformation.

4. The transition to a market economy in Uzbekistan, with its demographic characteristics and accumulated complex social problems, demanded the implementation of a strong social protection of the population. Uzbekistan inherited from the previous system, has got a very low standard of living of the population, especially in rural areas. By this phenomenon has increased more the problem of unemployment, which is aggravated by the economic crisis. The closure of many large enterprises of national importance, the cessation of deliveries and orders from other regions of the former Soviet Union, led to the cessation or drastic reduction in activity significant number of companies, which has led to an increase in the number of unemployed. Lack of work, of course, reduces the source of income and expanding the circle of poor families. The transition to a market economy, under the influence of supply and demand, leading to a sharp rise in prices for goods and services. Out of the country on the world resources market requires adaptation of the internal market prices on the international level. The introduction of market-based pricing mechanism, low income families requires the establishment of a strong and effective mechanism of social protection and social services. Only in this case it is possible to ensure a dynamic move toward a market economy and preserving social and political stability in the country.

5. The gradual formation of the new market is an essential feature of economic reforms. The experience of the transition to a market economy in a number of countries by the "shock therapy" for Uzbekistan was not suitable. The introduction of market mechanisms in the short term could further deepen the accumulated social problems and lead to a precipitous impoverishment of the population. Only a gradual transition to a market economy is one of the leading principles. It defines all the internal logic and dynamic nature of economic reforms. A gradual transition to market relations was caused by the fact that for a country like Uzbekistan, took time to create an appropriate legal framework, market structure, the implementation of far-reaching reforms in the area of ownership, agrarian relations in the social sphere. A gradual transition to a market economy required for the formation of a new economic thinking, market psychology, adapt to the market situation. It was necessary to solve the problem of training a new generation of cadres, specialists able to work in market conditions.

An important manifestation and indicator of transformation of public consciousness is public opinion. The backbone of public opinion are [4]:

- the importance of social facts and events on which public opinion is formed;
- spiritual and intellectual and moral level of society, different social classes and groups that represent public opinion;
- spiritual and moral stance, political views of citizens, political parties, social movements as the generators of public opinion;
- national, ethnic, religious characteristics of the population, defining social actions are reflected in public opinion;
- the ratio of principal and related interest to be implemented in the course of social action, the level of harmony that defines the status and sustainability of public opinion.

In the course of studying of public opinion in the above-mentioned features are considered logical relationship and sequence.

The main areas of expression of public opinion are morality, morality, law, religion, culture, ecology, economics, politics, and others. Public opinion in these areas of life in nature of society is a rapid response of social science to the relevant requests of social practice.

Public opinion is a necessary element and effective public administration system of socio-economic and political processes. Public opinion expressed by the people on urgent problems of social life, is a kind of "social barometer" that allows for a constant monitoring of the social development of the socio-political, socio-economic and other processes in the country. On this basis, it produced evidence-

based suggestions and recommendations (action model) on the most important aspects of the development of society, timely account of which contributes to the removal of emerging social tensions and improve the efficiency of public administration.

Conclusion

In Uzbekistan, the transformation of public consciousness steadily held in the context of the formation of free-thinking independent identity of the citizen with permanent views, beliefs, forms the world, as well as a powerful ideological immunity. The confrontation of different kind of ideological threats would allow beneficial to participate in all spheres of the Uzbek society with a view to the formation of civil awareness of the importance of reforms in the country.

For the formation of a strong civil society is necessary to build on the national traditional institutions and to provide an independent and self-development NGOs. Civil society - is, above all, self-government. Revived in independent Uzbekistan is a unique institution of self-government - Mahalla - is thus the foundation based on which is formed a strong and just civil society in the country.

So, elaborated and implemented in Uzbekistan's own model of social and political construction "From a strong state to a strong civil society" has proven its effectiveness in the process of formation of a democratic state of law, which protected human rights and freedoms.

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SECTION 17. World history. History of science and technology.

SOME ASPECTS OF THE CONSIDERATION OF THE SOCIAL PROBLEMS IN MODERN ECOLOGICAL SITUATION IN UZBEKISTAN

Abstract: *In this article some aspects of consideration certain questions of social problems in modern ecological conditions in the republic of Uzbekistan.*

Key words: *ecology, ecological policy, Ecological Movement of Uzbekistan, social politics, sustainable development.*

Language: *English*

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Introduction

At this stage of human development world community became concerned about the increasing environmental problems, changes in natural ecosystems, loss of biodiversity, the threat of global climate change, accidents at industrial sites, and as a result, the negative impact of economic and other activities on the environment and on human health. The impact of man on nature has led to the opposite effect on the nature of the conditions of human existence. As a result of this dual interaction of man and nature in the world there were multiple problems. Among the urgent problems of the history of Uzbekistan studying the issue surrounding the history of the medium is high. With the scientific and practical point of view, the objectivity of the consideration of this issue is determined by the importance of addressing policy objectives, particularly in the achievement of the transition of all mankind to sustainable development. President of Uzbekistan Islam Karimov said at the plenary session of the UN Summit "Millennium Development Goals", 20 September 2010, said: "Of great importance for achieving the goals of the Millennium Declaration, particularly in the context of contemporary anomalous climate change, environmental protection and acquires environmental conservation" [1]. Indeed, the social significance of the environmental challenges facing the planet including all the historical features of research clearly and precisely determines their environmental focus. As a result, environmental history has become one of the fastest growing areas of modern historical science. As is known in the Soviet period as a result of irregular administrative and bureaucratic politics, erroneous approach to the placement and development of the productive forces has led to environmentally critical situation in Uzbekistan. Carrying out economic policy based on the ideology of the Communist Party, led by cotton monoculture has caused damage to nature and human life. There are dried up of the Aral Sea, polluted water resources of the Amudarya and the Syrdarya, irrigated land. Difficult drinking water to the population. Because no careful attention to environmental problems worsened level of social life, exacerbated all sorts of diseases, which led to negative consequences. No wonder Islam Karimov noted that we inherited a economy "from the past Soviet system with its one-sided hypertrophied raw oriented, destructive monopoly on the production of raw cotton, primitive production and social infrastructure and almost the lowest per capita consumption of the population" [2]. The essence of the Center for Economic Policy in relation to Uzbekistan in 1950-80s different desire for the maximum exploitation of natural resources. Thus, if previously the focus was on a continuous assignment resource base of agriculture, it is now after the creation of the necessary material and technical conditions, along with the assignment of agricultural products, has begun the process of appropriation of natural resources. Unsubstantiated

scheduling programs and the development of productive forces and their reform issues from the standpoint of economic laws strengthened the socio-economic and environmental aggravation of various processes in the republic. In the developed Committee on the Study of Resources, Gosplan in 1983. "General scheme of distribution of productive forces in the USSR in the period up to 2000" particularly pointed "... the transformation of the problem of water resources is an important factor of progress and strengthening of its role in human and industrial factors of environment in the forecast period. " In particular, this document underscored the worsening situation of water resources in Central Asia in the 1990s [2]. As a result of continuous development of cotton production in the context of increased cotton yield by 5.5 times between 1946 and 1985-ies acreage 841 thousand hectares have risen to 1,989,800 hectares [2, 103]. By the mid-1980s, the specific share of cotton has reached 75%, and in some areas, and more. Although, according to the generally accepted world practice, to restore normal soil fertility status of land sown areas shall not exceed 60%. However, this is not much cared about "the Centre". As a result, Uzbekistan under the weight of policy cotton monoculture in full mobilization of all opportunities to improve the yield of cotton was forced to annually perform ever-increasing plans of the Centre for harvesting cotton. Thus, a whole range of social and economic problems caused by the sharp contradictions between formed at the behest of the Centre keeping system of the national economy and the real conditions and capabilities of ecosystems of different areas of the country.

Materials and Methods

With the arrival of the leadership of the republic Islam Karimov at the end of 1980, on his initiative, there were significant changes in the field of agriculture. In particular, steps were taken to improve the land reclamation, the elimination of cotton monoculture policy. August 17, 1989 at the enlarged meeting of the government chaired by Islam Karimov in Tashkent was adopted a decree on the allocation of public private gardens. As a result, in 1989-1990-ies more than 1.5 million families have expanded their garden plots, and 700 thousand families have received new land for these areas [2, 12]. Expansion of the territory adjoining the farm economy and its transformation into one of the priorities of agricultural policy creates the conditions for radical changes in agriculture. Area sown cotton in 1990 decreased by 307 000 hectares with respect to 1988, and the state order plan for the production of cotton fiber decreased by 210 thousand tons [2, 237]. By 1991 cotton area decreased by 22% [2, 2]. Thus was the beginning of the improvement of living standards and addressing a range of social problems.

The Republic of Uzbekistan has received its independence, also inherited a number of environmental problems. In the past, the achievement of economic objectives, in many cases there has been a primary character and determined the declarative formalism and Environmental Conservation of the environment. In the years of independence, the focus in the country has been given to the formation and protection of the environment conducive to human activities and the protection of human health. As a result of large-scale structural reforms in the country today a system of effective environmental security, based on the norms of the international legal practice, the achievements of modern science, engineering and technology. This system of environmental safety is an integral part of the national security of the Republic of Uzbekistan. Environmental policy of the country was formed as a separate political institution in the fullest sense. From the first days of independence, pays attention to the preservation of healthy environment for present and future generations. A great contribution in this direction made by the scientists and experts of various fields, who have spent a lot of study and research. During the years of independence it has completely changed the face of the country from the one-sided development and focused on raw materials economy with the lowest levels of per capita consumption and backward production and social infrastructure in one of the fastest growing advanced economies, achievements and priorities of which were announced in the Millennium Development Goals. Today in the republic in order to strengthen the foundation for sustainable development carried out a series of measures aimed at improving the socio-ecological situation in the country. Since independence, significantly increased the volume of investments aimed at implementing measures to conserve natural resources and their rational use [2, 205]. As a result of improved environmental quality in areas with a high level of danger to human health and the ecosystem it has become more stable. Carry out effective work in the regions of the Aral Sea region for the improvement of the ecological situation, the creation of small water basins, on the construction of the aqueduct. Over the past 20 years, emissions of polluting waste into the atmosphere was reduced by 2.1 times, 2 times reduced levels of toxic waters. In particular, it reduces emissions of toxic wastes from major sources in the atmosphere from 1.3 million tons to 0.6 million tons per year, reduced runoff of contaminated water per year from 394 million m3 to 119.4 million m3 of solid domestic waste the last 10-12 years - from 9.51 tons to 3.98 tons [2, 6]. Grown grain crops, legumes, vegetables, melons [2]. At present, the total area of the cotton crop does not exceed 40% of developed national reserves, parks, wildlife and environmental centers.

From the first years of independence, special attention was paid to the conservation of biological diversity. In particular, strengthened the material and technical base of 9 state reserves (total area 2164 km2), 2 national parks (6061 km2), 9 reserves (12,186.5 km2) and of the National Centre for the increase in the number of rare species of animals. Despite the fact that today are taken for environmental conservation measures there is a threat of ecological safety of the country are classified by degree: global, regional, national and local. Complex environmental hazards and problems play an important role in defining the main strategic directions of environmental safety, prevention and elimination of environmental threats.

Strategic priorities of environmental security of the Republic of Uzbekistan are:

1. Rational and comprehensive utilization of natural resources, including water, land, mineral, and biological.
2. Reduction of environmental pollution throughout the country to ecological and hygienic and sanitary standards.
3. The adoption of comprehensive measures to ensure localization, rehabilitation and improvement of the ecological state in the zone of ecological disaster - the Aral Sea region, as well as other ecologically unfavorable areas of the country.
4. Provision of the country's population with quality drinking water, food, medicines.
5. The introduction of environmentally-friendly and resource-saving technologies.
6. Development of scientific and technological potential and the use of the achievements in the field of environmental science and technology.
7. Improving and further implementation of the economic mechanism of regulation of interaction of state bodies of different levels and nature, the inclusion of environmental requirements in the procedure for evaluating the socio-economic efficiency of management decisions.
8. Establishment of experimental ecological zones of sustainable development.
9. Creation of a unified system of ecological monitoring, forecasting and information.
10. Improving the control services and protection of the territory of the country by cross-border pollution.
11. Prevention and mitigation of environmental disasters, disasters, emergencies and accidents.
12. Formation of the Central Asian Regional Ecological Security.
13. The development and improvement of environmental education, culture and education of the population.
14. Enhancing cooperation with the international community in addressing environmental problems.

Conclusion

With the consistent and gradual implementation in Uzbekistan of socio-economic, socio-political reforms in accordance with the chosen country, "Uzbek model" of state and social construction to the fore the task of strengthening the role of citizens in governing the country. Today, civil society institutions, have in their ranks more than 5300 NGOs are becoming an important factor in the protection of democratic values, rights, freedoms and lawful interests of people, as well as one of the most important elements to ensure effective feedback of the state due to the society, to identify the relationship of people to the ongoing in the country transformations. They create the conditions for citizens to exercise their potential, enhance their social, socio-economic activity, legal and environmental culture. A mass movement to win broad public support, is the Ecological Movement of Uzbekistan, created in 2008 to protect the environment and human health. Given the global nature of environmental problems, the importance for all segments of the issues surrounding the protection of public protection, public health, the decision which is the targets of the Ecological Movement of Uzbekistan, in 2008, the legislation of the Republic introduced a rule providing for the movement of 15 seats in the Legislative Chamber of the Oliy Majlis of the Republic of Uzbekistan. To date, in all regions of the country are successfully operating Ecological Movement units that could consolidate the capacity and resources of 125 local environmental NGOs, 130 NGOs, specializing in issues of health protection of the population.

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ANALYSIS OF MAVARDI'S WORK «AHKOM» - AS DOCTRINES OF GOVERNING A STATE FROM THE POLITICAL, SOCIAL AND LEGAL POINT OF VIEW

Abstract: *In article the work of Mavardi "Ahkam" is considered and its heads and paragraphs are analyzed. Ziyovuddin Mukhitdinovich Dzhuraev. The senior teacher of chair "Source study and archival science" of History faculty of National University of Uzbekistan named after Mirzo Ulugbek. The post-graduate student of Institute of Oriental studies of Academy of Sciences of Republic of Uzbekistan. For reception of more information see one of the scientific researches – studying of Al-Mavardi's work "Al-ahkom as-sultoniya va-l-valoyot ad-diniya" about a source (X-XI centuries), concerning the statehood. Creation, sense and historical essence of work "Ahkom". The Supervisor of studies: the academician of Academy of Sciences of Republic of Uzbekistan, Doctor of HS, Professor of faculty of History of National University of Uzbekistan Mukhammadzhanov A.R.*

Key words: *politics, law, social life, history, Muslim East, Mavardi, Ahkom.*

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Introduction

Living in the end of X beginning of XI centuries, one of the great scientists, brought a huge contribution to the science development, being the scientific figure of Baghdad "Byte al-hikma" Abdulkhasan Ali Ibn Mukhammad Ibn Habib al-Mavardi (364-450/974-1058) famous for his work "Al-ahkom-as-sultoniya va-l-valoyot ad-diniya" (Sultan ahkoms and the government doctrine)[1], was since ancient times well-known in a science world of constitutional science [2]. As about Mavardi and its work "Ahkom" [3] a lot of articles and publications has been resulted [4], we cannot stop in detail on it.

Materials and Methods

Actually, Mavardi, according to written sources, was well-known in the world public opinion as a jurist, a geographer, a statesman, a lawyer, a political scientist, a politician, a literary critic, an Islamite, a scientific-methodologist.

At the review of Mavardi on methods of a practical-political and methodical theology school "ahl al-sunna va-l-zhamoa" it is clear, that he was a reformer, the supporter of justice, the scientists who created a number of works.

For studying of creation of Mavardi's work "Ahkom", its recognition, sense and historical essence it would be reasonable to analyse it scientifically.

On bases of the Muslim theory of the state and the right, Mavardi's work "Ahkom" as the first sample of political legal doctrines, is made so that it suits to various epoch of statehood. On creation and essence of the content, Mavardi's work "Ahkom", being the doctrine directed to criteria of eternity, is studied through spaces and times, and also co-opted various ideas and public opinion, it is the main theme of doctrines.

The work "Ahkom" is the first sample of Muslim political-legal doctrines, the bases of the state and the right theory in it are presented fairly and objectively, with the account of the original perspective sides of statehood of the various periods.

In the centre of Mavardi's thinking there was a generalization of public ideas about the government, and from the methodical side the new sources of universal fair statehood were shined in "Ahkom".

For the first time in the Islamic world, Mavardi in his work "Ahkom" united the correctness of a trend of vital system of statehood, the stability of government from the social-political side, and the perfect legal doctrine about governing reforming [5].

The work "Ahkom" on logic sequence of the content, sense and structure of topics consists of 20 chapters and 109 sections. In them it is told about tradition of governing of politically – legal centralized fair state of a medieval human society. The laws, supply and demand, conditions, criteria of selection, a choice and appointment of corresponding candidates to operating state posts are noted.

Before to begin studying of ideas about the bases of the state government resulted in the given source, it is reasonable to stop on the purposes and the problems put before it, on the reasons and methods of a writing of work.

The main goal of a writing of work "Ahkom" was to define and strengthen by the legal-standard documents a duty and problems, the politically – legal duties of administrative governing establishments as mukhtasib and mukhtasibness, akso al-kuzo – kazy and qualifications of kazy, imorat – emirate and the emir, vazorat – the ministry and the minister, in the government of imomat – the rights of the government, a management and imams – heads of the state.

In the main work among the political works of Mavardi – "Ahkom" the laws of formation of the state, a basis and government methods, ability to a management, demand of offers, requirements, conditions, councils from the selected person as from the highly skilled governor – the head of the state and from employees of system of the government, as statehood component are stated.

Mavardi in work "Ahkom" has put before himself the following problems: to define office and private powers of the officials appointed to the post; public, political, legal duties, punishment measures, jizya, the tax, mukhtasibness before various problems of life of a society, to define the bases of the new perfect doctrine about the government, devoted to work, residing, thinking, obtaining of education.

The work "Ahkom" consists of definitions of general legal bases, the rights, politically-legal makoms of heads of the state (the imam - the sultan) and participation of the people, besides officials of the government, in governing by state, a person and a society.

The reason of a writing of Mavardi of work "Ahkom" was that recognised before "Ahkom" the subject of theoretical state administration sources were imperfect, it gave an abstract concept about creation, improvement and management by the fair Muslim state; till Mavardi the scientists of Islam have not created a work about the doctrine of political and administrative methods of government by the Muslim state; the revealed in secular and spiritual sphere inconsistent positions caused complications for the urgent solving of problems.

The style of a writing of "Ahkom": Mavardi, being the Islamic jurist, his work "Ahkom", after traditional basmala ("With a name of Allah, merciful and charitable"), began with words "Praise to Allah....". In its turn, the text of work began by a phrase concerning the traditional Muslim management: "Explained to us secular spiritual doctrines of the Moslems, granted to us kitobi mubin – the Koran which has trained us to politically-legal, sultan laws at conducting of state affairs, praise to Allah revealed distinction between khalal and kharam (permitted and forbidden), do will be Glory to Allah and prophet Mohammed, to his family, his fellowsoldiers" [6].

Considering the aforementioned, the purpose of a writing of Mavardi of the given work was to pay attention of Moslems, at conducting the state affairs, to socially-moral relations, secular and spiritual, political-legal, khalal and kharam (permitted and forbidden), legal and illegal works on the basis of the doctrine of legal state governing.

Secondly, it is said: "Allah, having strengthened the rights of the creations, determined by His rules the best of laws – sultan ahkoms, adapting its secular and spiritual sides, has established a comparative definition at solving of secular problems. Praise to Allah, for the gift given to us according to His purpose,– the doctrine for state governing" [7].

Therefore, Mavardi at writing of a doctrine about state and right bases, first of all, gave a great value of comparability of the secular and spiritual principles, the best and the refined sides of laws of the Koran – given by Allah.

From a work's phrase "Glory to Mohammed, his family, his fellowsoldiers who have introduced the instructions of Allah, ennobled them, explained through them the Lord" [8] it becomes clear that Mavardi as the scientific jurist, creating his doctrine, turned a great attention to experience of the Prophet created and operating the Muslim state, and strongly pronounced progressive ideas of his fellowsoldiers.

Mavardi as the theoretician who has incurred responsibility for creation, in initial stages of revival, the theory of centralized strong politically-lawful state in the Muslim East, has explained the difficult situation which has arisen at the creation of governing of a state so: "Being comprehensible in a state government, as a part of sultan decrees the stay of relevant secular and spiritual trends was till now an obstacle for acceptance of important concrete conclusions by the officials working only under spiritual laws" [9],.

Through this phrase Mavardi specifies that officials of the Muslim state, as a result of unilateral conducting activity, on the basis of spiritual laws,

lead to statehood decline. At the same time he has specified a unique way of rescue from decline:

"Therefore, I obeying decrees of my sovereign, has written such book that masters and scientists of all trends on the basis of political fikkh knew well their duties, rights and problems, and also operated on it and improved it. At each position and legality kept justice, and at generosity - a measure" [8].

Thus Mavardi asserted that state administration reform, its working out and designation of its legal-political bases, were the most necessary conditions of that time.

Mavardi in work "Ahkom" turns a great attention to set of interests of a state, a society and a person, and has stated about it the following: "It is a work for the state employees, based on secular and spiritual laws of the state government, co-ordinated with teoritical-practical laws. It (work), despite employment of people by social-political, legal-governing works, reforms a distance and renunciation from secular spiritual sultan ahkoms and directs on a right way. It is necessary for jurists to study public, political-legal norms of religious-sultan ahkoms (on the basis of a fair state government) and obligatory to use at conformity" [9].

Mavardi in work "Ahkom" turns a great attention to set of interests of a state, a society and a person, and has stated about it the following: "Masters and lawyers should observe criteria for the good of justice at solving problems between the ruler and the damned (the head of the state and the country population)" [9].

In the given work the words "For introduction of bases of the validity or observance, comparison of these bases at the solving of problems between ruler and the damned (the head of the state and the country population) has begun necessary work and on this theme has written the book" [9] testifies that it has not been written such perfect work of a difficult structure for a state government.

Mavardi, creating work on a state government, incurred high responsibility. In it (in work) an action of preservation of legal balance between Allah and a person is expressed. And sufficiency of the book of Allah and human experience, experiences of the theoritical-practical validity is underlined as well. Only at the comparative analysis of the fair reasoning defining and introducing a statement about the status of a state establishment, on what it is necessary to be based, the question can clear up as they say here: "My hopes of Allah, I wish, that He were my assistant directing to justice and truth. He is the great person helping me in achievement of my goals" [9].

Mavardi in the introduction of the work has underlined, on the basis of the incontestable data, that for directing the state government it is enough the ayats of Allah, the legends of the Prophet and the historical experiences of Moslem. Mavardi in work "Ahkom" has shown an action of preservation of legal balance between Allah and a person. He, asserting that for doctrine creation about the government there is enough book of Allah, human experience and validity experiences, has said so: "Undoubtedly, from the belief given by Allah (Islam and the book of Koran) are taken the sultan ahkoms about a state government, laws for corresponding thought. So it has shown force of the Prophet for the Muslim people. So Allah has defined, of what its consent consists" [10].

Mavardi, despite the contradictions created in Abbasas khalifat, aspiring to justice and truth, on the basis of the specified directions of Allah and his Prophet Mohammed, could create the political theory consisting from sultan ahkoms of a state government and laws. The administrative establishments, being the basis of the state political system leaning against steady laws at maintenance of legal freedom of a society and citizens are namely a political-public and legal task and the guarantor of development. Above-stated Mavardi has stated so: "Ahkoms of Allah will suffice for business management of political-legal government and maintenance of all requirements of a Muslim society. Khilofat – being a state establishment, has a great value at reforming of the state legality" [11].

Really, one of the traditional customs is a creation of state establishment, for maintenance of calmness and the safe future of the nation.

In particular, about it Mavardi says the following: "Reforming of works connected with a state, a society and a person is connected with paying attention to laws of the given work (the Koran and the Sunnahs of the Prophet). For, the head of the state, for reforming of the public person, and also, for the solving of affairs in favour of a society will lean against these bases and if these bases, in turn, correspond to the laws, specified by Allah so the relations between a state, a society and a person can develop successfully" [12].

Mavardi marks, that even after creation of establishment of state government on the basis of the above-stated theory, there will be a requirement for formation of the official chain entering into its structure: "After formation of the state and election of its governor, there will be more problems before sultan management connected with bases of a state government and methods of government" [9].

After state formation, in turn, there will be its administrative splits and control systems: "From this party, the given establishment, operating through the centre, connecting board departments (the ministry, emirate, kazyness), paying attention to their communications, should on a basis of governing and lawful execution of an order to enter orders, to make decisions, to declare decrees and directives" [9].

In the aforesaid, Mavardi has stated the methods of creation of the fair centralized state on a

theoretical-practical basis. The following problem involved for creation of administrative structures of the state, is directed on the solving of a political-legal problem about who the head of the state is and what it should be, or to whom and how it is possible to entrust to transfer a state government.

It has been above specified that work "Ahkom" was published in Kuwait. Under the statement of the publisher, in preface of this edition, the following ayat Mavardi considered as his slogan: (Iza khakamtum bayna an-naasi an tahkumu bi-l-adli) "Allah rules, that taking out a sentence between people, pronounce a sentence with justice" (K:4:58:Surah Niso). This ayat at the same time is criterion of justice in the given source.

On sense, content and a structure the work is conditionally possible to divide into three parts: the first – imomat; the second – vizorat; the third – imorot [13]. Mavardi in work "Ahkom" giving valuable and a detailed information on three basic branches of the government – legislative, executive and judicial, has entered scientific and positive-methodical innovations into the system of a state government [14]. Below, we shall stop briefly on the sections developed and planned by Mavardi and their subjects about state establishments.

Chapter 1 of work "Ahkom" – akd al-imoma: imomat – the state administration rights [the contract of imam (the head of the state), the agreement and an establishment of obligations, also legal statuses] [15] consists of the following 15 sections: Imomat – this part is about an obligatory establishment of the state government and its compulsion; "Ahl al-imam" – (candidates) on imam, that is the considered conditions at a choice of corresponding candidates on a post of the head of the state; the Imam – two best ways and methods of a choice of the head of the state;" Izhtamaa ahl al-hal va-l-akd-li-l-ixtiyor "– conditions to permit Imam (the head of the state) (a choice of the people or from the side of palace officials) and council of the people solving problems (judges of elections); irrelevance of formation at the same time of two imams (two heads of the state) in one state; irrelevance of doubtful positions [the reference to the Koran] at a choice of the imam; one of the conditions of imomat (state administrations) – relevance of the imam in due time to appoint one successor (candidate); according to worthy conditions of imomat, justice at appointment of the successor as an imam for imomat, appointment of the successor and some special positions, connected with it; at position of appointment of two or more successors on imomat, schedules of serial transfer of government to them; a statement about maintenance of stability by appointment of the successor or elections in the course of state creation; hukuk al-imoma – after establishment of aforementioned imam (ruler), one of duties of fellowsoldiers – a choice of the worthy head on a post of the imam (by the position, the perfect, highly skilled managing director) (to permit); positions at insufficiency of bodies of the imam (the head of the state): (an ear, feet, hands), (the invalid, a lack of bodies, defects), the positions interfering him to be the imam; positions at damage of important bodies (a hand, feet and other parts of a body) of the imam (head of the state) at government; a part about preparation of important decisions (laws) on the organization for described imomat (state government); a part about very important (personal) managing directors of the imam.

The second chapter of work "Ahkom" "fi taklid al-vazira" (appointment of the ministry and definition of its powers) [16] consists of 4 sections: ministry division into two parts: vizorati tafviz (the ministry with unlimited possibilities) and vizorati tanfiz (the ministry with the limited possibilities); an establishment of conditions and possibilities of vizorati tafviz; conditions and possibility of vizorati tanfiz; the separate minister who is engaged in social matters, and the separate minister, prosecuting individual matters for vizorati tanfiz, admissible for khilofat (khalifat state government).

The third chapter of work "Ahkom", about creation of emirates in regions and appointment of emirs [appointment of heads of region, assistants to region] [17], consists of following two sections: the first part: are given valuable and detailed data about emirate and mobilization [tadbir al-zhaysh] of its army according to the policy of the government [siyosat ar-raiya], the special emir [(emir al-umaro) appointment of heads of regions (khakim, emir, the assistant)] on the military affairs, necessary conditions for duties over won emirates [(established by force), necessity of emirates conquesting].

The fourth chapter of work "Ahkom" "On appointment of emirates (imorat) for jihad [(military movements against the enemy)" [18] consists of the following 6 sections: the first section – law of seven rights about military duties (tasir al-zhaysh) of mobilized armies (masir al-zhaysh – a high-speed military army (consisting only from horse soldiers)) – in previous part of ahkoms of military emirate; the second section – laws (ways of battles, military management) tadbir al-harb; the third section – laws and requirements put before the military emir (emir al-zhaysh); the fourth section – laws of relations between emirs and a military army; the fifth section – law of appointment of capable constrained emir (emirate), invincible before the enemies, keeping military firmness; the sixth section – laws about military– circuit (fast) emirate, encirclement of the enemy, battle with it, fulfilment of mass punishment.

The fifth chapter of work "Ahkom" consists of data concerning the conditions of armistice [19] at management of military campaigns, and consists of three sections. In the given chapter it is told about conducting battles against apostate rebels, sinners,

deviating from war (fight for rescue of the great Native land) and robbers (maintenance of the internal law and order, prevention of mutinies).

In the sixth chapter of work "Ahkom" is elucidated the management (legal structure) [20] of kazyness (justice), and it consists of 8 sections. In the given sections are stated: relevance of believers to a trend of shofii to appoint to the post of kazy the believer to school of Abu Hanifa, administrative conditions of regional kazy, incompatibility of kazy government with general or private kazyness, relevance, on the general point of view of special post of a kazy, regulations of appointment of two kazys in one state, creation of governmental specialized regional kazyness, requirements to kazy and the reference to imams, irrelevance of acceptance by the person appointed as a kazy, gifts from the hostile party.

The seventh chapter of work "Ahkom" named "Mazolim" - management of struggle against violence and injustice [21], consists of six sections. This chapter deals with a matter of introduction of extreme Chancery kazy control, tasks and duties of extreme office"vali", specialized for reforming of claims between the quarrelled claimants, use of a chancery method to the claimant at whom the claim is not proved, about the claim, free from the different reasons, a method of ibrozy (opened), iody (appeal) of discussion of proofs, adjudgment of tavkiot (revolt) – to the risen by the inspector of office mazolim (emergency situation), improvement of decisions of extremely authorized establishments (management of emergency situations, management of justice), (a difference between extreme and generalle authorized khakim and kazy).

The eighth chapter of work “Ahkom” is called management [affairs (high society) al-ansob, nufus] of nakiba (public castes) [22], and divides on two sections: the first – management of nakobat (public work), duties of the chief of inhabitants and the representation, the second nakib – about public managements.

The ninth chapter of work “Ahkom”, about the instructors operating by namaz [23], consists of four sections. In these sections it is discussed about appointment of esteemed qualities of imams to a public Mohammedan prayer by fellowsoldiers (people), disagreements of fakihs about imam to a Friday Mohammedan prayer, appointment of imams for groups of reading mustahab namaz and namaz Sunnah.

The tenth chapter of work "Ahkom" about pilgrimage management [24], consisting of two sections in which it is told about pilgrimage carrying out, management and maintenance of execution of pilgrimage.

The eleventh chapter of work "Ahkom" about zakat management [25], consists of seven sections. These sections deal with a creation of zakat, things subject to zakat, hoofed animals, fruit, grain products, gold and silver, zakat of deposits (mine), duty of the zakat’s collector, delivery of donations to a person, who is worthy of it, methods and terms of zakat’s repayment, methods of distribution of donations to needing people.

The twelfth chapter of "Ahkom" about distribution of property and military spoils [26] which consists of 4 sections: property and spoils of war; censure of execution of chronically sick old men, old women, married women, women and children taken to a prison; conquest (force) of enemy territories by Moslems; distribution of portable property and the spoils of war received for the account of a victory over the opponent.

The thirteenth chapter of "Ahkom" about conditions of definition of zhizya and hiroj (tax) [27], also consists of 4 sections. In them the control establishment over the lands – kharadja (a land tax), legal essence and norm of gathering of kharadja, various units and measurement methods are stated.

The fourteenth chapter, about the countries in which the conditions of ahkams are different [28], also consists of 4 sections. In them the information on Haram (the Kaaba) and its territories, classification of areas, the sacred zones having a great value, the description of area of Hizhoz having the original power, rights of other countries on areas of Haram (Mecca) and Hizhoz (Medina), a condition of independent regions and the lands of Iraq (kept away from the centre) is supplied.

The fifteenth chapter, about development of virgin lands and irrigation [29], consists of 3 sections. In these sections the distribution to 3 parts of irrigation waters, legal bases and distribution of flowing and well waters, division of spring waters into 3 parts is described.

In the sixteenth chapter of work "Ahkom" the information about djaylau [reserves, meadows] and irfaks [30] [an additional economy, an estate] which consists of two sections is given. In these sections the legal motives of meadows, use of mosques and madrasahs, matters on meetings of scientists are described.

The seventeenth chapter - about ahkoms ikto [the state lands and the hereditary lands from parents, about matters of privatization of property of owners of the ground areas], the rights, system of conditions, distribution of the state lands, as privatization, to citizens in a form of ikto [31], consisting of three sections. In these sections the themes stated are: the legal motives of privatization of the private lands, transformation to private property of ikto of mastered virgin lands and its division in two, the assignment to the person of ushur (1/10) and the tax (regular affairs), ore ikto, legal motives of private property.

The eighteenth chapter of work is called the foundation of secretariate and zikr of ahkoms [32], and it consists of four sections. The preliminary

section is about duties of the governmental secretariate which consists of four parts. The first part – the basis of special military secretariat and its work on distribution of salaries, the schedule in military secretariat [formality and the book of registration], definition of salaries to an army and its quantitative sufficiency. The second part – the official rights of special amals (the manager of the head of the state) (secretariat of supervision of the state profits). The third part – secretariat to assignment of amals (manager) for works on a speciality (taklid and azl) and their dismissal. The fourth part – works on arrival and the expense of byte al-mol (treasury), sohibi zimmiy– secretariat of adherents of a different faith, living in the Muslim state and their duty.

The nineteenth chapter about structures of punishment [33] [the rights of crimes, on the basis of the established laws, according to a position, methods of punishment of criminals], consists of 4 sections. In these sections the penalties for a crime, namely ithom (slander) and the general discussion, ways of punishment and infoz (execution), punishment of adultery, a cutting penalty (hands, a foot and other bodies) of the thief, hamr haddlari (ways of application of punishment to alcoholics and smokers), iftiro (slander) of adultery, a method of punishment of speaking kazf (slander innocent, an insult) and reproaches, damnation, application of punishment of the state payments for special crimes as procurement and intellectual attack to people (moral damage), punishment by reprimand, methods of educational punishment (to call for politeness, to respect of the law), specifications of punishment by a stick beating are stated.

The last, twentieth chapter of work "Ahkom" – about ahkoms of khisba [34], consists of ten sections. In these sections the concrete information, for example: about intermediary establishing of khisba between mazolim and kazy ahkom, muhtasib – control of the auditor-supervisor over scales on markets and in trade, maintenance of cleanliness, comfort, decent building of kishlaks, cities, streets, calling people for good affairs and refusal from bad ones, mutotovviy – honourable administration; carrying out of political-legal, morally-educational works between people; an appeal to scientific understanding of spiritually-secular, educational works – amru maruf; propagation not to operate blindly, carrying out of explanatory works; nahi ani-l-munkar – to make only those affairs which are ordered by Allah and his ambassador (on the basis of laws), the general things between laws of people and Allah (the right of people), abstention from not ordered affairs and propagation of abstention from them; division of works into three nahi ani-l-munkar, mahzurot – (forbidden affairs), about negation of affairs - forbidden and suspicious to debauchery, illegal profit, usury and forbidden actions in trade; about the rights of fair people; things forbidden by Allah (prohibition of intricate and insidious affairs leading to forbidden); a general law between human rights and the supreme Allah and the things forbidden by Allah.

In the conclusion of work "Ahkom" it is said: "In this book the themes which were not stated by jurists at all or were stated in brief are given. The themes not mentioned till now, short themes are stated in detail and clearly. For rescue and piety I wait from the supreme Allah".

Speaking on the basis of the above-stated, Mavardi in work "Ahkom" has stated the ways and scientifically-practical bases of creation of fair centralized state. From the point of statehood bases view, the work of Mavardi "Ahkom is a statehood source, consecutive continuation of statehood's tradition as a work covering regular and majestic laws and state government methods, historical and positive result of earlier created work "Ahl al-sunna... " .

In work of Mavardi "Ahkom", the state government methods are stated in 20 chapters, 109 sections. Mavardi, as a result of the spent researches, being based on istinbot, istisloh, islohot [35], could create the work "Ahkom". At writing "Ahkom", Mavardi was based, on an ideological basis of statehood - on the doctrine of Farobi, and on problems of religious beliefs – on ideological bases of Abu Mansura Maturidi.

In a basis of "Ahkom" the ideas reforming the public problems and enrichment of political rights for the account of comprehensively proved doctrines are taken. The given work has got a high value as the constitutional doctrine, the legal doctrine for Abbosy's state in century XI, and carried out the function of the basic grant for works with subjects of statehood and the political right, created in the next centuries.

Conclusion

As a result of the above-stated analyses the next conclusion has been made:

Mavardi, being the theoretical and practical creative scientist, his scientific heritage - outstanding work "Ahkom" has written for introduction in the Muslim world of ways of a state government, management of a political order and public life at will of circumstances, according to the offer of the head of the Abbissies state - Al-Kadir Billah.

The carried out analyses of work "Ahkom" on its sense and structure have shown that the author has generalized in it the scientific and narrative ideas on a state government from sources, written before it. In it, in a consecutive order, the financial sources, methods of political, legal, administration government, the charter and legal powers as a state institution of the imam – head of the state, the

ministries, emirates, kazyness – on the basis of secular – shariat laws are logically stated.

Mavardi, having compared and critically studied the works of statehood created before it, leaning against his practical experience, has created the most perfect doctrine, defining the bases of statehood in the public and Islamic world. In this doctrine, each theme of system of the state government is stated consistently, providing a harmony of secular and spiritual trends.

Work of Mavardi "Ahkom" can be studied as the important ideologically-historical source concerning a state government, and also for definition of the relation of Muslim padishahs to citizens, for definition of the rights, problems and management statuses, for maintenance of conformity of spiritually-secular responsible powers with a debt and the duties strengthened in sources of fikh, for balance keeping between the state and a society, and for creation of a convenient basis for their sustainable development.

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SECTION 19. Management. Marketing. Public administration.

ESSENCE OF MOTIVATION ON INCREASE OF EFFICIENCY OF LABOR

Abstract: *In this article the essence of concepts of workers and their attitude to labor, motivation of the labor, promoting and influencing on motivations of the mechanism in the enterprises on the market-economic attitudes are theoretically investigated. Also, scientific conclusions and offers of the result of practical researchs carried out on the improvement of attitudes of labor and motivation of labor for increase of efficiency of labor are revealed.*

Key words: *efficiency of labor, motivation, stimulations, management efficiency of labor, norm of labor, labor attitudes.*

Language: *English*

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Introduction

The social and economic structure of Uzbekistan undergoes today qualitative changes, it is necessary to touch the sphere of labor attitudes. Social and economic position of the worker at the enterprise varies, its attitude to carried out work, motivation of labor activity changed also.

Any economic way is based on the certain system of the values accepted by a great bulk of the population. Economic reforms are carried out when they create the new system of values perceived by the population adequate to them. Otherwise transformations mention only superficial layer of social and economic attitudes and, in the queue, "conversed", transformed by weights with reference to the system of sights accepted by them.

Economic transformations spent at us, as a rule, are carried out to accounts of the uzbek's, welfare stereotypes coincide with the system of values inherent in them and motives of activity.

Materials and Methods

The theoretical substantiation of the change of the attitude to labor, labor ethics as a whole at fundamental social and economic shifts has been made by Maks Veber at the end of the XIX - the beginning of the XX c.[1, p. 48]. Developing these ideas, D.Makklelland[2] on the big empirical material demonstrated dependence of economic successes of a society on a condition of labor motivation. With reference to the problems of management of labor questions of labor motivation were analyzed in a different context by such scientists as A.Maslou[3, p. 114], K.Levin[4, p. 247] and etc.

Before to start the analysis of mechanisms of functioning of labor motivation in market conditions, it is necessary to define a circle of concepts with which we shall operate, and to formulate some general provisions, leaning on which it is possible to build logic designs of these mechanisms. The basic concepts which are used in the analysis mechanisms motivations, essence: motive, motivation, a motivational nucleus, motivational potential, and also definitions describing them - riches, force, an orientation, a level of claims.

The motive - is the realized prompting to activity. It will consist of the following components: need (interest); the blessing, capable to satisfy the given need[5, p. 201]; the expenses necessary for reception the blessings (activity); and the price, as result of comparison of the received blessing and the expenses (costs) connected to it.

It is necessary to emphasize, that as the same need can be satisfied with the various blessings, and the same blessing is capable to satisfy various needs[6, p. 98]. Thus a link between need and the blessing can be various kinds of activity, and the price includes not only economic, and the physiological, psychological, moral, aesthetic and

other costs connected to assignment of the blessing.

The motivation - is the interconnected set of all motives inducing the person to activity. It represents complete structure with difficult interrelations between elements making it. As in any system, its properties cannot be shown to properties of elements making it. The motives which are included in system, form a difficult configuration in which there is a nucleus and periphery[7, p. 145].

Motivational nucleus of the person - set of the motives mutually conditioned understanding by motive of activity, internal determinant of the behaviour, determining its general orientation.

The motivational nucleus is basically criterion at definition such as motivation.

The type of motivation is a characteristic of motivational potential of the person or the group, reflecting semantic an orientation of labor activity on the satisfaction of the certain groups of needs.

Type of motivation mediated character and an orientation of the requirements showed by the worker to the industrial environment, an estimation of an opportunity of realization of these requirements, a degree of personal labor activity of the subject and the general satisfaction work.

It is necessary to distinguish motivational potential of economic culture and motivational potential of the subject of labor activity - industrial group or the separate worker.

The motivational potential of economic culture expresses a level of development of those valuable orientations which provide high economic results, a level of opportunities of activization of labor activity which carry in itself social institutes, characteristic for the certain economic culture.

Motivational potential of the subject of labor activity (the worker or industrial group of workers) are those opportunities of activization of labor efforts which can be realized during stimulation of labor activity[8, p. 55].

The motivation of work is formed in that and only in the event that actual needs for the person and their satisfying blessings are connected with labor activity.

Special value of this group of motives will be, that its place in structure of motivation defines an orientation “on itself” or “on others” and by that predetermines the attitude to consumer properties of made production. The market economy is focused on the consumer. Force of these motives and their place in the structure of motivation, alongside with the attitude to the labor as to the goods, can serve as the indicator of a degree of transition to market motivation of labor.

The third group - the needs connected about maintenance of means of existence, reproduction of the person. These are needs for a payment, earnings for maintenance of the certain prosperity for the family; in satisfaction of those social needs with which for whatever reasons not always it is possible to satisfy for money[9].

The fourth group of needs - status the needs connection about position of the worker in reviewer for it to the social group. It is possible to attribute needs for dialogue, a recognition (respect), service promotion (career) to them.

Each of these groups of needs can become rod (force of motivation), main around of which the motivational nucleus of the person is formed to define understanding motive of labor.

Force of motivation - is a total intensity of desire to satisfy significant needs. The level of force of motivation allows to allocate motivation of achievement and motivation of preservation[10, p. 264].

The motivation of achievement is directed on the development of new needs and expansion of a spectrum of the blessings, their satisfying. It a source of development of labor activity.

The motivation of preservation is directed on maintenance and preservation of the achieved level of satisfaction of needs and supports labor activity at that level which allows to avoid the sanctions directed on restriction or reduction of quantity of the received blessings.

A line of the conditions connected to freedom of a choice is necessary for formation of motivation of achievement.

First, the society should authorize a high level of vital standards (quality of a life here and now).

Second, it should have a variety of the blessings attractive to the individual.

Third, the individual should have confidence that these blessings are accessible to it that it can receive them as a result of the labor activity. At last, the costs connected to their purchase, should be for it comprehensible. Only at presence of these necessary conditions the motivation of achievement providing high labor activity and, accordingly, efficiency of labor can be generated.

Taking into account, that the type of motivation of the worker only mediated is connected to the type of manufacture or a field of activity, the policy of stimulation of labor activity in any manufacture should versification in view of the personal factor. Methods and measures of stimulation can give positive result only in the event that they noted features of motivational type of the worker.

The correct organization of stimulation - a basis of efficiency of motivation of workers. Just because the payment is perceived and as a recognition of the social status as the form of a social estimation, it shows and fixes in consciousness of workers those quality which are most significant for the employer.

Differently, by means of a payment come to light really functioning, and not just professed social

norms and the priorities regulating labor activity. It and norms - samples, following which is encouraged, and norms - interdictions, infringement which is punished.

Conclusion

As a result resulted theoretical analysis researches show, that the creative beginnings in work are directly connected with the opportunities of self-regulation of intensity of labor, with expansion of sphere of freedom of the worker as conditions of growth of labor activity. For development of initiative, innovative and creative forms of labor behaviour the rigid labor discipline as creativity and the initiative of the worker directly produce it sense of duty is contra-indicated and do not demand on imperous methods of prompting to work.

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SECTION 4. Computer science, computer engineering and automation.

THE APPROACH TO THE CALCULATION OF SCIENTOMETRICAL INDEXES ON THE BASE OF DATA FROM RUSSIAN AND FOREIGN QUOTATION SYSTEMS UNDER THE CONDITIONS OF NONCOMPLETE DETERMINATION

Abstract: *This work presented the problem of calculation of the main scientometrical indexes on the base of data from different quotation systems under the conditions of noncomplete determination caused by limited access to the quotation systems. It was offered the approach including following components: data collection and processing; the construction of aggregative publications list; the calculation of total number of quotations for each publication; the calculation of citation index and Hirsch index. The offered approach allowed make the calculation of citation and Hirsch index on the base of data from RSCI and SCOPUS quotation systems under the conditions of noncoplete determination. There were carried out the investigational studies of developed approach that allowed make the conclusion about the possibility of their usage for calculation of the citation and Hirsch indexes under the conditions of noncomplete determination.*

Key words: *scientometrical indexes, citation index, Hirsch index, conditions of noncomplete determination, the construction of aggregative publications list, the calculation of total number of quotations.*

Language: *English*

Citation: Boldyrev PA (2017) THE APPROACH TO THE CALCULATION OF SCIENTOMETRICAL INDEXES ON THE BASE OF DATA FROM RUSSIAN AND FOREIGN QUOTATION SYSTEMS UNDER THE CONDITIONS OF NONCOMPLETE DETERMINATION. ISJ Theoretical & Applied Science, 02 (46): 205-208.

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Introduction

At the moment to estimate the effectiveness of scientific work the scientometrical indexes are used together with experts' opinions. It's due to the presence of secure available for measurement and comparison information about the scientific researches results presented in different quotation systems. To the most popular foreign quotation systems can be referred Web of Science [1] and Scopus [2] and to the Russian – RSCI [3].

However despite the big choice of quotation systems offering data for estimation of authors' publication activity there is number of problems preventing their wide usage in scientific and educational organizations [4]. Quotation systems Web of Science and Scopus don't include the majority of publications in Russian. Quotation system RSCI doesn't have an access to the big number of foreign publications and also doesn't have the majority of works up to 2000. Special importance this problem gets under the conditions of limited access to scientometrical information because of high price.

Materials and Methods

Some scientists tried to develop software tools providing additional possibilities working with quotation systems [5, 6, 7]. However after the analyses [8, 9] of developed software tools following conclusions were made:

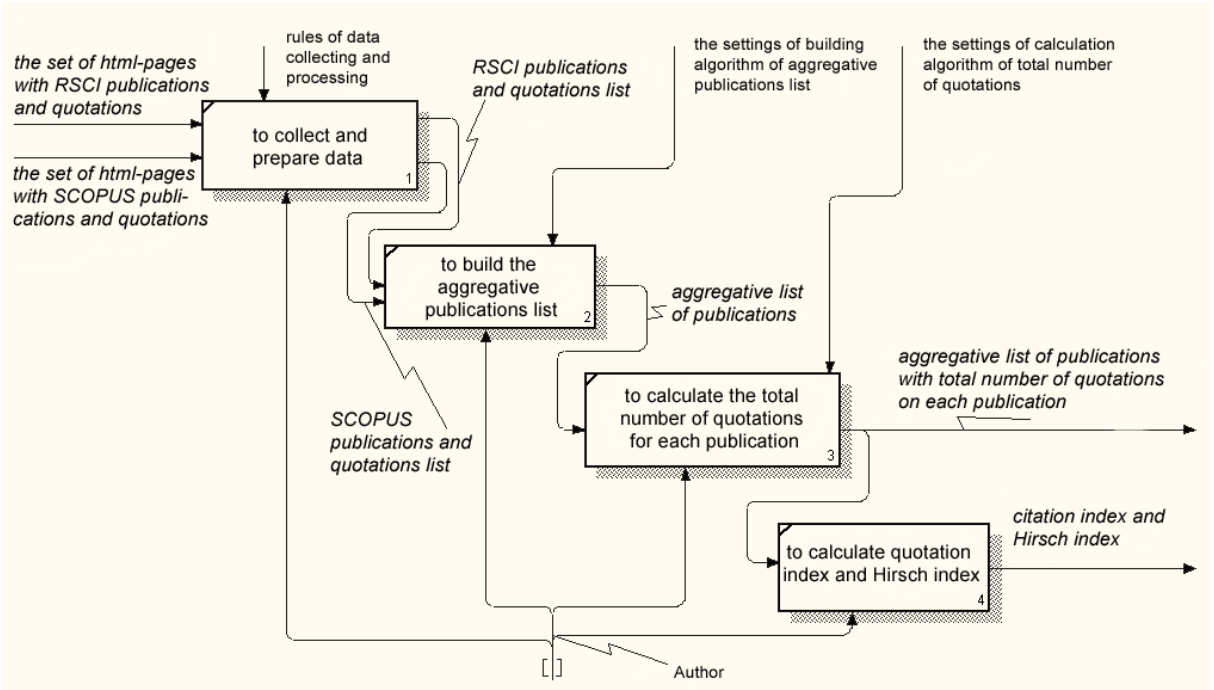
- there aren't software tools that can aggregate data and calculate scientometrical indexes taking into account Russian Science Citation Index;
- developed software tools are supposed to work with the availability of full access to the quotation systems and can't work under the conditions of noncomplete determination.

In that case under the conditions of noncomplete determination is meant the absence of possibility to identify uniquely and relate the

quotations (the title of quoted work, the source and publication year) in foreign quotation systems with the list of quotations in RSCI for each publication. Whereas there is provided only the quantity of quotation for each chosen publication in foreign quotation systems. As a consequence there is the problem of calculation of total quotations number for each publication. It's also impossible to calculate the main scientometrical indexes (quotation index, Hirsch index [10] and others).

Consequently the objective of this work is the realization of calculation of the main csientometrical indexes (quotation index and Hirsch index) on the base of data from RSCI and SCOPUS under the conditions of noncomplete determination.

To solve the presented problem there was developed the approach allowing make the analyses of the main scientometrical indexes such as quotation index, Hirsch index and others on the base of data from quotation systems under the conditions of noncomplete determination. The main components of developed approach and their relations are shown through IDEF0-diagram of the first level on picture 1.



Picture 1 – IDEF0-first level diagram.

Let's consider the analyses of authors' publication activity on the base of RSCI and SCOPUS quotation systems.

At the stage of data collection and preparing is performed the review of html-pages with the list of publications and quotations from RSCI and SCOPUS quotation systems.

By building of aggregative list of publications it's being formed the list of author's publications on the base of data from RSCI and SCOPUS quotation systems in which there are no duplicated publications. The base of building algorithm of aggregative list of publications makes shingles algorithm.

The stage of data collection and preparing and also the stage of aggregative list of publications building are presented more detailed in work [1].

To calculate the total number of quotations on each publication there are used data received at the stage of building of aggregative list of publications precisely the number of quotations in RSCI system, the number of quotations in SCOPUS system and also the number of found duplicated publications in SCOPUS system.

The base of calculation algorithm of total number of quotations under the conditions of noncomplete determination makes mathematical apparatus of fuzzy decision trees [6]. This mathematical apparatus combines the advantages of decision trees and fuzzy logic.

There were detached 2 target classes: «small proportion of intersectional quotations» (negative result), «big proportion of intersectional quotations» (positive result).

The belonging to the target class for new recording can be found in the following way:

$$\delta_j = \frac{\sum_l \sum_k P_k^l \cdot \mu_l(D_j) \cdot x_k}{\sum_l (\mu_l(D_j) \cdot \sum_k P_k^l}\,,$$

where P_k^l - coefficient reflecting the correlation of sheet examples *l* for the meaning of the whole class *k*, $\mu_l(D_j)$ - belonging level example *j* to the knot *l*, x_k - target class meaning belonging *k* to the positive result.

The calculation of total number of quotations is made in the following way:

$$S_i = K_i^{SCOPUS} + K_i^{RISC} - \min(K_i^{SCOPUS}; K_i^{RISC}) \cdot \delta_i$$

where K_i^{SCOPUS} - the number of quotations in SCOPUS system for the current publication, K_i^{RISC} - the number of quotations in RSCI system for the current publication.

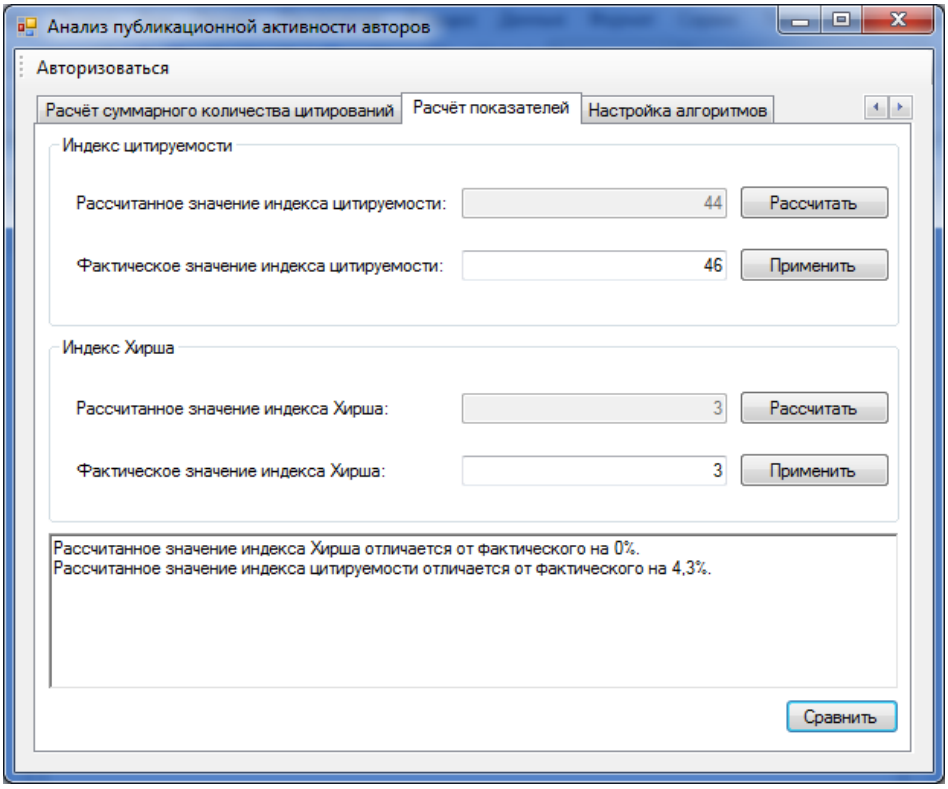
The citation index is defined as the sum of quotations calculated at previous stage in all publications. Hirsch index is calculated by formula presented in work [4] on the base of total number of quotations calculated at previous stage.

The results of citation index and Hirsch index calculation for one of the authors included in test set are presented in table 1 and on picture 2.

Table 1

The results of citation index and Hirsch index calculation

The name of index	Index value in RSCI	Index value in SCOPUS	Calculated index value	Index real value
Citation index	35	13	44	46
Hirsch index	2	2	3	3



Picture 2 – The screenshot of the program at the stage of the main scientometrical indexes calculation.

Conclusion

The results of citation index and Hirsch index on the base of developed approach allowed make following conclusions: Hirsch index calculated value matches with real value; calculated value of citation index differs slightly from the real one.

As it can be seen from the above it's possible to talk about acceptable results of developed approach and the possibility of its further usage for citation index and Hirsch index calculation.

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SECTION 4. Computer science, computer engineering and automation.

CALCULATION ALGORITHM OF TOTAL NUMBER OF QUOTATIONS UNDER THE CONDITIONS OF NONCOMPLETE DETERMINATION

Abstract: *It was reviewed the problem of total number of quotations calculation on the base of data from RSCI and SCOPUS under the conditions of noncomlete determination. It was offered the calculation algorithm of total number of quotations the base of which makes mathematical apparatus of fuzzy decision trees. Fuzzy decision tree was learnt on learning data set. The developed algorithm was researched on testing data set that allowed make conclusions about its usage for calculation of total number of quotations under the conditions of noncomplete determination.*

Key words: *scientometrical indexes, noncomplete determination conditions, total number of quotations calculation, fuzzy decision trees.*

Language: *English*

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Introduction

At the moment none of the existing quotation systems individually displays the full picture about the authors' publication activity: not all list of publications and citations comes into account. One of the possible solutions of the problem is the building of aggregative list of publications on the base of data from different quotation systems and also the calculation of total number of quotations for each found publication. The special actuality this problem gets under the conditions of noncomplete determination specified by limited access to the quotation systems. One of the most popular foreign quotation systems is Scopus [1] and Russian is RSCI [2].

In this case under the conditions of noncomplete determination is understood the lack of possibility to associate quotations in SCOPUS system with the list of quotations in RSCI for each publication. In foreign quotation systems it's provided only the number of quotations on each chosen publication. There is the problem of calculation of total number of quotations for each publication. As the result it's getting impossible to calculate the main scientometrical indexes (citation index, Hirsch index [3] and others).

The aim of this work is the development and experimental researches of calculation algorithm of the total number of quotations on the base of data from RSCI and SCOPUS quotation systems under the conditions of noncomplete determination.

Materials and Methods

To calculate the total number of quotations for each publication the data used received at the stage of building of aggregative list of publications [4] precisely the number of quotations in RSCI, number of quotations in SCOPUS and also the number of found duplicated publications in SCOPUS system.

The base of calculation algorithm of total number of quotations under the conditions of noncomplete determination makes mathematical apparatus of fuzzy decision trees [5]. This mathematical apparatus combine decision trees and fuzzy logic advantages: allows operate quality characteristics of the subject; used in situations when it's difficult to classify the subject exactly according to any attribute позволяет; provides training on comparable small data set.

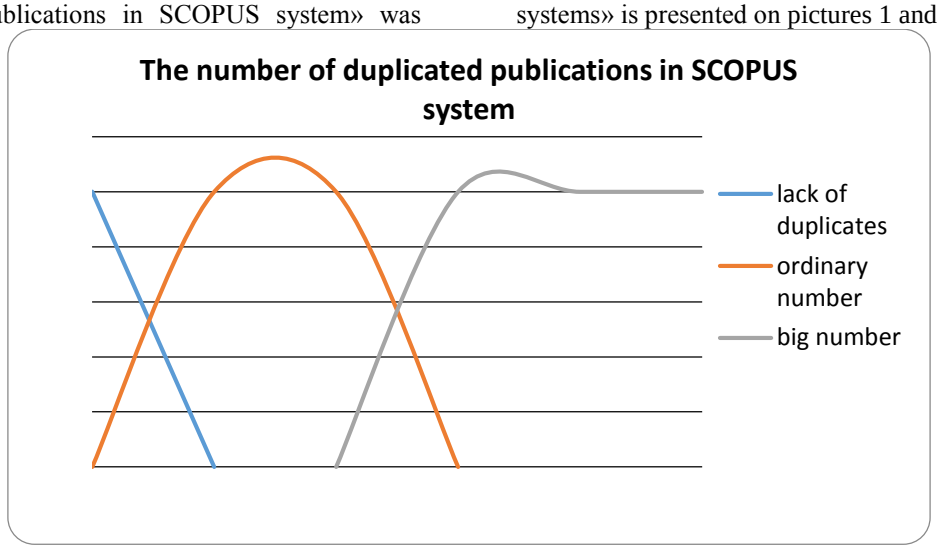
By building fuzzy decision tree for each attribute were selected some linguistic variables and defined examples membership degree. Instead of

number of examples for each knot fuzzy decision tree groups their membership degrees.

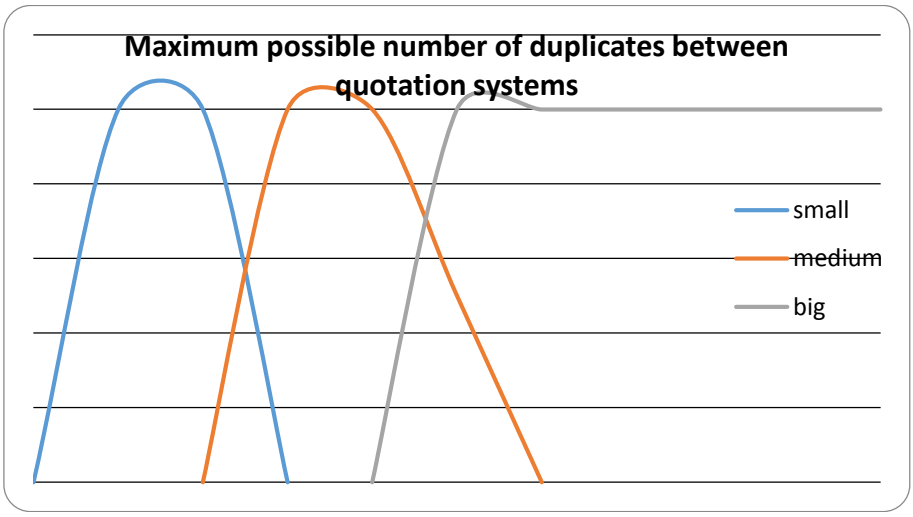
There were selected 2 target classes: «small portion of intersectional quotations» (negative result), «big portion of intersectional quotations» (positive result).

As attributes by which decision tree was built were selected the following: «the number of duplicated publications in SCOPUS system», «maximum possible number of duplicates between quotation systems». The attribute «the number of duplicated publications in SCOPUS system» was given by linguistic variable with the following term-set of meanings: «lack of duplicates», «ordinary number», «big number». The attribute «maximum possible number of duplicates between quotation systems» was given by linguistic variable with the following term-set of meanings: «small», «medium», «big».

The type of membership function [6, 7] for term-sets on attributes «the number of duplicated publications in SCOPUS system» and «maximum possible number of duplicates between quotation systems» is presented on pictures 1 and 2.



Picture 1 – Membership functions for term-sets on attribute «the number of duplicated publications in SCOPUS system».



Picture 2 – Membership functions for term-sets on attribute «maximum possible number of duplicates between quotation systems».

Numeric value of attribute «maximum possible number of duplicates between quotation systems» is calculated in the following way:

$$x_i^1 = \min(K_i^{SCOPUS}; K_i^{RISC}),$$

where K_i^{SCOPUS} - the number of quotations in SCOPUS system for the current publication, K_i^{RISC} - the number of quotations in RSCI system for the current publication.

For construction of fuzzy decision tree is used the algorithm consisting of several stages.

At the first stage of algorithm work general entropy is calculated.

In the following stage are calculated coefficients P for each possible node. The calculation of coefficients P for each node N is accomplished in the following way [8]:

$$P_i^N = \sum_{S^N} \min(\mu_N(D_j), \mu_i(D_j)),$$

where $\mu_N(D_j)$ – membership level of the training example D_j to the node *N*, $\mu_i(D_j)$ – membership level of training example toward objective value *i*, S^N - the variety of all examples.

Coefficient defining main characteristics of the node *N* is calculated in the following way:

$$P^N = \sum_i P_i^N ,$$

In the following stage is calculated the entropy that estimates the average number of information to determine the object class from the set P^N:

$$E(S^N) = -\sum_i \frac{P_i^N}{P^N} \cdot \log_2 \frac{P_i^N}{P^N}.$$

Then the entropy for each attribute individually is calculated:

$$E(S^N, A) = \sum_j \frac{P^{N|j}}{P^N} \cdot E(S^{N|j}),$$

where *N*|*j* – child of node *N*.

Then the information gain on each attribute is calculated:

$$G(S^N, A) = E(S^N) - E(S^N, A).$$

Finally as root attribute is chosen the attribute with the maximum information gain.

Then node *N* is devided into subnodes *N*|*j*. Membership level of each example D^k for node *N*|*j* is calculated from node *N*:

$$\mu_{N|j}(e_k) = \min(\mu_{N|j}(D^k); \mu_{N|j}(D^k, a_j)),$$

where $\mu_{N|j}(D^k, a_j)$ demonstrates the membership level D^k to the attribute a_j. In case if none of the examples belongs to the node *N*|*j*, this node is deleted.

The algorithm work continues until all the attributes are used or all the examples aren't classified.

The membership to the target class for the new recording is found in the following way:

$$\delta_j = \frac{\sum_l \sum_k P_k^l \cdot \mu_l(D_j) \cdot x_k}{\sum_l (\mu_l(D_j) \cdot \sum_k P_k^l},$$

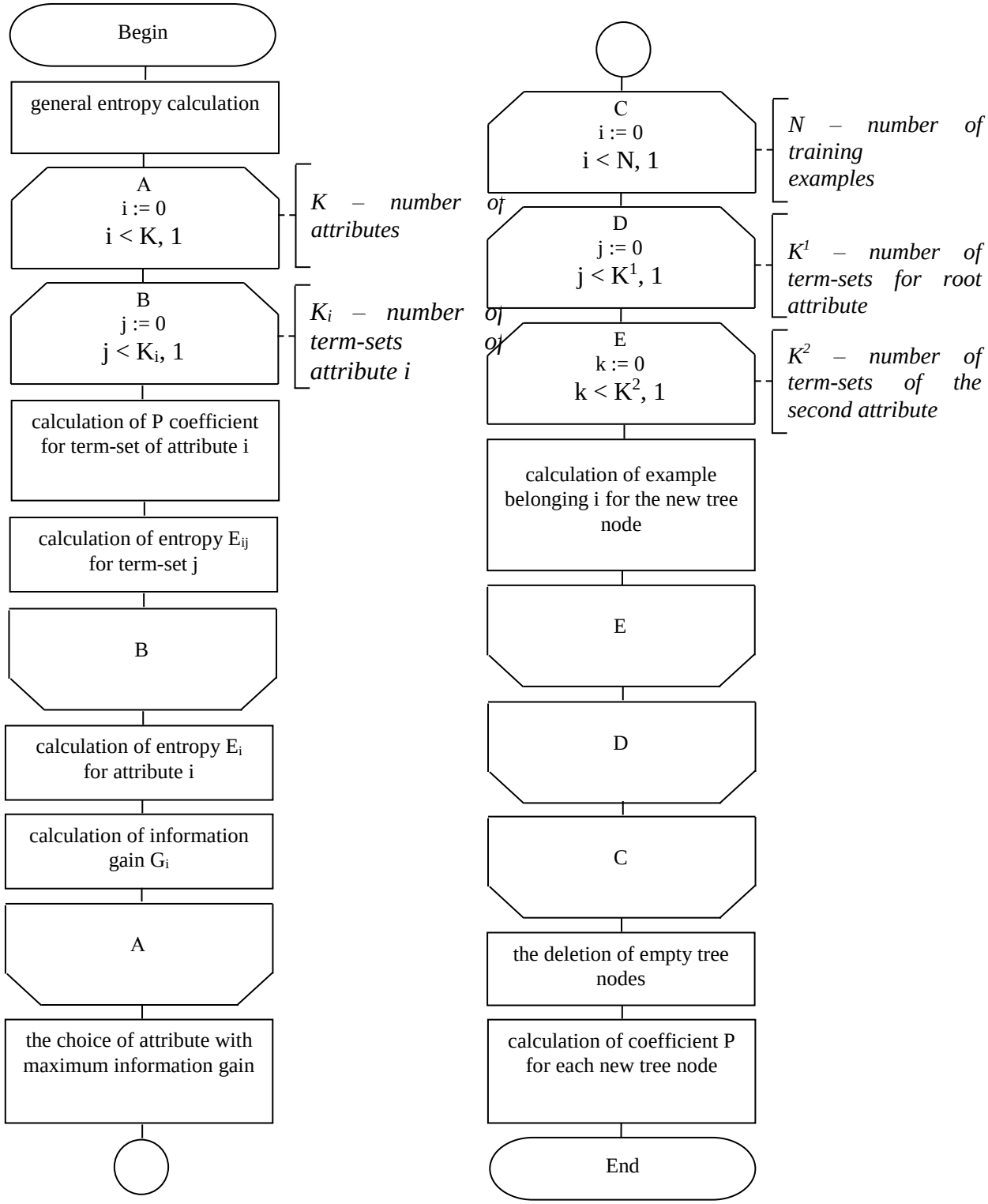
where P_k^l - coefficient displaying the correlation of examples *l* for target class values *k*, $\mu_l(D_j)$ - membership level of example *j* to the node *l*, x_k - membership of the target class value *k* to the positive result.

The calculation of total number of quotations is made in the following way:

$$S_i = K_i^{SCOPUS} + K_i^{RISC} - \min(K_i^{SCOPUS}; K_i^{RISC}) \cdot \delta_i$$

.

The algorithm of building of fuzzy decision tree [9, 10] on the base of training set is presented on picture 3.



Picture 3 – Algorithm of building of fuzzy decision tree.

The generalized chart of calculating algorithm of total number of quotations by means of built decision tree is presented on picture 4.

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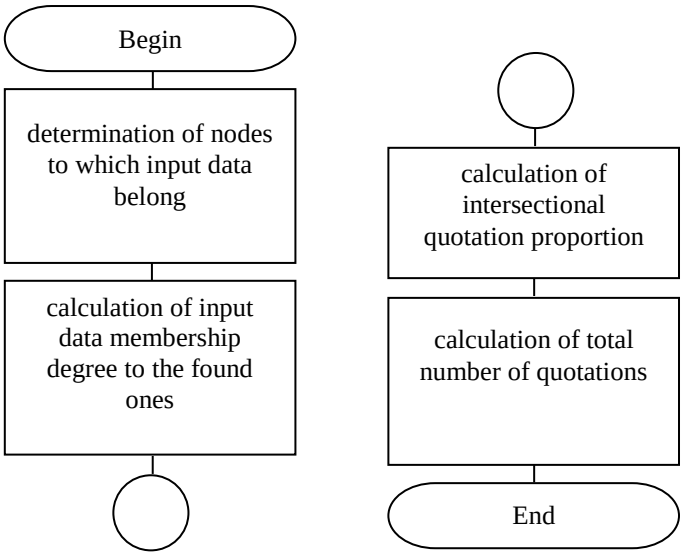
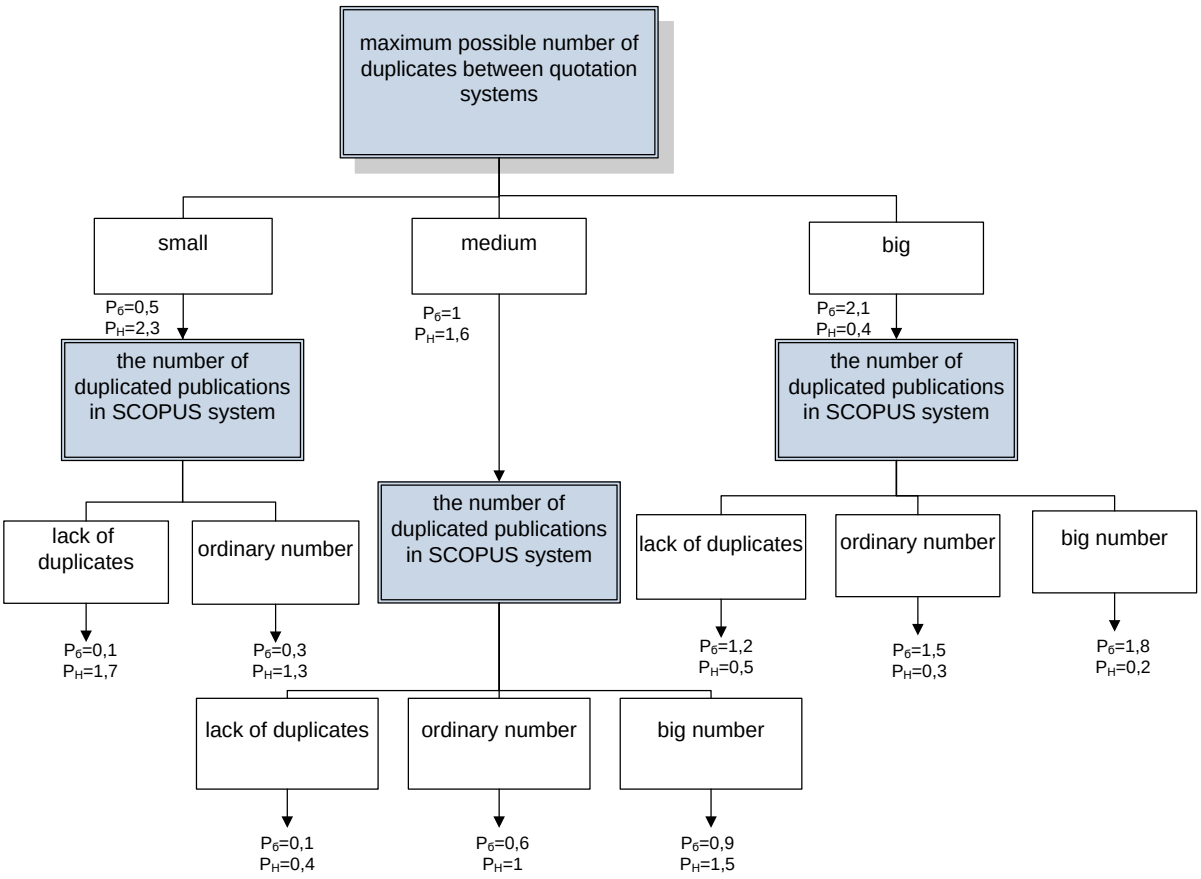


Picture 4 – Generalized chart of calculating algorithm of total number of quotations.

For analyses of algorithm work results on calculation of total number of quotations for each publication at first stage was carried out the building of fuzzy decision tree on the base of training set.

Training set was formed on the base of publications list of 5 leading authors of Orenburg State University having fairly large number of duplicated publications in RSCI and SCOPUS quotation systems.

Constructed fuzzy decision tree is presented on picture 5.



Picture 5 – Constructed fuzzy decision tree.

At the next stage trained tree was tested. The test set was formed on the base of list of publications of 3 leading authors of Orenburg State University that aren't included in training set and having fairly large number of duplicated publications in RSCI and SCOPUS systems.

Conclusion

As result of algorithm work in training set were received the following results: for more than 82% publications were noticed the coincidence of total number of quotations calculated by means of developed and real algorithm; for 18% of publications calculated total number of quotations by means of developed algorithm differed slightly from real value.

Thus it may be concluded that it's possible to use the developed algorithm for calculating of total number of quotations on the base of data from RSCI and SCOPUS quotation systems.

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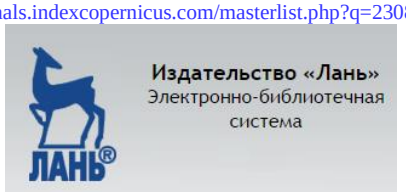

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