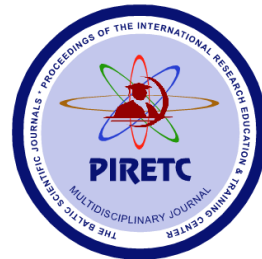


ISSN: 2613-5817; E-ISSN:2613-5825, DOI PREFIX: 10.36962/PIRETC

VOLUME 15 ISSUE 05 2021

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JOURNAL OF SOCIAL RESEARCH & BEHAVIORAL SCIENCES
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The beautiful thing about learning is nobody can take it away from you—B. B. King

ISSN: 2613-5817; E-ISSN:2613-5825, DOI PREFIX: 10.36962/PIRETC

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REFERRED & REVIEWED JOURNAL

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ISSN: 2613-5817; E-ISSN: 2613 – 5825; UDC: 0 (0.034)

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MTÜ Rahvusvaheline Teadus-, Haridus- ja Koolituskeskus.

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MACHINE TRANSLATION FOR ACADEMIC PURPOSES

Ayten Rahimli

Teacher, Ganja State University. Email: aytanrahimli26@gmail.com

ABSTRACT

In the second millennium, due to the trend of globalization and the growth of knowledge, multilingual translation has become a cause for concern. To gain knowledge in the academic field, automatic translation should be considered not only from an academic point of view, but also in practice. Automatic translation is a reliable translation method used by professional translators in various professional fields. Automatic translation is the ideal approach used by professional translators, translation instructors and translation learners to find ways to learn and teach the bilingual / multilingual translation functions in the software. In fact, automatic translation theories and computer aids have been praised by many scholars.

This article explores the current state of development of automatic translation, why it is important to fully implement automatic translation in textbooks or training courses for academic purposes, and what types of software are suitable for this area.

Keywords: machine translation, computational linguistics, bilingual / multilingual translation, open courses, software.

Introduction: Machine translation (MT) is a modern method of translation through computer assistance, which is a sub-field of computational linguistics. This academic and professional area associated with both Translation and Computer Science explores the functions of computer software that can translate texts into foreign languages to be readable and comprehensible. MT performs simple replacements with basic translated key words for non-native speakers to understand content in an original foreign language that they need to assess. Using computer translation software, such as Dr.Eye, translation functions in Google toolbar or Yahoo toolbar, complex contents in foreign languages can be comprehended at a glance by people who does not familiar with the languages in the original contents. The MT software professionally and cautiously created, and assisted language experts and linguists to handle linguistic differences in typology, grammatical differences and idioms.

According to Vauquois (1998), MT is aimed at enabling a computer to transfer natural language utterances, or to process a natural language in terms of lexical, syntactic and semantic dimensions. For both of texts or speeches from one language in the original texts to another language for the receivers, and even for both of explicit and implicit meanings, the MT productions can be found working in an effective way. Vauquois (1998) implies that MT should be an applicable technique of doing translation.

However, some other scholars of translation field hold a different way looking at this issue. Thriveni (2002) has ever emphasized that “one language cannot express the meaning of the other; different languages predispose their speakers to think differently....” Thriveni (2002) surely holds a negative attitude to see the translating functions of processors and soft-wares of computers. He insists that cultural interpretations and recognitions through natural translation by a translator should be a more precise way of doing translation, since the literature and culture senses in the text and the speeches cannot be uncomplicatedly revealed by a machine.

Literature Review: The concepts of idea of machine translation can be found in the early 17th century. In 1629, René Descartes proposed the idea of universal language, with equal ideas in different tongues sharing one symbol. In the 1950s, The Georgetown experiment (1954) developed fully-automatic translations of more than sixty Russian sentences into English through computer. The empirical evidences generated by Georgetown experiment of machine translation was a surprising achievement so that this field of MT is established by later scholars and translators who hold a positive attitude toward machine-translation research. After a long-term involvement, translation through computer assistance becomes a mature field so far, and it is a current issue that is still debated by many scholars in the field of translation (e.g. Achikgoz, 2005; Bahar, 2001; Chelik, 2003; Furstenberg, 2001; Rodrigo, 2001; Topchu, 2004).

Melby (1996) firmly notes that for some texts, predominantly highly technical texts treating a very specific topic in a rather dry and monotonous style, computers sometimes do quite well. He implies that future computers might be able to make judgments, decisions and choices consistent with non-linguistic knowledge that people frequently refer to in their daily lives. That is to say, when the contents in original texts are not complex and are highly repetitive texts that can be frequently found in the texts of human being's language of daily lives, the computer sometimes can make accurate judgments and help us to approach the needed meaning of original texts in a foreign language. Achikgoz and Sert (2006) at Hacettepe University in Ankara of Turkey support above ideas and mention in their conference paper titled Interlingual machine translation: prospects and setbacks, indicating that any field in which human beings are actively involved requires the knowledge of another field, MT, having a history almost as old as the modern digital computer, emerged as an attempt to overcome the intricacy of "being informed" in a group of offers to sustain communication.

Achikgoz and Sert's (2006) study obviously leads us to consider if one of the reasons why the world is globalized should be the development and result of development of MT. Due to global residents' assessable knowledge from the web-pages of all the nations' websites, universal residents are becoming intelligent in a way that they can integrate other races' thoughts and philosophies into their own cultural and traditional ideologies.

In fact, there are more and more learning approaches that can be found from Open Courseware in highly industrialized nations, such as Open Course-wares in Massachusetts Institute of Technology, Johns Hopkins Bloomberg School of Public Health, Utah State University, and Tufts School of Dental Medicine in the United States of America, and Paris Tech in France. Most of the online courses translated for the foreigners were mostly ever provided in the formal system of education at a certain university. They later became on-line courses after either naturally or through machine being translated into different languages for learners of academic subjects around the world to learn at home without going abroad.

One of the methods how these sufficient online courses are created, translated, and adopted voluntarily by many translators and teachers should resort to contributions of computer assistance. It is suggested that some translations of the course contents including course descriptions, assignments, handouts and examinations, were actually firstly translated through computing assistance. Then, they are upgraded, edited, revised and given more details by human translators and experts of the professional and academic fields.

For example, the authors of this conceptual and empirical study tried to adopt and translate an online course in Open courseware of MIT, 24.03 Relativism, Reason, and Reality, Spring 2005, through bilingual translating with both of machine and natural translations. From Appendix A of

this paper produced by translation tools of Google toolbar, it is clear that the texts assisted through computer are readable and understandable. The translator of this study applied the MT tool of computer and translated the text with one minute, and then it was read by human eyes, edited, and given details for vague words in the translations using another ten minutes. For one page of original text, it took only eleven minutes.

Therefore, the translation version of MIT's course is strongly supported by a scholar Lucifer Chu and also by teachers in schools. According to Lee, Lin and Bonk (2007) "An all-volunteer organization called the Open courseware Prototype System (OOPS), headquartered in Taiwan, was initially designed to translate open source materials from MIT Open Course Ware (OCW) site into Chinese." This is absolutely a piece of good news for learners in different academic fields because this international website for learners in different areas provided course syllabi, handouts and examination contents for students in online studies for free. Although it does not provide diplomas and certificates for graduates who have taken the online courses, it makes people around the world who have time and budget acquire approaches to be experts in varied academic fields. **Authors'**

Example of Machine Translation Bilingual or Interlingual machine translation is an example of rule-based machine-translation approaches designed in the software that can be easily applied by translators. Through this updated method of translation, English texts can be translated and transformed into at least vague Chinese. Translators usually can edit the ambiguous meanings into comprehensible ones using techniques of repetitions and giving details.

According to the researchers' experiences of translating a course in MIT, the target language, English can be translated and understood easily through the translation functions in Google toolbar and yahoo tool bar. Based on the experiences of the researchers, the translated words by the tool of MT, eighty percent of the translations can be accurately generated by the computer. The translators as well as the researchers of this study, as well as English teachers at university, only has to spend a little time and energy to read and find the vague parts that needs more repeated details and interpretations. The above ideas may imply that each English major of universities of Taiwan can adopt and translate a course easily when they have time after learning at school.

That is to say, it is really trouble-free to gain the honor as a volunteer of the MIT's course adaptor as well as the academic translator. Why the researchers of this study emphasize this issue of adopting MIT's online course to translate is that the translators can learn a lot of knowledge when translating the course. Moreover, a large number of courses were translated into simplified Chinese. If people in Taiwan insist to read and learn in traditional Chinese, much work of translations into traditional Chinese needs to be done. **Humanized Translations** Dictionary-based translating is a translation method that makes the translated article even more humanized since the meaning of each word can be more accurately located. Besides Google toolbar and Yahoo toolbar that are provided by the internet, dictionary entries, such as Dr. Eye can make the words translated by a dictionary system sound more humanized and normal. Since the high-priced translation softwares are designed by linguistics and translation experts, people might find the translated texts are even more truthful and legible than translated web-pages by toolbars of Google or Yahoo. In order to make the text translated by machine more intelligible, the translation process through re-encoding by human being's eyes needs to be executed.

Re-encoding meanings through understanding the target language and examining the machine translated text are two of the most significant steps in making the translations more humanized. The behaviors of doing translation play an important role in the cognitive operation. For decoding

the original ideas in the source text into its completely logical entirety, the translator must explain and analyze all the possible ideas involved in the context. This is actually a step of doing translations which requires sufficient linguistic knowledge of the grammar, semantics, syntax, idioms, in the target/ source language. At the same time, a professional translator should be familiar with the traditions, cultures and linguistics knowledge of the receivers in order to make the translation acceptable.

Most importantly, for making the translated contents more cogent and rational, after re-decoding and making the translations coherent by our eyes, more details and interpretations based on an experts' professional knowledge or the translator's research should be added in order to reproduce the intricate ideas that the receivers might not be able to straightforwardly comprehend. That is, in order to make the complicated source-contexts explicable, more abundant words should be provided with the translation in Chinese than the original source contents. For example, if there is a page of one-thousand-word article in English, a translation of one thousand and five hundred words to three thousand words of Chinese translations should be provided to the receivers in order to make them easily comprehend the original English content.

Conclusion: Based on one of the authors' experience of translating her own dissertation, she found that a translator needs to fully apply the machine translating functions in order to convey the ideas that a scholar has learned in a target language. The knowledge gain in another nation can be transit to another place if the scholars are willing to apply the MT functions and bring learned updated knowledge to their own lands. If a translator insists to use the traditional way of translation through reading and handwriting without using computer, s/he might not be able to catch the speedy tempo of globalization.

Based on Achikgoz and Sert's (2006) assumption that MT is one of the significant reasons why this world is globalized, the researchers of this study suggest MT must be applied. Applying MT in a humanized way makes people outside of the professional field understand a topic in an in-depth level without delay. In sum, achieving deep understandings for the contents of a professional context through applications of MT as a translator, an expert of the professional field or an English major can do might no more be a utopian concept for anyone in the current globalized world. This means through applying computer assistance, professional knowledge is no more non-assessable. Therefore, for improving ourselves as an updated global citizen, learning online using the MT functions and translating professional texts through computer soft-wares might be better techniques that we should apply, which would assist us to cast away the limitations in time-consuming and expensive translation.

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ASSESSING ORAL MICROFLORA DURING PERIODONTITIS AGAINST THE BACKGROUND OF INVOLVEMENT OF COMPLEX TREATMENT WITH SAPERAVI GRAPE OIL

¹Maia Gogua, ²Manana Chkhikvishvili, ³Ketevan Gujabidze, ³Maia Jervalidze

¹Assistant professor, David Aghmashenebeli University of Georgia, MD, PhD, Georgia,

²European University, MD, LTD Hebe

³Invited Lecturer, European University, LTD Hebe, Georgia,

⁴Associate professor, University Geomedi, MD, PhD, Georgia,

Email: maiko.gogua@gmail.com; manana.chkhikvishvili@eu.edu.ge; makojervalidze@gmail.com

ABSTRACT

Periodontitis is a very common disease. Due to this pathology, a person loses teeth 5 times more often than due to caries complications.

Grape seed extract (GSE) was supplied as a promising immunomodulator, especially due to its proanthocyanidin effect.

The aim of our research is to study the microbial characteristics of oral fluid during periodontitis against the background of involvement of traditional treatment.

Methods: 88 patients with periodontitis aged 25-59 years from the contingent of the Sadasu Dental Clinic were under study, and the study cohort was divided into two groups. 41 of them were receiving traditional treatment, 47 - traditional+application with seed extract. The oil was taken into the oral cavity with dental instruments and was immobilized with an insulating swab. Microbiological characteristics were studied in oral fluid by routine method.

Statistical analysis

For qualitative indicators, comparisons between groups were performed using the accurate Fisher test, and before and after treatment using the Wilcoxon test. The risk of microbial contamination was determined.

Results: During the standard treatment there was remarked a tendency to reduce the frequency of all microbes, from which the incidence of those who have had fungus and streptococcus is being significantly reduced.

When adding grape seed oil applications to the standard treatment, the incidence of persons in whom fungus appeared decreased by 15%, $p=0.0082$, staphylococcus - by 21% $p=0.0016$, streptococcus - by 15%, $p=0.0082$; e-coli - 19%, $p=0.0027$, reduction in all cases was reliable.

During the mild and moderate severity periodontitis, when including grape seed oil in traditional treatment, after treatment the frequency of patient who had staphylococcus and streptococcus is significantly lower in the oral cavity fluid compared to traditional treatments alone - $\chi^2=4.25$, $p=0.040$; $RR=0.60$ (95%CI:0.34-1.0) and $\chi^2=17.90$, $p<0.001$; $RR=0.25$ (95%CI:0.10-0.62) respectively. In the case of fungus and e-coli, there is remarked a tendency to improve outcomes compared to traditional treatments.

Conclusion: The inclusion of grape seed oil in the traditional treatment of periodontitis improves the microbial characteristics of the oral cavity and reduces microbial contamination.

Keywords: Grape seed extract, periodontitis, microbial contamination

Inflammatory disease of the periodontium is defined as a pathological process that damages the periodontal tissue and manifests itself in the form of gingivitis and periodontitis.

The disease is characterized by a high frequency - the prevalence of periodontal disease in the adult population is 98%, in 15-19 years old population this figure reaches 55-99%.

Periodontitis is a very common disease. Due to this pathology, a person loses teeth 5 times more often than due to caries complications.

To date, several hundred species of microorganisms have been described as part of the normal microflora of the oral cavity. They include bacteria, viruses, fungi and protozoa. Among the microbes in the oral cavity, there are autochthonous and allochthonous species - immigrants from other biotopes of the host (nose-throat, intestines, etc.) and microflora from the environment. In the autochthonous microflora there are obligates that permanently reside in the oral cavity, and temporarily-transitory, in the composition of which are often found pathogenic or conditionally pathogenic bacteria.

In the conservative treatment of periodontitis, both local and general antimicrobial drugs are used (prescribing chlorhexidine, doxycycline-containing gels, minocycline microspheres, appointment of Peros doxycycline, amoxicillin, metronidazole).

However, with the use of anti-inflammatory and antibacterial drugs, a decrease in the immunobiological reactivity of the body, the emergence of allergic reactions and other undesired side effects may be observed.

A study of the antimicrobial efficacy of various medicinal plants found a positive correlation with the therapy with herbal extracts and the rate of elimination of all types of bio-membrane in the oral cavity.

Grape seed extract (GSE) was supplied as a promising immunomodulator, especially due to its proanthocyanidin effect. It represents a natural polyphenolic compound which has a wide range of biological activities, such as antioxidant, anticancer and anti-inflammatory.

GSE generates its anti-inflammatory effect by calibrating the balance between proinflammatory and anti-inflammatory cytokines. It protects collagen from decomposition and has a bacteriostatic effect on anaerobes, thereby weakening the maturation of bio-membrane, hence it can be used to prevent periodontal disease.

The aim of our research is to study the microbial characteristics of oral fluid during periodontitis against the background of involvement of traditional treatment.

Methods: Treatment of chronic generalized periodontitis was based on the principle of individual approach to each patient, a detailed analysis of the form and severity of periodontal tissue damage was performed for each patient. Taking into account the peculiarities of the clinical course, concomitant pathology, the general condition of the organism and the dental status.

Patients with periodontitis were divided into two groups according to the degree of periodontitis - two groups of patients with mild and moderate severity periodontitis were distinguished.

Eighty-eight patients with periodontitis aged 25-59 years from the contingent of the Sadasu Dental Clinic were under study, and the study cohort was divided into two groups. 41 of them were receiving traditional treatment, 47 - traditional + application with seed extract. The oil was taken into the oral cavity with dental instruments and was immobilized with an insulating swab. Microbiological characteristics were studied in oral fluid by routine method.

Statistical analysis: For qualitative indicators, comparisons between groups were performed using the accurate Fisher test, and before and after treatment using the Wilcoxon test. The risk of

microbial contamination was determined. Mathematical support was implemented using IBM SPSS 22.0 software package.

Results: As can be seen in the table, the same type of microbes were observed in all three groups before treatment, however their frequencies in individuals with periodontitis did not differ reliably by groups. Streptococcus predominates among oral fluid microbes. Staphylococcus is also distinguished by high frequency.

The microbiological status of the oral cavity before and after treatment against the background of standard treatment of periodontitis is given in Table 1

Table 1. Microbiological status of the oral cavity before and after treatment against the background of standard treatment of periodontitis.

					P
	n=41	Mean	n=41	Mean	
Fungi	13	31.71	6	14.63	0.0196
Staphylococcus	20	48.78	16	39.02	0.1573
Streptococcus	31	75.61	20	48.78	0.0009
e-coli	10	24.39	8	19.51	0.1573

During the standard treatment there was remarked a tendency to reduce the frequency of all microbes, from which the incidence of those who have had fungus and streptococcus is being significantly reduced.

Table 3.6.4 presents an assessment of the microflora in the oral fluid during periodontitis before treatment and after treatment with the inclusion of seed extract in standard treatment.

Microbial reduction occurred after treatment with both standard and grape seed preparations.

During the standard treatment, the number of people in whom fungus appeared decreased by 17%, those with the staphylococcus - by 10%, streptococcus - by 27%; e-coli - by 4%. Thus, in the case of standard treatment for fungus and streptococcus, the reduction was found to be credible.

Table 2. Microbiological status of the oral cavity before and after treatment against the background of standard + grape seed treatment of periodontitis.

	Before treatment		After treatment		P
	n=47	%	n=47	%	
Fungi	14	29.79	4	8.51	0.0016
Staphylococcus	19	40.43	9	21.28	0.0027
Streptococcus	29	61.70	4	8.51	0.0001
e-coli	19	40.43	5	10.64	0.0002

When adding grape seed oil applications to the standard treatment, the incidence of persons in whom fungus appeared decreased by 15%, $p = 0.0082$, staphylococcus - by 21% $p = 0.0016$, streptococcus - by 15%, $P = 0.0082$; e-coli - 19%, $p = 0.0027$, reduction in all cases was reliable.

Thus, the inclusion of grape extract in the standard scheme of the treatment of periodontitis is marked by a significant reduction in the incidence of all microbes. Comparison of results in the first and second groups and relative risk assessment are given in Table 3.

Table 3. Statistical analysis and risk assessment of microbial contamination in traditional treatment and treatment with the inclusion of grape oil in the standard scheme

	χ^2	p	RR	95% CI(RR)	
Fungi	0.82	0.367	0.73	0.33	1.59
Staphylococcus	4.25	0.040	0.60	0.34	1.0
Streptococcus	17.90	<0.001	0.25	0.10	0.62
e-coli	1.37	0.242	0.69	0.34	1.41

During the mild and moderate severity periodontitis, when including grape seed oil in traditional treatment, after treatment the frequency of patient who had staphylococcus and streptococcus is significantly lower in the oral cavity fluid compared to traditional treatments alone. In the case of fungus and e-coli, there is remarked a tendency to improve outcomes compared to traditional treatments.

The inclusion of grape seed extract in traditional treatments for mild to moderate severity periodontitis significantly reduces the relative risk of staphylococcal and streptococcal contamination.

Discussion: The primary cause of periodontal inflammatory diseases is the microbial plaque of the tooth, as associations of microorganisms existing in the latter lead to the development of inflammatory changes [11].

The development of inflammatory changes is caused by the interaction between microbial bio-membrane and inflammatory mediators, followed by disruption of tooth-supporting structures such as periodontal ligaments and alveolar bone [12].

As local and general factors are involved in the genesis of periodontitis, the treatment of metabolism and dysfunction should be complex in nature and should consist of general and local remedies. Must include anti-inflammatory, anti-allergic, immunostimulatory agents. The following is considered a modern trend in periodontology: Priority of conservative methods over surgical treatment and saving attitude towards periodontal tissues [13];

In recent times, herbal remedies have been widely used to treat periodontal disease, and the growing interest in them is explained by the side effects of antibiotics and hormonal drugs. In addition, microbial resistance reduces the effectiveness of antibiotics. In contrast, medicinal plants have a broad spectrum of action, are non-toxic and well tolerated by the patient regardless of age. In this regard the grape seed extract is of a great interest; Its containing proanthocyanidins, resveratrols and other bioflavonoids which have anti-inflammatory [14], antibacterial [15,16] and antioxidant properties [17]. Our research showed that after the inclusion of grape seed preparations in standard treatment, the incidence of fungi, staphylococci, streptococci, enterococci, and intestinal sticks was significantly reduced.

Conclusion: The inclusion of grape seed oil in the traditional treatment of periodontitis improves the microbial characteristics of the oral cavity and reduces microbial contamination.

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THE IMPACT OF THE SOUTH CAUCASUS CONFLICTS ON THE REGIONAL ECONOMY

¹Gvantsa Chkheidze, ²Irakli Mekvevrishvili

¹PhD student of Doctoral Educational Programme in Political Science, Coordinator of the Faculty of Social Sciences Caucasus International University, Email: gvantsa.chkheidze@ciu.edu.ge

²PhD student of Doctoral Educational Programme in Political Science, Director – LEPL Alexander Tsintsadze Tbilisi Public School N150, Caucasus International University, Email: irakli.mekvevrishvili@ciu.edu.ge

ABSTRACT

We can say that the current geopolitical situation in the world shows that security is of invaluable importance. It should be noted that in the modern world, states have to deal with a number of threats and challenges which require a great deal of effort from them. The threats posed by the global player in world politics further complicate the national security of states. With this in mind, we should mention the conflicts in the South Caucasus, in particular - in the direction of Abkhazia, Tskhinvali and Karabakh. All this has a huge impact on the region's economy and its rate of stability. Therefore, the article will focus on the interests of global and regional actors.

The South Caucasus conflicts are still a problematic issue. Recent events have otherwise shown the impact of Russia's soft power on the Karabakh conflict. The article presents an analysis of the conflicts in the South Caucasus, also its impact on the regional economy.

Keywords: South Caucasus region, conflicts, economy, interests of the players

Reasons for causing conflicts in the South Caucasus: Most Russian politicians and political scientists considered the disappearance of the superpower from the map - the Soviet Socialist Union - quite a catastrophe. The collapse of the international system of socialism and the establishment of new sovereign states in the post-Soviet space made a correction on the world map. Geostrategic changes have taken place around the world. A new stage has begun in international relations. It must be said that new centers of power have emerged, and the struggle between them over the redistribution of influence has exacerbated the already difficult situation.

It must be said that the most acute and urgent problem in the world is solution of regional conflicts, especially in such a difficult environment as the South Caucasus.

The issue of peaceful settlement of the conflicts in the South Caucasus is always relevant in the reports of all important international organizations. The urgency of this issue is certainly due to the growing rate of ongoing ethno-political conflicts in the world.

“It should be noted that the origin of the Caucasian conflicts is conditioned by the peculiarities of the new historical period of international relations. This is the era of the formation of a multipolar world. Also, this is a period of establishing completely new relations between the West and the East, the US and Russia.”

As the Cold War ended, the South Caucasus became one of the main venues for global and regional superpowers. This is due to the fact that the region has a favorable location and a solid supply of energy resources. It must be said that from a geographical point of view, the South Caucasus is located on the very historic trade route that connects Europe and Asia. It is a space where Caucasian, Turkish, Persian and Slavic cultures, Christian and Muslim civilizations are united.

Indeed, the conflicts in the South Caucasus have slowly turned into the most difficult space for confrontational geopolitical rivalry, where the interests of states of scale were opposed to each other. These countries are global (US) and regional (Russia, Iran, Turkey). Conflict resolution is really important for the world, but it is all incredible. Now we discuss the interest of each player in this region.

The interests of global and regional players in the South Caucasus: Interests of Russia - The regional factor plays a big role in shaping Russia's policy towards Georgia. We know that the North Caucasus is a serious hotbed of instability. Therefore, Moscow sees the growing influence in the South Caucasus as a guarantee of stability in the North Caucasus. By establishing control over Georgia, Russia can easily control the East-West energy corridor, as well as gain a monopoly on the transit of Caspian energy resources.

Achieving a monopoly on energy resources is a guarantee of economic stability for Russia. Oil and gas are the main sources of income for the country. Therefore, the operation of the Baku-Tbilisi-Ceyhan oil pipeline and the Baku-Tbilisi-Erzurum gas pipeline is undesirable for Russia. In our opinion, Russia needs Georgia as a transit country with Armenia.

Professor Gegeshidze, who published the article "Global Processes and Georgia" in the "Guide to Democratization of Georgia", shares his views on the Russian factor: "The issue of Georgia has a special place in Russia's foreign policy. It is based on personal and geopolitical reasons. We must mention five points:

1. Euro-Atlantic aspirations of Georgia;
2. Development model of Georgia (non-Russian, non-Soviet), which sets a dangerous precedent for Russia to achieve its goal in the post-Soviet space.
3. Georgia's clear strategic partnership with the United States, in the post-Soviet space;
4. Georgia's neighborhood with the North Caucasus;
5. Competitive transit energy corridor through Georgia to Russia"

It should be noted that gaining influence over Georgia is the best way for Russia. This will strengthen Russia's position in the South Caucasus.

The interests of the United States: American political scientist Zbigniew Brzezinski noted that American policy should be extended throughout Eurasia. The countries of the Black and Caspian Seas were considered to be the most important strategic parts, which made the region especially important. In the book, the political scientist calls this region "Eurasian Balkans". This in turn leads to an association of ethnic conflicts and rivalries between powerful states in the region. "The word "Balkans" in Europe evokes an association of ethnic conflicts and rivalries between great powers. Eurasia also has its "Balkans", although the "Eurasian Balkans" is much larger. It is also more densely populated and more ethnically diverse". It can be said that the main areas of American interest in the South Caucasus are:

1. Access to Caspian energy resources, also providing free transit;
2. Resolving "frozen" conflicts and ensuring security in the region;
3. Forming an anti-terrorist coalition against Islamic fundamentalism. Also, increasing pressure on Iran.

We consider that the geopolitical factor in the South Caucasus is much more important to the United States than the economic one. The Black Sea is located in the Caspian region on the Eurasian continent, surrounded by three American rivals - Russia, China and Iran. Therefore, by

gaining control of the region, Washington manages to dominate between the five seas (Black Sea, Caspian Sea, Mediterranean Sea, Persian Gulf and adjacent Arabian Sea) and accordingly on the whole continent.

The Interests of Iran: Iran's Caucasus policy is characterized with two main features:

Control of Azerbaijan as a potential threat: The issue is conditioned with the factor of so called "South Azerbaijan". More than 20 million ethnic Azerbaijanis reside in the northern part of Iran, 2 times more than in the Republic of Azerbaijan itself. Of course, Iran sees a threat to national security in this particular case.

Strengthening its positions in the energy-rich Caspian Sea region: thus preventing Turkish influence on transit pipelines;

The interests of Turkey: Turkey's interests in the Caucasus are large in scope, therefore, it seeks to have closer ties with the countries of the region. The proximity of Turkey with Azerbaijan is worth mentioning. The latter is due to the linguistic-cultural adjacency of both countries and the special geopolitical location of Azerbaijan. Baku-Tbilisi-Ceyhan and Baku-Tbilisi-Erzurum pipelines, as well as the Baku-Tbilisi-Kars railway, have attached special importance to the South Caucasus, all of which are important for Turkey. "From the very beginning Turkey's desire was to fulfill the function of an energy and transport corridor between Europe and the Caspian region"

Overview of the South Caucasus conflicts: The Nagorno-Karabakh conflict is topical to everyone nowadays and has a significant impact on the region. The history of Karabakh ownership is a complex issue because the territory of Karabakh has historically passed from hand to hand. Traces of Albanian and Azerbaijani, Armenian or Persian are found. Each mosque, church, inscription or cemetery reinforces the arguments for different parties. It is indisputable that during the Soviet Union, the Karabakh region belonged to the Soviet Socialist Republic of Azerbaijan. It should be noted that since 1994, the independence of Karabakh has not been recognized by any state, including Armenia. Azerbaijan repeatedly urges foreign partners to respond to conflict. The positions of Armenia are also interesting. Naturally Armenia wanted to resolve the conflict in compliance with its own interests and therefore tried to act in the international field.

Before the active phase of the conflict began with the Karabakh war in 2020, several facts are noteworthy.

In July, there was a military clash between Armenia and Azerbaijan, which resulted in significant casualties. According to experts, this military confrontation took place quite far from the territory of Nagorno-Karabakh, which was a bit strange. The population of Azerbaijan became more active in order the government to take decisive measures from July. At the same time, Turkish propaganda was intensified and military support was expressed on the Azerbaijani side. Then the joint Turkish-Azerbaijani military exercises began.

On September 27, 2020, the active phase of the military conflict began and lasted for about a month and a half. Armenia had expectations that Russia would be involved in this war, but its expectations were not met. A large number of unmanned aerial vehicles were used in the war, which presented a completely different model of war production. Armenia, despite great efforts, could not cope with the opponent. On November 9, 2020, the Azerbaijanis captured the city of

Shusha, which, due to its geo-strategic location, ended the hot phase of the conflict with a ceasefire agreement. This agreement entered into force on November 10, 2020. Russia's involvement in the ceasefire agreement was really great, but in our opinion, the interference was initiated because of its interests to act again as a savior for Armenia and as a peacemaker for the Caucasus.

Turkey's strengthening in the region irritates Russia for failing to launch a conflict with Turkey, the latter is a member of NATO, and strengthening weakened positions in the Caucasus will inevitably fit its future prospects.

Russian military bases were not only located on the territory of Azerbaijan, from the countries of the South Caucasus. It now also has armed forces in Azerbaijan with peacekeeping status. It should be noted that during the Karabakh war, Georgia found itself in a rather difficult situation. Our country could be involved in this war at any time. It is a welcome fact that Georgia has calmly and decently coped with its impartial position in the region and its partnership with both neighbors.

The cessation of the Nagorno-Karabakh conflict at this stage, ended in a crash only for Armenia. However, it must also be noted that without the involvement of large actors, the war could have ended much more dramatically for Armenia.

Conflict in Abkhazia: The conflict in Abkhazia turned out to be the most acute manifestation of the North Caucasians' confrontation with the Georgian state. It started on August 14, 1992 with the entry of the armed formations of the State Council of Georgia on the territory of Abkhazia. At the same time, at a congress in Grozny, the confederation announced a mobilization aimed at gathering large numbers of volunteers to help Abkhazia and fight against Georgia. Representatives of almost all ethnic groups of North Caucasian origin fought against Georgia in the war; both volunteers and mercenaries, regular Russian military units, including special forces.

In September 1993, the capital of Abkhazia, Sukhumi, fell. Georgian government troops suffered heavy defeats, which resulted in heavy casualties, and 250,000 people became refugees.

The fact that Russia has a big role in the tragedy in Abkhazia is proved by concrete facts. Professor Tamaz Nadareishvili shares an interesting view on this issue:

“The great Russian Empire, which with centuries of experience in conquering various countries and peoples can perfectly cut off the population of the targeted country and successfully carry out its plans there, easily managed our split and confrontation and as a result of many years of special services, the icon of the Georgian as an enemy for Abkhazia has been masterfully sculpted.”

The Russian Federation still carries out its propaganda for the people living on the territory of Abkhazia. The country easily manages to create an enemy icon and fake stories.

Conflict in Tskhinvali Region: The Georgian-Ossetian conflict is of a typical ethno-political nature.

The ongoing processes in Georgian society can be considered as a cause of the controversy.

On January 27, 1989, the newspaper "Literary Georgia" published an article by Professor Tamaz Shavgulidze on the definition of the legislative status of the language, which discussed that the proceedings in the territory of the South Ossetian Autonomous District, according to the current legislation, should be conducted in the state language - Georgian.

This was followed by retaliation from South Ossetia, which later escalated into the so-called "War of Laws". Since then the situation has been constantly complicated. The controversy escalated in 2004-2008.

In August 2004, Georgian-Ossetian conflict in the Tskhinvali region escalated into a military confrontation. The reason for the escalation of the conflicts was the closure of the Ergneti market by the current government.

The Georgian side explained this fact by the necessity of fighting smuggling: "The Roki tunnel, through which the South Ossetians have a direct connection with the northern republic - Alanya, played a big role in the escalation of the conflict. Thanks to this tunnel, the separatists regularly received military and other assistance from Russia, both during the 1991-1992 armed conflict and the well-known events of August 2004."

On August 13-14, 2004 an emergency meeting of the Joint Emergency Commission was held in Tskhinvali, where a protocol on the ceasefire was signed. Nevertheless, the parties constantly accused each other of violating the existing agreement.

On August 7, 2008, about 150 units of armored vehicles of the 58th Regular Army of the Russian Federation crossed the Georgian-Russian state border through the Roki tunnel and headed for the town of Tskhinvali, marking the start of a large-scale military operation by Russia against Georgia. The conflict covered the whole of Georgia, which eventually took the form of a Georgian-Russian military confrontation.

On August 12, 2008, a six-point ceasefire agreement was signed between Russia and Georgia, mediated by the European Union. The August war showed the world that Russia is an occupier and is trying to gain control of Georgia by force.

In conclusion, we would like to note that the conflicts in the South Caucasus have a significant impact on the regional economy. The important North-South transport highway runs through Tskhinvali region which connects the Russian Republic with Georgia, Armenia, Azerbaijan, Iran and Turkey. The aggravation of the situation in the Tskhinvali region poses a threat to Armenia, both from economic and security point of view.

From our point of view, in order the existing conflicts to be resolved, it is necessary Russia to refuse to recognize the independence of Abkhazia and the so-called "South Ossetia". Afterwards, the Tskhinvali region will be completely demilitarized and traffic communications will function freely. This, on the one hand, will help restore trust between the Georgian-Ossetian side, and on the other hand, will enable the countries of the region to be strategic partners in the economic direction.

Peaceful settlement of the conflict in the Caucasus will facilitate the implementation of economic mega-projects of international importance.

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DEVELOPMENT OF A STRUCTURAL MODEL OF INTELLIGENT MEASUREMENT AND CONTROL SYSTEM

¹L.R. Bakirova L.R., ²S.N. Huseynov

¹Azerbaijan State Oil and Industry University, lala_bekirova@mail.ru

²“Control measuring instruments and automation” LLC, mp-717@mail.ru

ABSTRACT

In this paper, the development of multisensor and remote measurement system with the main function of monitoring the process by measuring the technical parameters characterizing the object of research, improvements in the quality of operational monitoring of the process, increasing the efficiency of the decision-making process, remote control of the research object, reduction in the number and time of transition processes on a modular basis, has been studied on the basis of the architecture of the intelligent system. The main principles of the created model are its ability to take the specification of the research object into account, possess flexible hardware and software, as well as have the appropriate database, processing, visualization and exchange capabilities to make operational decisions.

Keywords: measurement system, intelligent sensor, intelligent system, multifunction sensor, diagnostics, control system, functional model, structural model.

Introduction: Methods for measuring characteristic parameters to determine the state of the research object are classified as direct (contact) and remote measurements (non-contact), and appropriate transmitters or sensors are applied [1]. During the monitoring of the state of the facility, the appropriate output of these sensors amplify, normalize the signals in certain units, and can transmit them at a certain distance with the required accuracy. The transmitted signals can take different forms and parameters. When the facility is a part of a technological process, the required optimal measurement and control are based on the application of microprocessor techniques and technology, and being mainly digital, it has analog and digital input and output units and processing facilities. Analog data transmission is still used over short distances, and some systems use both analog and digital forms of signals because of their hybrid functionality [2].

Figure 1 shows the structural model of the system, which performs the comparison of the received signal with the pre-specified normative limits in the program memory and the control according to the obtained difference.

The research object or process, a measuring junction consisting of a sensor, converter and transmitter, a processor, a comparator, a controller consisting of software and a given memory, a control unit of the actuating mechanism and an actuating mechanism, perform the goal based on a pre-written program.

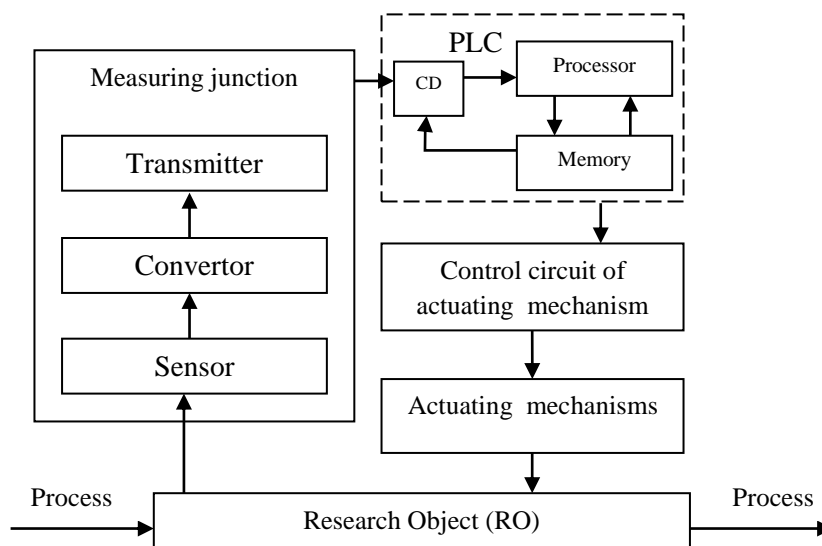


Figure 1. Control system for technological process or research object

The objective of the work is to develop a structural and functional model of the system which is capable to improve the efficiency and quality of control and diagnostics to complex process taking place at the research object on the basis of intelligent sensors being able to control various parameters and transmit information.

The structural model of the proposed system is presented to perform the control based on the parameters characterizing the complex process.

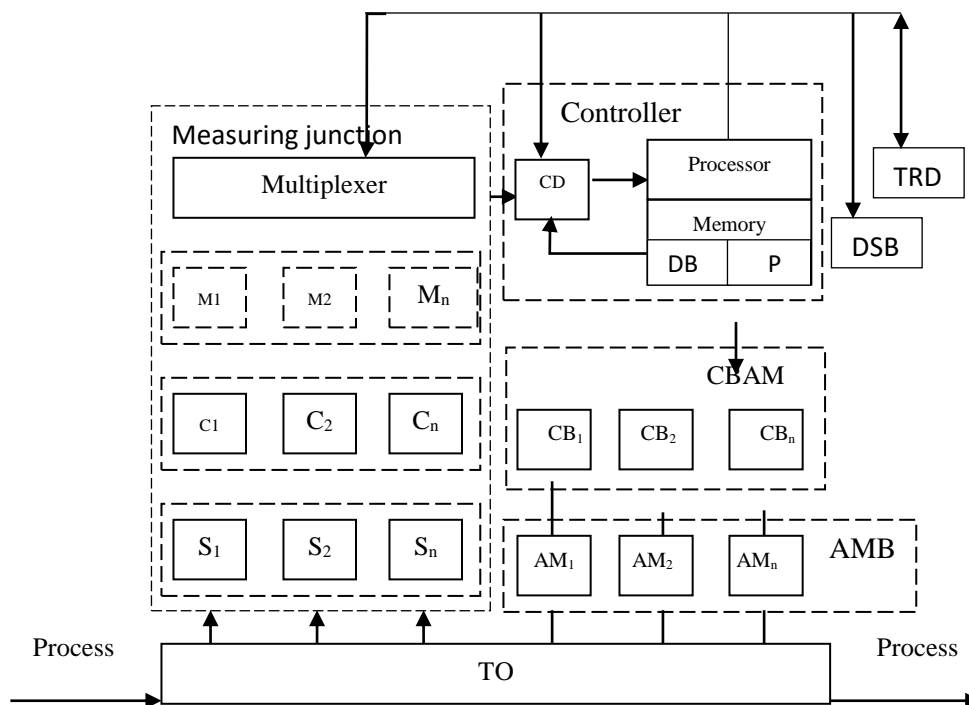


Figure 2. Structural model of the system being capable to control various parameters and transmit/receive information

Here, the measuring junction is arranged in a number of sensor (S) units according to the controlled parameters, converters (C) unit, an interface unit consisting of corresponding channel multiplexer; the controller module program memory performing processing and control and the database (DB) provided for norm limits, the processor and comparison (CD) unit; data storage (DSB) unit for further processing and use of measurement results; the transmitting and receiving unit (TRD); a unit of actuating mechanisms consisting of relevant actuating mechanisms and a unit of its control devices (CBAM). The presented structural model has such functional capabilities as measurement, initial processing, memory, transmitting and receiving, control.

As is seen from the figure, the data is transmitted to both the read-only memory device for further processing, presentation and decisions, as well as to the comparison device, where the database is compared with the corresponding, pre-entered data.

By applying multifunction sensors, it is possible to measure the parameters that characterize complex processes with a minimum number of sensors at the measuring junction. In this case, the control signal allows the microcontroller to select the control signal modes with frequency and sequence according to the parameter and facility characteristics (in Figure 2, this control signal is indicated by punctuation). By applying the same approach to the control unit of actuating mechanisms, a universal control unit is created.

The applied technique allows us to increase the functionality of the system through a simpler structural model at the measurement and control junctions.

In order to improve the quality of the system created during the monitoring of the research object and the technological process, it is required to expand the measurement range, increase the sensitivity limit, ensure simplicity, efficiency and universality, record the controlled parameters with a minimum number of sensors, etc. At the same time, it provides flexibility in hardware and software to control changes in internal and external factors that can directly affect the reliability of the system, the longevity of the equipment, the accuracy of measurement results and, consequently, the functional adaptation of the system to impact factors.

The development of new techniques and technologies, as well as innovations in sensor technology have been achieved, and modern sensors have become integrated circuit-based (IC) sensors in the form of microsystems, intelligent sensors, nanosensors [3]. The advantage of these sensors as an integrated circuit (chip) which integrate such digital elements as microprocessor, microcontroller, converter, logic circuits, etc. is proved by their effective applications. Modern sensors ensure a great number of sensors that provide the control of various technological processes by integrating micromechanical methods, mechanical, optical, magnetic, chemical, biological and other types of measurements, along with semiconductor processing technology (Figure 5). The choice of technology, hardware and software allowing the implementation of modern sensors with the above-mentioned advantages, as well as the development of their other functional capabilities, enable to apply intelligent sensors [4]. In this case, it is especially important to have a standard physical interface between the sensor and the communication device using standardized components to build intelligent sensors. When designing a process measurement and control system, a simpler and more effective approach is applied to the development of other intelligent sensors included in the structural model based on the characteristics of the intelligent sensor, which is a module of the intelligent system.

The structural model of intelligent sensors is presented in Figure 3.

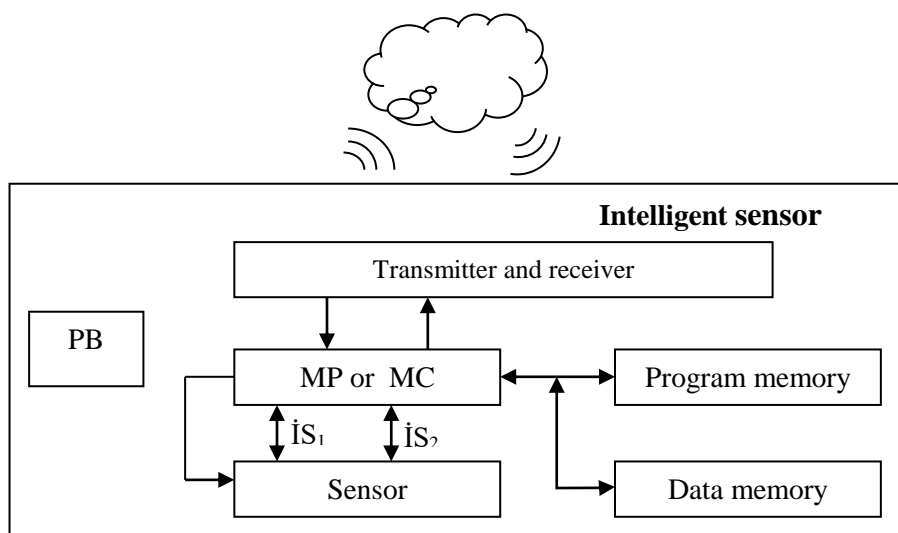


Figure 3. Structural model of an intelligent sensor

As it is seen from the figure, the intelligent sensor structural model includes a microprocessor or microcontroller along with the sensor, software and memory, a power supply unit, a transmitter and receiver for communication with cloud technology. For this reason, the intelligent sensor is able to digitally process the data corresponding to the sensitive signal and convert it into electrical signals and communicate with other devices of the system, external devices and the Cloud. And this manifests itself as a tool that expands the measurement and processing functions of the intelligent system, simplifies the structural model, minimizes design indicators, as well as allows the user to use and process data online. Their analog and digital, consistent and parallel interfaces universalizes the use of their output signals. As is seen from the structural model of the systems presented in Figure 2 and Figure 3, various external circuits and element bases are required to convert, process and visualize and transmit conventional sensor signals that measure various physical, biological or chemical parameters and convert them into electrical signals.

The intelligent sensor has a main sensor, a microprocessor, which is capable of communication and has options, self-diagnostics, evaluation and self-calibration. They provide value-added functions, thus improve the quality of the data instead of transmitting the unprocessed signal. They can perform functions such as self-identification, self-testing, search tables, calibration curves and communication with other devices. These functions are carried out by integrating the sensors with a microcontroller or a microprocessor or with logic circuits on the same chip. Obviously, the microprocessor contains RAM and ROM and can be easily programmed from the outside. Intelligent sensors also cover amplification, collection, processing of the signal and A/R conversions.

Various intelligent sensors are developed by neural network techniques programmed and stored on a chip and other intelligent techniques. These sensors are capable of absorbing large amounts of data; therefore, they can act autonomously and appropriately to achieve goals in any dynamically changing environment. They adapt to anticipating events and the complexity of the process;

therefore, measurement, studying and self-configuration are key elements. Intelligent sensors are presented as pressure sensors and accelerometers, biosensors, chemical sensors, optical sensors, magnetic sensors, etc. Intelligent vision systems and parallel processor-based sensors are typical samples of this type of device.

The connection diagram of intelligent sensors used in the measurement of parameters such as pressure, temperature, level, etc. for performing automatic measurement and control in production areas is developed at the level that allows to receive, process and make decisions on the state of the research object characterized by these parameters.

The Intelligent Sensor plays a very important role in Smart Factory of Industry 4.0, which is considered to be the fourth revolution of the manufacturing industry. Thus, the first revolution was remembered as the invention of steam and water engines, the second revolution was remembered as the production and use of electricity, the third revolution as the construction of automated production processes using computers and robots, and finally the current fourth revolution as the Internet of Things (IoT) and Intelligent Factory (Smart Factory of Industry 4.0).

A standard way to determine the operation and calibration of a standard device was developed to enable the use of standardized components to construct a standard physical interface and intelligent sensors between the sensor and the communication device.

Conclusion: Development of multi-sensor and remote measurement and control system based on intelligent system architecture allows us to improve the quality of operational monitoring process of the research object, increase the efficiency of the decision-making process, remote control of the research object, reduce the number and time of transition processes with the module principle at the basis of the element.

Thus, when constructing intelligent systems, it is important to base the structural model on the following classification:

- possibility to take the specifications of the research object into account;
- possibility to have a database that reflects the dynamics of changes in the state and characteristics of the facility;
- possibility to take into account the effects of internal and external factors that cause these changes;
- possibility to change according to the areas of application;
- possibility to have flexible hardware to solve the stated problem;
- possibility to have flexible software to solve the stated problem;
- possibility of self-control and correction of working capacity by checking the system's hardware and software (diagnostics and testing);
- possibility of information exchange between relevant areas and control center;
- storage, processing and visualization of new data;
- possibility to make quick decisions.

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AN INNOVATIVE MODEL FOR MEASURING INTELLECTUAL CAPITAL

Aygun Abdulova¹

Azerbaijan State Economic University, Ph.C., Lecturer.

Email: Aygun_Abdulova@unec.edu.az, Sabah.aygun2015@gmail.com

ABSTRACT

Measuring mental capital got to be a fundamental inquire about zone within the 1990s. The significance of mental capital comes from the fact that traditional bookkeeping frameworks don't reflect reality for directors or speculators in such a way that they get it how their assets – numerous of which are intangible – make esteem within the future.

Additionally, assessment instruments given by them are becoming less pertinent and less reasonable for measuring the esteem of mental capital for companies. The reason of this paper is to plan a estimation show which would give a great device for endeavors to oversee their mental capital and to create competitive preferences

Keywords: Model, measuring, intellectual capital, human capital, customer capital;

Introduction: Over the past a few a long time there have been seriously talks around the significance of mental capital within our society. The mental capital is advanced as an critical and essential figure for organizational survival and upkeep of competitive quality (Draghici, 2013). To stay at the bleeding edge, organizations require a good capacity to hold, create, organize, and utilize their employees' capabilities. Mental capital shows up to be regarded as progressively imperative highlights for organizational survival. In this setting it should be made a model that may enlist, analyze and assess intangible resources since the bookkeeping - monetary point of view is not sufficient.

Besides, this show of measuring mental capital must permit profound examination of organization exhibitions (beneath the mental capital viewpoint) in arrange to recognize potential openings for expanding competitiveness.

In arrange to legitimately degree and oversee mental capital there are a number of standards that ought to be observed (Stewart, 1997):

- To create and develop mental capital organization ought to advance cooperation, create arrange and communities of practice
- Organizational riches is made around the abilities and gifts of representatives. To manage these assets the organization should discover ability, to enact them, contribute in them and to propose measures for their preservation
- Basic capital ought to be utilized to create those intangible resources with which the organization can create competitive advantage
- Organizations must alter the concept of information collection fair for the purpose of gathering information. Concept within the organization must be situated to gather the information, the data they require / the basic information
- Utilizing information ought to be made custom. Mass generation will not create tall returns
- Each organization ought to reevaluate chain, string, flow of data that can be found within the field of work, and decide to abuse the pivotal data, vital in its claim reason

In arrange to streamline the method of measuring and overseeing mental capital and to fulfill the principles listed over we built a show for assessing mental capital vital to regard concepts of mental capital sharing components between the organization and other partners.

A survey of the accessible IC estimation models: Currently there are an assortment of proposition for models, highlighting the significance of mental capital and to quantify the esteem of numerous of these information being exploratory and hence a few inalienable inadequacies.

In other words there is no for the most part acknowledged hypothetical show for measuring mental capital of an organization. Inquire about to assess mental capital of organizations have brought about within the development of a expansive number of models and proposed strategies.

A few models center fundamentally on money related measurements and offer a limited idea of knowledge assets. Others take a more all encompassing see but require subjective judgment in deciding a composite list that will be utilized for objective comparisons. The most prevalent estimation models as well as the foremost broadly utilized or fair the effectiveness of their applications of all nonfinancial estimation strategies are: Balanced Scorecard, Skandia Navigator and Intangible Assets Monitor.

Balanced Scorecard (BSC): After a multi-year, multi-company think about supported by Harvard Business School, Kaplan and Norton suggested that supervisors require a multi-dimensional estimation framework to direct their approach making and proposed utilizing what they called a “balanced scorecard” approach to execution estimation.

It was the primary time that the company was energized to degree money related and non-financial variables, counting the client point of view bunches, the inner trade handle and the learning and development viewpoint, and to interface all these measures in a coherent framework (Bontis, 1998).

Over the past decade, the adjusted scorecard has advanced from being a estimation system to being a strategy implementation device. It speaks to a set of cause-and-effect connections among output measures and performance drivers within the four points of view (Kaplan & Norton, 1996):

- Financial measures: how do we look to shareholders, for example, cash flow and profitability
- Customer measures: how do our customers see us, for example, price as compared with competitors and product ratings
- Internal process measures: what must we excel at, for example, length of cycle times and level of waste
- Learning and growth measures: can we improve and create value, for example, percentage of sales derived from new products

Nowadays, Kaplan and Norton stretch the significance of visualizing causal connections of measures and objectives.

These are basically communication apparatuses that visualize an organization’s procedure and the forms and systems needed to actualize it. Although Kaplan and Norton demanded that companies ought to select their possess measures, numerous have criticized the BSC demonstrate for being as well constrained.

The BSC, in any case, considers representatives as insignificant, neglecting the noteworthiness of information administration as a basic victory figure of the unused financial substance and as the key to its long-run survival.

The BSC is just supplementary in adjusting the conventional points of view by including non-financial perspectives.

Skandia Navigator: Skandia appointed Leif Edvinsson as director of Intellectual Capital.

Edvinsson developed a dynamic and holistic IC reporting model named the Navigator. It reflects four key dimensions of its business (Edvinsson, & Malone, 1997):

- Financial focus
- Customer focus
- Process focus
- Renewal and development focus

At the heart of these is human center, which drives the total Skandia Pilot mode. is an imperative instrument. Other companies have depended broadly on Skandia Navigator to esteem their R&D and obvious handle. However, because it depends on a adjust sheet to reflect the money related esteem of a company's IC, Skandia Navigator neglects many substance of IC which play vital parts in making esteem, such as a company's culture, organizational learning and an employee's inventiveness. In expansion, among the more than 100 files prescribed within the Skandia model, there may be a few mistaken assumptions. For case, workers appearing up for work and sitting before their computers don't fundamentally cruel they are contributing information which can be changed into their company's competitive advantage, so Skandia's auxiliary capital variables, counting the number of possessed computers, can be criticized (Husman, & Goodman, 1999).

Intangible Assets Monitor: Intangible Resources Screen was created by Eric Sveiby and characterizes three sorts of intangible resources that account for the book value-to-market esteem disparity within the valuation of a firm. The 'residual' that's not accounted for by the book esteem is ascribed to person competence of workers, inner structure, and outside structure (Sveiby, 1997). Whereas Skandia Navigator treats culture and the administration logic of the organization as a part of human capital, Intangible Assets Screen classifies them beneath the inner structure. With its essential emphasis on individuals, this demonstrate is based on the introduce that individuals are the as it were genuine specialists in trade and all viewpoints of structure, inside and outside, are inserted in human activities. Application of this demonstrate is exceptionally context-specific and the markers are chosen as polar descriptors (such as great or awful) that are particular to the relevant objectives that may make sense in an unexpected way over organizations.

The foremost imperative estimation models for the intellectual capital are displayed within the table underneath (table 1) considering a few criteria: the show of mental capital, focal points, drawbacks and execution in an organization. Table 1 gives a comparative diagram of the estimation

models talked about over. Summary description of each of the estimation models is given beside comparative examination approximately their qualities and weaknesses.

The comparison makes a difference in deciding the reasonableness of accessible models for private and open sector contexts of all-encompassing improvement.

Table 1. Analysis the model of measuring intellectual capital

Model	Advantages	Disadvantages	Implementation
BSC	Attention to the needs of the stakeholders Takes into account interrelations	Weak financial analysis Rigid model	Gorenje
Skandia Navigator	Incorporates financial elements Can be adapted to any company	It is difficult to apply the same methodology to different types of capital and their relations Does not analyse synergies between the areas	Skandia
Intangible Assets Monitor	Provides a comprehensive image of the intellectual capital Relations with suppliers and other key stakeholders are taken into account	Do not give a numerical value to intellectual capital. There may be difficulty in choosing appropriate indicators	Celemi

An innovative model to measuring intellectual capital: All of the above intellectual capital measurements contribute a lot to measuring intellectual capital from diverse points of view, but unfortunately, methods of measuring intellectual capital have been slow to develop.

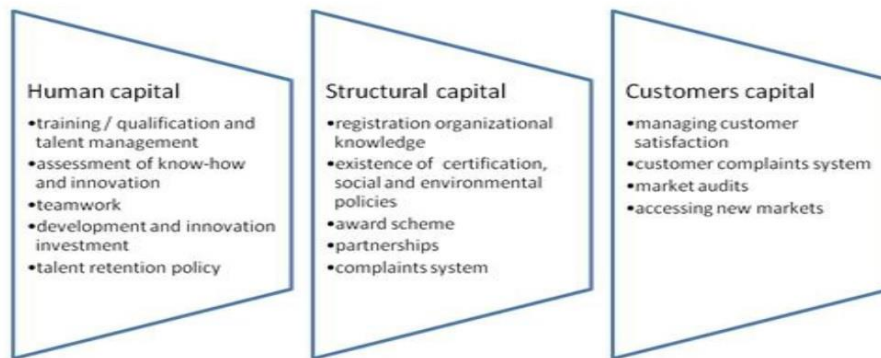
The proposed model has the following characteristics:

- Relevant to final users
- Provide useful management information
- Is operational and manageable
- Is easy to understand
- Refers to the cognitive areas of strategic importance operating system

The significance of this IC measurement model lies in its ability of providing timely necessary information for the manager of a company, which thus enables him/her to modify their strategies of IC management according to the specific situation, to obtain and make full use of knowledge, and to achieve long-term competitive excellence.

The model is represented by 3 components: human capital, structural capital and customer capital. Each component corresponds to the specific indicators shown in Figure 1. Should be noted that intellectual capital evaluation model is a dynamic model, therefore it is not completely stabilized. Indeed, this is one of the advantages

of the model: dynamic or interactive proves to be very good in turbulent business context.



Conclusions: It can be seen that within the studied organization every time an employee acquires new knowledge shared with rest of the team, being part of the culture and regulations of the company. The value of the company generally refer to: focus on the customer, employee development, its behavior as an entrepreneur and innovator acting through teamwork and sharing knowledge. The organization is encouraging talents of each employee by providing professional training related to employee skills. The employees who pass on their individual skills are rewarded financially and professionally. The company encourages employees to be innovative and also has a policy for retaining talent. All results of the case study lead to the conclusion that the success of the organization lays in the high degree of investment and recognition which has intellectual capital.

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REGULATION OF THE PUMPING UNIT SPEED ACCORDING TO CHANGING DAILY WATER CONSUMPTION BY THE METHOD OF FUZZY INFERENCE

Shahla Huseynzade

Sumgayit State University, Azerbaijan.

Email: shahla.huseynzade@gmail.com

ABSTRACT

The task is to develop a fuzzy model for controlling the speed (rotation frequency) of a pumping unit during the operating according to a changing daily water consumption. It is proposed to bring the pumping unit to the most optimal operating modes using control rules, using elements of fuzzy logic. Basic control principles are discussed, but not detailed pump design. Ranges of values of control parameters are formed on the basis of a daily stepwise schedule of water consumption. The term of the set of linguistic variables "water consumption" and "pump speed" are defined.

Fuzzification of controlling influencing linguistic variables is performed using the Fuzzy Toolbox application of the MATLAB package. For the input linguistic variable "water consumption", three membership functions of piecewise-linear triangular type in graphical form are built. For the output linguistic variable "pump speed", three membership functions of piecewise-linear trapezoidal type are plotted in graphical form. The base of rules for the implementation of a logical solution is built. The results of the logical solution were obtained using the logical inference method – of the Mamdani algorithm.

Keywords: Water pump control, fuzzy values, linguistic variables, membership function, Mamdani algorithm.

Introduction: As a rule water consumption modes, are variables and have pronounced fluctuations during the days, weeks, seasons. They are influenced by weather, social and other factors [1]. This requires regulation of the capacity of the pumping equipment installed at the station, including the speed of the pump motor. The most important issue in the development of an intelligent pumping system is the choice of a control system for this engine. A modern pumping system must have fast response and precise speed control.

The basis for the mathematical description of the balance between mass of fluid flows and the momentum of the pump are the differential equations of Navier-Stokes [2]:

$$\begin{cases} \rho g_x - \frac{\partial p}{\partial x} + \mu \left(\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} + \frac{\partial^2 u}{\partial z^2} \right) = \rho \frac{du}{dt}; \\ \rho g_y - \frac{\partial p}{\partial y} + \mu \left(\frac{\partial^2 v}{\partial x^2} + \frac{\partial^2 v}{\partial y^2} + \frac{\partial^2 v}{\partial z^2} \right) = \rho \frac{dv}{dt}; \\ \rho g_z - \frac{\partial p}{\partial z} + \mu \left(\frac{\partial^2 w}{\partial x^2} + \frac{\partial^2 w}{\partial y^2} + \frac{\partial^2 w}{\partial z^2} \right) = \rho \frac{dw}{dt}. \end{cases}$$

Here g – the gravitational acceleration, v – the speed of the particle of the liquid, t – the time, p – the pressure, ρ – is the kinematic coefficient of viscosity, μ – the dynamic viscosity coefficient, u , y and w – are the designations of the components v_x , v_y , v_z .

The Navier Stokes equations describe the processes at each point in the flow using partial differential equations. The calculation of each separate spatial point of the flow is impracticable due to the incredible laboriousness [3]. There are different approaches to solving this problem. In a coordinate grid is drawn up and its nodal points are calculated. After the appropriate preparation of this coordinate model, approval is made for the distribution of pressure and velocities, or these parameters are subjected to numerical or graphical analysis. Many mathematicians have tried to formalize the idea that the existing analytical technique is insufficient for solving this problem. Terence Tao proves the impossibility of solving the Navier-Stokes problem with the currently existing means [4].

Various approaches have been developed to the construction of models for controlling pumping units: In [5], it is proposed a method for optimizing the operation of the engine speed regulator based on fuzzy logic together with a bottomhole pressure sensor. Fuzzy water pump control simulation is evident in simulation studies using MATLAB / Simulink in various atmospheric conditions [6]. Both TRNSYS and Simulink provide detailed design, but are not suitable for modulating existing pumping units based on varying water demand [7].

From a brief review of the literature, it can be seen that when controlling pumping units, fuzzy logic is considered as an effective way to reduce energy consumption in water distribution processes. Each of the approaches has its own advantages, disadvantages and there are unsolved problems in the control of pumping units, especially in the mathematical description of fluid flows and fuzzy relationship between the performance parameters of pumps.

Formulation of the problem: The task is to develop a model for fuzzy control of pump speed control when operating according to changing daily water consumption, which consists of the following stages:

- Formation of input parameter (water flow) and output parameter (pump speed), determination of ranges for maximum water flow;
- Fuzzification of the controlling influencing linguistic variables “water flow” and “pump speed” using the Fuzzy Toolbox application of the MATLAB package;
- Formation of control rules based on various situations during the operation of the pump unit to determine the correspondence between the values of the linguistic variables "water flow" and "pump speed";
- Regulation of the “pump speed” output parameter according to the changing values of the “water flow” input parameter by the logical inference method - by the Mamdani algorithm based on control rules.

Problem solution

Formation of control parameters: The maximum water consumption in Azerbaijan, respectively, in 1000 conventional residents is equal to an average of 7.4 l/s [8]. The daily schedule of water consumption is cyclically repeated from the moment of commissioning until the end of the service life of the water distribution system. The value $Y1 = 1.5$ is the maximum, and $Y1 = 0.4$ is the

minimum value of the characteristic curve of the daily graph. Depending on the value of the characteristic curve, the values of the daily step graph change (Fig. 1.).

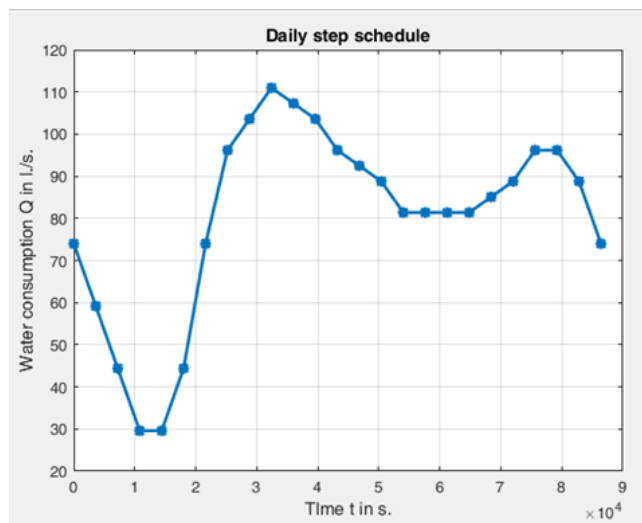


Fig. 1. Daily stepwise graph of water consumption per 10000 inhabitants

Where t – time with a time interval of 3600 s. and Q – water flow rate at the corresponding time values: $t = \{0, 3600, 7200, 10800, 14400, 18000, 21600, 25200, 28800, 32400, 36000, 39600, 43200, 46800, 50400, 54000, 57600, 61200, 64800, 68400, 72000, 75600, 79200, 82800, 86400\}$, $Q = \{74.0000, 59.2000, 44.4000, 29.6000, 29.6000, 44.4000, 74.0000, 96.2000, 103.6000, 111.0000, 107.3000, 103.6000, 96.2000, 92.5000, 88.8000, 81.4000, 81.4000, 81.4000, 81.4000, 85.1000, 88.8000, 96.2000, 96.2000, 88.8000, 74.0000\}$.

Accordingly, the interval (20,120) covers the whole range of changes in water flow per 10,000 conditional inhabitants. Interval (0.1000) can be selected by the conditional range of pump speed change.

Fuzzification of variables: To introduce fuzziness into the control model, fuzzification of variables is performed in the MATLAB system [9]. During the functioning of the system, the current information is converted into linguistic values using the fuzzification procedure. The linguistic variable "water consumption" has a term set $T = \{\text{"small"}, \text{"medium"}, \text{"large"}\}$, defined in the universe $A = [20, 120]$ (conditional unit). Three membership functions of piecewise-linear triangular type in the universe A , which are named as "cs", "cm", "cl" according to the names of the terms, are plotted in a graphical form (Fig. 2).

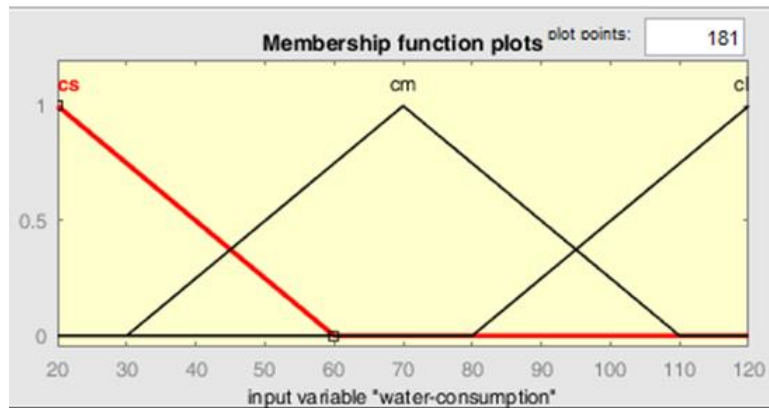


Fig. 2. Membership functions of the linguistic variable "water consumption"

The linguistic variable "pump speed" has a term set $T = \{\text{"low"}, \text{"medium"}, \text{"high"}\}$, defined in the universe $B = [0, 1000]$ (conditional unit). Three membership functions of piecewise linear trapezoidal type in the universe B , which are named as "sl", "sm", "sh" according to the names of the terms, are plotted in a graphical form (Fig. 3).

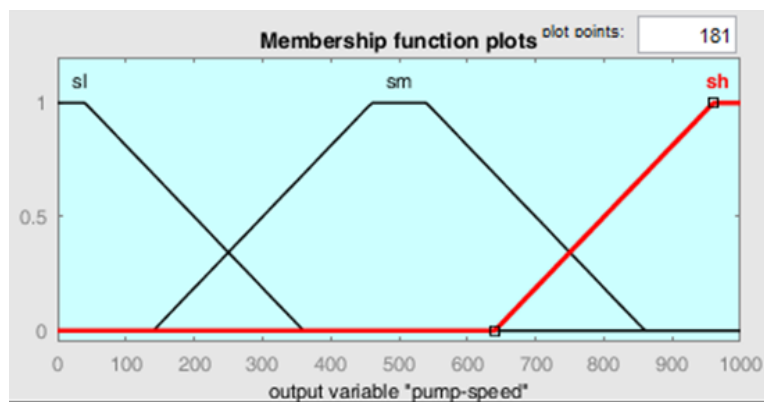


Fig.3. Membership functions of the linguistic variable "pump speed"

Using the IF-THEN rule base, a logical solution is formed. The correspondence between the values of the linguistic variables "water flow" and "pump speed" is determined by the logical inference method – by the Mamdani algorithm based on the control rules:

If ("water consumption" is *cs*) then ("pump speed" is *sl*);

If ("water consumption" is *cm*) then ("pump speed" is *sm*);

If ("water consumption" is *cl*) then ("pump speed" is *sh*).

The system of production rules is modified into an algorithm that is implemented programmatically in the Fuzzy Toolbox application of the MATLAB package. By entering the above rules from the "Rule editor" window, the results of logical inference are obtained, which can be visualized using the "View" menu (Fig.4).

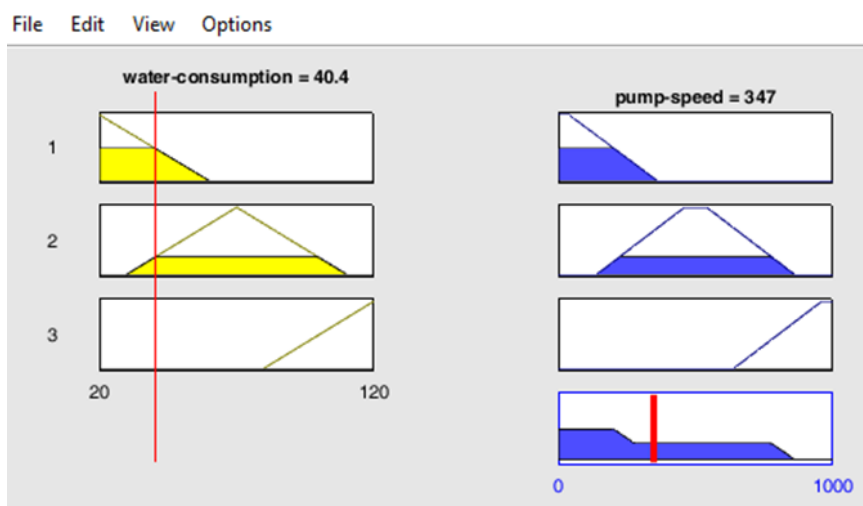


Fig.4. Visualization of inference results

Conducting computer experiments for different values of "water consumption", the corresponding values of "pump speed" were obtained, some of them are described in the table (Table 1). By using MATLAB synchronization with the control system, it is possible to transfer the obtained results to the control system.

Table 1. Results of inference execution.

"water consumption"	"pump speed"	"water consumption"	"pump speed"
31.3	168	70.9	509
35,5	270	78.2	519
40.4	347	84.9	531
45.9	407	91.0	566
50.2	443	97.7	630
56.7	479	104	719
63.6	500	111	870

Conclusion: Effective control using fuzzy pump control can reduce energy consumption compared to traditional control methods. The results obtained, along with practical qualities, also have theoretical significance. Potential areas of application of the developed approach can be found in the creation of an intelligent automated control system for thermal, water distribution, oil production.

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A GAN-STYLE APPROACH IN CYBERATTACK DETECTION

Azar Umudov, Tofiq Nazarov, Sanan Cafarov

^{1,2,3}ASOIU, Azerbaijan

Email: ¹azarumudov@gmail.com, ²tofignezarov1998@gmail.com, ³sanan.cafarov@asoiu.edu.az

ABSTRACT

Nowadays, the internet is being used extensively that it autogenously leads to encountering cyberattacks and malware. Variety techniques and systems have been applied to avoid and detect these anomalies in order to prevent their harmful effects on data security, software systems. Due to the success of deep neural networks in many domains, many models have been developed to detect cyberattacks. The main obstacle in real applications of these machine learning models is to collect labeled data samples. To overcome this problem, we developed a Semi-Supervised Generative Adversarial Network being trained with a small number of labeled data samples. We tested it over the NSL-KDD dataset and gained a successful result – 92.32% accuracy that was close to the performance of the studied models.

Keywords: Generative Adversarial Networks, Cyberattack Detection, Semi-Supervised Learning, Deep Learning.

Introduction: Due to the high usage of the Internet in many domains, cyberattacks are frequently encountered which carry an extreme risk for data privacy, IT systems of corporations, etc., and can be cost millions of dollars. In order to protect from cyberattacks, many traditional prevention techniques such as network firewalls, user privileges, data access security are being used as a first defense line of systems. Nowadays, many systems utilize Intrusion Detection Systems (IDS) as a prevention technique in the second defense line which assists in the diminishing of cyberattacks. Using specific features of attacks and normal cases from historical data, the performance of IDS can be advanced to detect the cyberattacks. These systems may benefit from the application of machine learning models in detection tasks based on features of the historical data.

Machine learning, especially deep learning models, have demonstrated their ability in various domains, from computer vision to classification of malign medical diseases. Machine learning models can learn specific features of the given data, which is the essential factor for high-fidelity prediction or classification. These achievements inspired us to the adoption of machine learning for cybersecurity. However, the main drawback of the machine learning approach is a dependency on comprehensive and labeled datasets, which are hard to find in real applications. Therefore, in this research study, our objective is to develop a machine learning model that can achieve high accuracy without a huge labeled dataset. We utilized Semi-Supervised learning in Generative Adversarial Network (GAN) and proposed a GAN-style approach to detect cyberattacks and accurately classify the type of them based on the scant labeled dataset.

The paper is organized as follows. The first section of the research paper comprises an introductory section about cyberattacks and the objective of the study. In the second section, we review the literature and previously proposed ML approaches for intrusion detection. The architecture of the GAN-style deep neural model, its cost function are introduced in section

3. Section 4 consists of the experimental setup (dataset, hyperparameters of the developed model) and the result of the experiment. In section 5, we discuss the results of our work and conclude the paper.

Related Work: In the literature, different studies deal with cyberattack detection using machine learning and deep learning techniques. Different types of deep learning models have been used for intrusion detection, such as feed-forward neural networks, recurrent neural networks, convolutional neural networks, and deep belief networks in these studies. Long-Short Term Memory (LSTM) achieved 98.8% accuracy for KDD Cup 1999 dataset in the intrusion detection task. The model was trained epoch 500 with 50 batch size [1]. Y. Zhang et al. [2] developed a stacked neural network that the first layer was the improved LetNet-5 convolutional neural network, and the last layer consists of LSTM. This architecture surpassed 94% accuracy on the CICIDS2017 dataset. For intrusion detection, not only discriminative models used but also generative models like Restricted Boltzmann Machine has been applied. The generative models are conducive to detect anomalous cases with a small portion of the training set for traditional machine learning models or deep neural networks. Restricted Boltzmann machine was used by K. Alrawashdeh et al. [3] and trained with KDD 1999 dataset. The simulation results show that the model classified cyberattacks with 92% accuracy. Another restricted Boltzmann machine was developed by M.Z. Alom et al. [4] has achieved to detect 97.5% of cyberattacks for only 40% of the NSL-KDD dataset used in training. Auto-encoder architecture has also been applied for intrusion detection and cyberattacks. N. Shone et al. [5] proposed a deep auto-encoder with non-symmetrical multiple hidden layers, which advanced the performance of the model for classification on KDD Cup and NSL-KDD datasets. The auto-encoder achieved satisfactory results in five metrics: accuracy, recall, precision, F-score, and false alarm. Moreover, copious studies and experiments with traditional machine learning models such as Support Vector Machine, Decision trees, etc., have been done as an AI-based intrusion detection system.

However, the main problem of most of the above models is the requirement of tediously prepared and extensive datasets. Generative models like GANs can overcome this problem, but GANs have been designed for generating realistic data, which are primarily 2D structural data like images, by means of boosting by discriminator model. For classifying tabular data, we have developed a GAN architecture for tabular data and applied semi-supervised learning as altering the working mechanism behind the GAN.

Proposed Model: Unlike supervised learning, semi-supervised learning can achieve satisfying results with a small portion of labeled data for classification tasks by learning the hidden structure of the data distribution from an unlabeled dataset. Semi-supervised GAN is distinctive from a regular GAN. In regular GAN, we utilize a discriminator part to facilitate the performance of the generative part and make the output more realistic. However, in SGAN, we have to change the working mechanism of the regular GAN to surpass or close to the performance of the supervised classifiers while training with only a small fraction of the labeled dataset. For a better classifier, we need a “bad” generator [6]. In SGAN, attention in the discriminator model and generator model aids in internalizing hidden features of real data by producing fake samples. Discriminator of the semi-supervised GAN accepts 3 inputs – real labeled samples, real unlabeled samples, and fake samples by the generator. The discriminator produces $N+1$ predictions where N corresponds to the number of classes in the training dataset, 1 is for the fake samples. The goal of

the SGAN discriminator is to classify each class correctly if the input is real or distinguish the input as a fake example.

Our SGAN is designed based on traditional GAN architecture: generator, discriminator, and critic model using fully-connected neural layers. The skeleton of the developed model is depicted in Fig. 1. The generator model consists of 5 layers: 1 input, 3 hidden with accordingly 128, 256, 512 nodes, one output layers. After each layer except the output layer, we used Dropout layers in order to avoid overfitting cases. For input and hidden layers, Rectified Linear Unit (ReLU) was applied. Due to the importance of weight initialization, the weights were initialized by He uniform. The discriminator model comprises 4 layers: 1 input, 3 hidden layers with consecutively 1024, 512, 128, which outputs were passed to ReLU as an activation function. In the case of the generator, the dropout layers follow each layer. To stable the neural net and maintain the same distribution of the dataset after each layer, we utilized Batch Normalization. As an output layer, the discriminator applied softmax activation function and normalized sum of the exponential outputs prior to the softmax activation for classification and differentiating fake samples (Eq. 1).

$$D(x) = \frac{Z(x)}{Z(x)+1}, \text{ where } Z(x) = \sum_{k=1}^K \exp[l_k(x)] \quad (1)$$

Training Process: We have trained our model with 128 batch size through 5000 epochs. In each training iteration, first, the supervised discriminator predicts an output and backpropagate the sparse categorical cross-entropy loss to optimize the classifier. Secondly, the unsupervised discriminator is optimized twice to minimize the binary cross-entropy loss for unlabeled samples and fake examples produced from random noise by the generator. Finally, we update the generator based on computed a binary cross-entropy loss for the generated sample and binary output of the discriminator. For both parts of the Semi-supervised GAN, we use Adam optimizer. Comprehensive information about the hyperparameters of our model is given in Table 1.

Table 1. Hyperparameters of the Semi-supervised GAN

Table 1. Hyperparameters of the Semi-supervised GAN		
	Discriminator	Generator
Learning rate	0.0002 for classifier 0.0001 for detector	0.0001
Optimizer	Adam(beta_1=0.5, beta_2=0.999)	Adam(beta_1=0.5, beta_2=0.999)
Loss function	Sparse Categorical Cross-Entropy for classifier Binary Cross-Entropy for detector	Binary Cross-Entropy
Epoch	5000	

Experiment Result: In order to conduct the cyberattack detection and classification experiment with our developed GAN model, we use NSL-KDD [7] dataset, which represents real network data for network-based Intrusion Detection Systems. NSL-KDD dataset consists of 148517 samples and four categorical, 39 numerical features. In Fig. 2, information about the dataset is de-

scribed. Due to the measure of pure performance of our model, we had not applied comprehensive data preprocessing and feature engineering for the dataset before the training except One-Hot Encoding that was applied for handling categorical features. For labeled data, 100 samples are randomly selected for each attack type used in the training process. We have classified nine more common cyberattack types out of 23 cyberattacks on NSL-KDD. We randomly dichotomize the dataset in 0.9 and 0.1 portions for correspondingly train set and validation set.

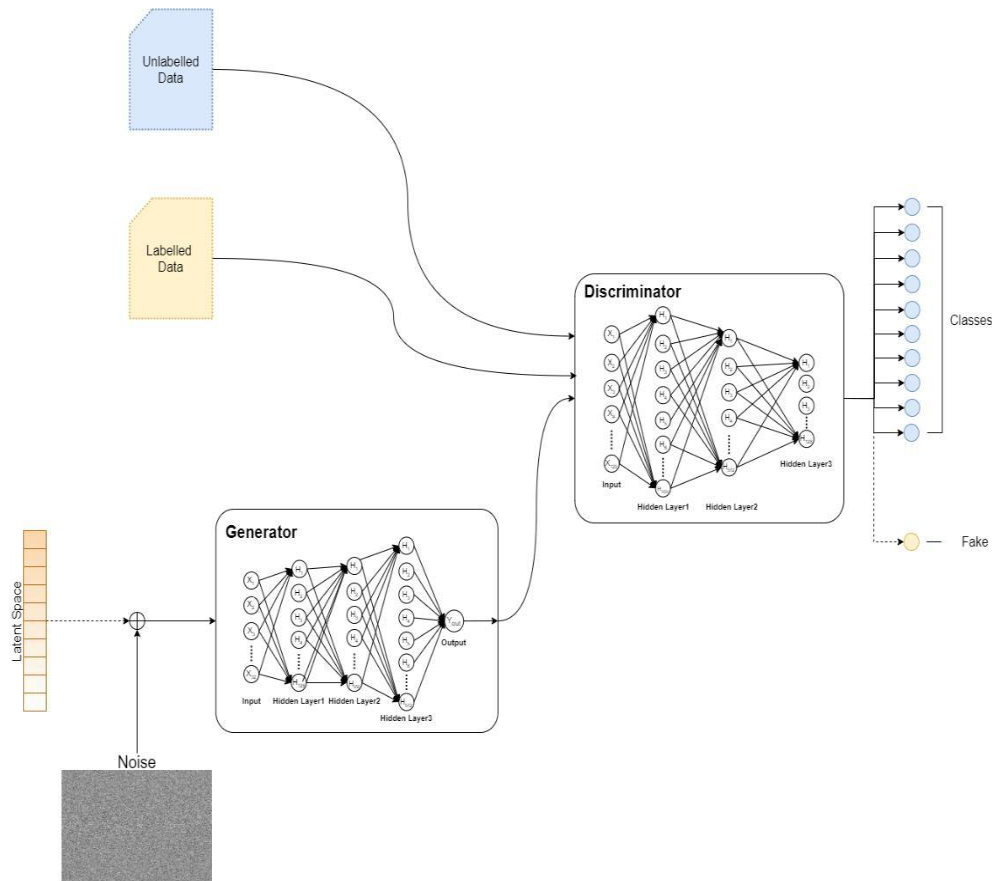


Fig. 1. An architecture of proposed Semi-Supervised Generative Adversarial Network (GAN)

We have utilized 5000 data samples to test the performance of the SGAN model. Our model accomplished to become in the same cluster with other studied models for performance accuracy. Despite the fact that labeled data sample size was 1000, it classified nine cyberattacks and detected normal conditions in a 92.3 accuracy rate. Fig. 3 depicts accuracy rates in training and validation and loss of classifier and generator in each epoch.

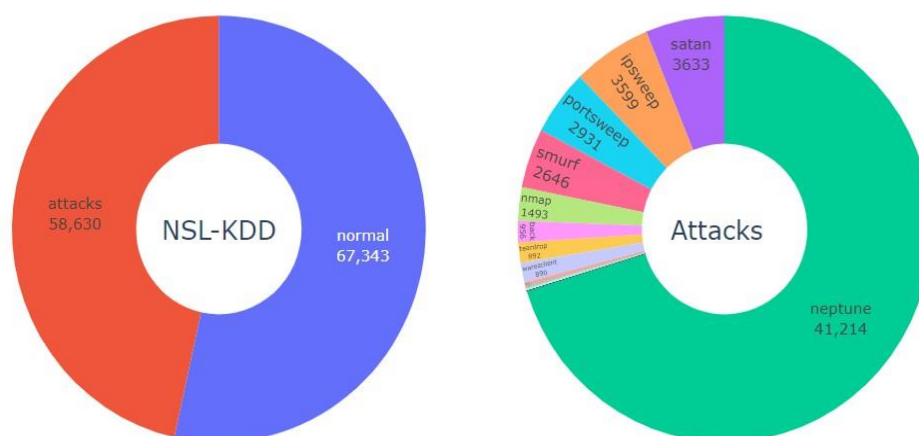


Fig. 2. A representation of independent feature distribution on NSL-KDD dataset

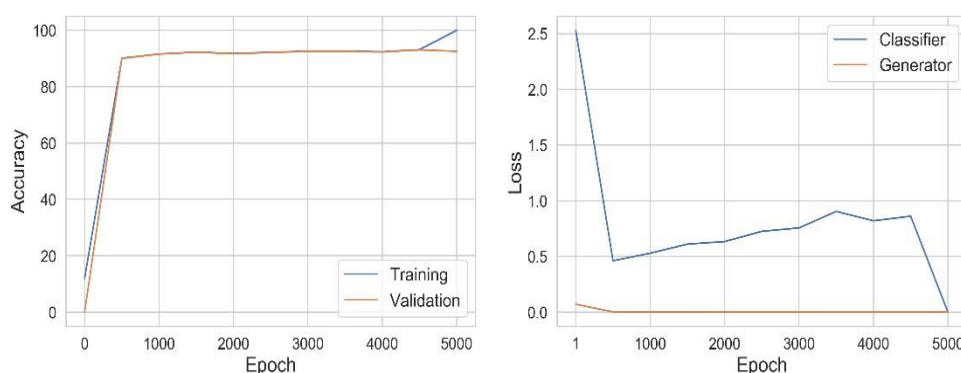


Fig. 3. Changes in accuracy and loss in each epoch (GAN)

Conclusion: The main goal of this study was to provide a new approach to accurately detect anomalies and classify cyberattacks without needing extensive labeled datasets. We developed the Generative Adversarial Network, which enabled the effective classification of cyberattacks based on semi-supervised learning. As a result, we demonstrated that our GAN-style approach for intrusion detection could be used in real world applications.

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TO INCREASE THE RELIABILITY AND STABILITY OF ROTATING MACHINES USING DATA-DRIVEN SENSORS

Valeh Bakhshali, Nail Mardanov

Azerbaijan Technical University, Azerbaijan.

Email: v.bakhshali@aztu.edu.az

ABSTRACT

The research purpose is to study the activities of rotating machines and prove the relevance of determining technical conditions in time. By providing regular monitoring of the machine to identify problems at an early stage, we can eliminate unwanted and unplanned malfunctions, increase reliability and stability. The main causes of malfunctions of rotating machines and their causes identified. The static unbalances and its causes are considered. It is noted that the static unbalance is characterized by a high amplitude of vibration signals. The results of investigation can be used in machines and equipment used in oil and gas transportation pipelines.

Keywords: Rotor dynamics, Mechanical oscillations, Free vibration signals, Piezoelectric sensors, Diagnosis of defects, Time-domain methods

Introduction: As is well known, rotary machines are very important units of oil and gas industry, and without them, it is impossible to imagine technology. These machines experience extreme mechanical loads that affect their parts, and in the end, they eventually collapse and fail. Thus, it is required to ensure efficient operation of machines to reduce the substantial losses and possible downtime caused by these reasons. In this case, in order to reduce productivity and ensure sustainable operation, monitoring the technical condition of various parts, assemblies and machines are very necessary and complementary in a wide area of industry. Analysis of the literature shows that the method of measuring parametric data used when conducting technical monitoring and signal processing to analyse vibration signals from rotating machines, etc. [1, 2].

It is known that it is necessary to ensure the reliable operation of more important systems, such as systems of energy suppliers, plumbing and sewage pipelines, telecommunications systems and reducing the high cost of repairs, reducing heavy work in these systems. To reliably determine the technical condition of systems, emergency situations, and faults, the useful role of data obtained from sensors in a network of spatially separated sensors, especially in systems with a long extent, increases. The ability to expand and scale the sensor network is very necessary for our lives today. Because today we are faced with the need to expand sensor networks by adding a huge number of sensors to monitoring systems through clustering local systems. This will contribute to the development of structural monitoring of the technical condition. The ultimate goal of the Structural Health Monitoring (SHM) system using sensors is to improve the decision-making process in order to ensure reliable protection of the structure in the case of [3].

The difficulty is associated with an increase in the number of machine parts and their functionality, which hampers and complicates the procedure for monitoring the technical condition. In the assessment procedures of the situation in order to reduce the complexity in recent years, a new method of monitoring the technical condition has been developed, based on a data-driven approach (data-driven methods) [4].

Analysis of the transverse oscillations of the rotating shaft of the vortex pump: Designed shafts and axles, taking into account the provision of static or fatigue strength, sometimes fail due to insufficient rigidity or vibration. In addition, low rigidity disrupts the normal operation of gears and bearings. Shafts and axles additionally count on stiffness and vibrations. It has the great value of calculating the optimal length of the shaft. The issue of the stability of the shaft of rotating machines is important for its normal operation. The differential equation of transverse oscillations of the shaft of rotating machines under the action of force N (varying in size and direction depending on time), has the form [5-7]:

$$\frac{d^4 y}{dx^4} - \frac{N}{EJ} \cdot \frac{d^2 y}{dx^2} + \frac{m}{EJ} \cdot \frac{\partial^2 y}{\partial t^2} = 0 \quad (1)$$

Where m - is the mass of shaft per unit length, E is the modulus of elasticity, J is the moment of inertia of across section of the shaft, and EJ is bending stiffness in the plane of oscillation of the shaft.

We will look for a solution to this equation in the following form:

$$y(x, t) = S_1(x) \cos \frac{\omega t}{2} + T_1(x) \sin \frac{\omega t}{2} + S_2(x) \cos \omega t + T_2(x) \sin \omega t \quad (2)$$

To solve equation (1), we formulate the boundary conditions of the problem, which have the form:

$$\begin{aligned} x = 0; \quad y(x, t) = 0; \quad \frac{\partial y}{\partial x} = 0; \\ y = y_1; \quad \frac{\partial^2 y}{\partial x^2} = 0; \quad \frac{\partial^3 y}{\partial x^3} = 0; \end{aligned} \quad (3)$$

Substituting expression (2) into equation (1), we obtain the identity.

$$\begin{aligned} S_1^4(x) \cos \frac{\omega t}{2} + T_1^4(x) \sin \frac{\omega t}{2} + S_2^4(x) \cos \omega t + T_2^4(x) \sin \omega t - \frac{N}{EJ} \left[S_1^2(x) \cos \frac{\omega t}{2} + T_1^2(x) \sin \frac{\omega t}{2} + \right. \\ \left. S_2^2(x) \cos \omega t + T_2^2(x) \sin \omega t \right] + \frac{m}{EJ} \left[-\frac{1}{4} S_1(x) \omega^2 \cos \frac{\omega t}{2} - \frac{1}{4} T_1(x) \omega^2 \sin \frac{\omega t}{2} - S_2(x) \omega^2 \cos \omega t - \right. \\ \left. T_2(x) \omega^2 \sin \omega t \right] = 0 \end{aligned} \quad (4)$$

Equating the coefficients at $\sin \frac{\omega t}{2}$, $\cos \frac{\omega t}{2}$, $\sin \omega t$ and $\cos \omega t$, in (4) we will have:

$$S_1^4(x) - \frac{N}{EJ} S_1^2(x) - \frac{m\omega^2}{4EJ} S_1(x) = 0 \quad (5)$$

$$T_1^4(x) - \frac{N}{EJ} T_1^2(x) - \frac{m\omega^2}{4EJ} T_1(x) = 0 \quad (6)$$

$$S_2^4(x) - \frac{N}{EJ} S_2^2(x) - \frac{m\omega^2}{4EJ} S_2(x) = 0 \quad (7)$$

$$T_2^4(x) - \frac{N}{EJ} T_2^2(x) - \frac{m\omega^2}{4EJ} T_2(x) = 0 \quad (8)$$

Solving the characteristic equation corresponding to equation (5), we find its roots:

$$r_{1,2} = \pm \sqrt{-a + \sqrt{a^2 - b}} \quad (9)$$

$$r_{3,4} = \pm \sqrt{-a - \sqrt{a^2 - b}} \quad (10)$$

Where $a = \frac{N}{EJ}$, $b = \frac{m\omega^2}{4EJ}$. Thus, of the four roots of the characteristic equations (9) and (10), all four roots r_5, r_6, r_7 and r_8 for differential equations (6), (7), (8) have complex values. In accordance with this function is presented in the form:

$$S_1(x) = L_1 \cos r_1 x + L_2 \sin r_1 x + L_3 \cos r_2 x + L_4 \sin r_2 x \quad (11)$$

To determine the unknown coefficients L_1, L_2, L_3, L_4 included in expressions (11), we use the boundary conditions (3). We get the following dependencies:

$$L_1 + L_3 = 0$$

$$r_1 L_2 + r_2 L_4 = 0$$

$$-r_1^2 L_1 \cos r_1 l - r_1^2 L_2 \sin r_1 l - r_2^2 L_3 \cos r_2 l - r_2^2 L_4 \sin r_2 l = 0$$

$$r_1^3 L_1 \sin r_1 l + r_1^3 L_2 \cos r_1 l + r_2^3 L_3 \sin r_2 l + r_2^3 L_4 \cos r_2 l = 0 \quad (12)$$

So, we have a system of four algebraic equations (12), containing four unknown values L_1, L_2, L_3, L_4 . The systems (12) thus obtained are linear systems of algebraic equations for determining the specified unknown quantities. Since these systems of equations are homogeneous, nonzero solutions are possible only if the determinant composed of the coefficients of these unknowns is zero.

$$\begin{vmatrix} 1 & 0 & 1 & 0 \\ 0 & r_1 & 0 & r_2 \\ -r_1^2 \cos r_1 l & -r_1^2 \sin r_1 l & -r_2^2 \cos r_2 l & -r_2^2 \sin r_2 l \\ r_1^3 \sin r_1 l & r_1^3 \cos r_1 l & r_2^3 \sin r_2 l & r_2^3 \cos r_2 l \end{vmatrix} = 0 \quad (13)$$

By expanding the determinant (13), we obtain one equation containing the length of the shaft y_1 and the angular velocity ω

$$-r_1 r_2^5 \cos^2 r_2 l + r_1^2 r_2^4 \sin r_1 l \cdot \sin r_2 l + 2r_1^3 r_2^3 \cos r_1 l \cdot \cos r_2 l + r_1 r_2^5 \sin^2 r_2 l - r_1^4 r_2^2 \sin r_1 l \cdot \sin r_2 l - r_1^5 r_2 \cos^2 r_1 l + r_1^5 r_2 \sin^2 r_1 l = 0 \quad (14)$$

Here we can determine the value of the length of the shafts, which is critical in certain values of the design and operating parameters of rotating machines. Or, if we know the length of the shaft, thereby using equation (14) can calculate the angular velocity, respectively, for the harmonics of the first and second-order lines, which define the boundaries of the instability regions of rotating machines with its given design and operating parameters [8, 9].

Thus, by calculating we find the length of the shaft, in which the state of the shaft of the machine is unstable, in which its work becomes abnormal. To avoid this, the estimated length of the shaft must be different from its two found critical values. But, as can be seen from equation (14), there are many other parameters in this equation that, when changed, will create high vibration amplitudes.

Above, we have shown that static unbalance creates a strong peak of amplitude at the frequency of rotation of the rotor in the vibration spectrum. To avoid damage to the shaft of the machine and to identify discrepancies in the behavior of the shaft, we can also trace the graphical dependence of vibration on time. To study the behavior of vibration signals generated by the shaft and other parts of rotating machines, it was necessary to measure the vibration signals from different parts of the machine. For this, we used piezoelectric sensors.

The main idea of the research is to assess the technical condition using a data-driven method for identifying and diagnosing failures and defects by collecting data from sensors into computer memory and processing them. After that, the traditional static analysis used a data method based on machine learning, data mining [10-13].

Formulation of the problem: The proposed technical method of assessing the technical condition by collecting data in real-time using sensors will improve the ability to obtain useful data and store data in databases, simultaneously increase the reliability of nodes, the efficiency of repair costs, operational security and the overall competitiveness of companies. From the analysis of the literature we can see that the implementation of SHM systems in real structures cannot assert itself completely. In this case, the improvement of forecasting systems is a challenge; the monitoring systems need to be improved. Algorithms for detecting defects and making decisions have to consider several important parameters:

- Micro Measuring Defective Mechanism;
- Diagnosis of defects in local components of products;
- Global assessment of technical conditions as a structure.

Taking into account everything noticed, the purpose of the study is to conduct experiments, compare the obtained data and results, as well as monitor the tests that implement the system in a real environment. It is known that, in particular, diagnostic transmission simulators are especially important for simulating errors in rotating machines. It should be noted that maintenance systems based on the technical condition, prognostics, and health management were created for different machines, they were introduced and used in industry [10].

Work in critical conditions, the intensity of faulty cases, the possibility of different definitions of the causes of faults and damage made it interesting to study rotating machines by monitoring them. Structural components under stress, corrosive surfaces, affected parts, etc. are other attractive

criteria for rotating machines. We can separate measuring sensors for detecting and determining diagnostic defects in critical systems into two different types: temperature, speed, location, pressure and flow meter, both static and process-related measurements and characterized by their high output capacity parameters (high-frequency components). These include ultrasound, vibration, acoustic recordings, alternating current or voltage.

Experimental equipment consists of an electric motor with adjustable rotations turnover, a coupling, a cyclone pump, a fluid inlet, outgoing fluid, a fluid supply line, a fluid outlet line, a shut-off valve fluid, several other hydraulic valves, etc. (Fig. 1). The received vibration signals from the observed experiments in equipment that simulated real units of measurement show the possibility of using the presented method.

2 digital temperature sensors ("DS 18B20 Temperature Sensor Manyee 1M/39.37", Thermal Probe with Stainless Steel Tube Probe, $-55^{\circ}\text{C} \sim +125^{\circ}\text{C}$), 2 pressure sensors (Generic Carbon Steel Alloy Variable Pump Water/Air Pressure Sensor (DC 5V)), 2 flow rate sensors (Generic DC 5~24V Water Flow Sensor Nylon + Fiber Glass DN25) and 2 vibration sensors (Wingoneer High Sensitive vibration sensor module SW-18010P) were mounted to the monitoring units (the angles between the vibration sensors should be 90° [14]). Sensors connected to the Raspberry and Arduino boards and through these boards to the main computer [15].

In this case, sensor recordings transmitted in real-time to the hard disk of the Raspberry board. We can write this data into Comma Separated Value(s) (database export/import format and file extension) (CSV), Microsoft Excel spreadsheet (XLS), etc. files in a computer store or send to other applications or DBMS using web services.

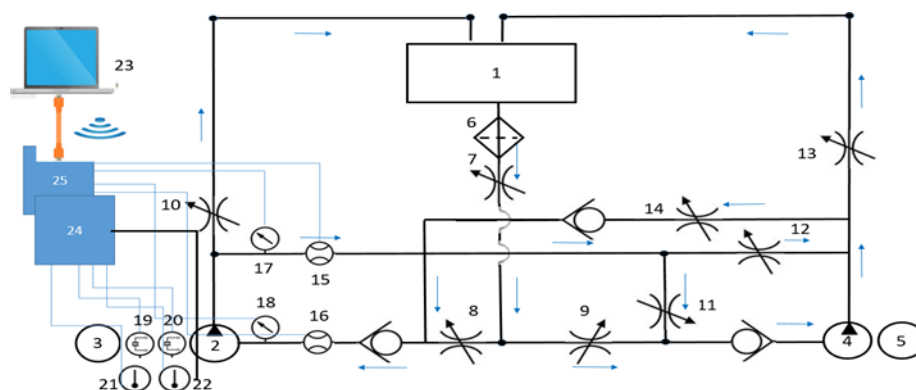


Fig. 1. Measurement of vibration signals of the cyclone pump system by sensors.

1. Reservoir; 2. 4. Pumps; 3. 5. Pump Motors; 6. Filter; 7. 8. 9. 10. 11. 12. 13. 14. Adjustable flow control valves; 15. 16. Flow Meter sensors; 17. 18. Pressure Transducers (sensors); 19. 20. Piezoelectric vibration transducers; 21. 22. Temperature sensors; 23. Workstation PC; 24. Paspberry board; 25. Aurduino board.

The new hydraulic pump was used in test measurements, the signals from the sensors were less excited, and the sensors could not detect any fault signals. For these reasons, when testing using valves and when connecting and disconnecting a second pump, shown in Figure 1, the artificial decrease and increase in pressure and flow in the pipe were caused by static loads for a certain time

to obtain changes in hydraulic forces by improvisation of turbulence and cavitation processes in the pipes. The jumps on the graphs were triggered by hydraulic shocks (water hammer).

The PuTTY software carries out the storage of sensor records on the hard disk. PuTTY is an open source, free terminal emulator and file-sharing program. A PuTTY is a universal software that supports several other network protocols, such as Secure Copy Protocol (SCP), Secure Socket Shell (SSH), Telnet, rlogin, etc. allows you connect to remote computers [13].

After collecting the data received from monitored devices by observers on the Raspberry hard drive using the Windows Secure Copy (WinSCP) [10] software application, we copy the file with the collected data from the memory of the controller board to the computer store. WinSCP is a client protocol for the Microsoft Windows environment that supports other protocols such as File Transfer Protocol with Secure Sockets Layer (SFTP), File Transfer Protocol (FTP), and Web-based Distributed Authoring and Versioning (WebDAV), Amazon S3, and SCP. WinSCP was developed in the 2000s. Its main goal is to ensure a reliable and secure data transfer between local and remote computers.

Table 1. Parametric data and vibration signals received from sensors.

Time, sec	Temperature, C ⁰	Pressure, P1, KPa	Pressure, P2, KPa	Flow rate, L/min	Consumption, Q1, mL/Sec	Vibration, m
18:03:29	29,125	185,71	2,11	12,6	210	0,003370079
18:03:32	29,062	185,71	2,11	16,6	277	0,000149606
18:03:35	28,937	187,66	2,11	16,4	273	0,005653543
18:03:38	28,875	191,57	4,07	16,4	273	0,001055118
18:03:41	28,812	193,52	4,07	16,2	270	0,003984252
18:03:43	28,75	193,52	4,07	16,2	270	0,005188976
18:03:46	28,687	191,57	4,07	15,9	266	0,002937008
18:03:49	28,625	191,57	6,02	16,2	270	0,002724409
18:03:52	28,625	191,57	6,02	16,4	273	0,001834646
18:03:55	28,562	193,52	4,07	15,9	266	0,002582677
18:03:58	28,5	193,52	0,16	16,1	269	0,004165354

Table 1 shows the file format in which the sensors recording data recorded. Before processing the data, we need to clear the row data from unnecessary data, and then prepare the data for the next analysis. After the data is ready for processing, in the Python programming language, using matplotlib, pyplot and numpy.fft, we plot graph. Below is a graph of vibration signals in the time domain.

Fig. 2 shows a graphical function of the dependence of vibration signals on the time domain in nearly 40 minutes.

To control the technical condition of the equipment, general vibration signals measured, allowing evaluating the current technical condition of the unit. The dynamics of the general vibration signals allows you to monitor the dynamics of the technical condition of the equipment and identify defects at an early stage. Measurement of general vibrations is the first stage and allows you to monitor various types of machines, providing a simple vibration analysis.

The measurements fulfilled in this stage are not enough to detect defects, required detailed spectral analysis of equipment vibrations to localize defects. The majority cases the sources of defects detected in their frequency specters (frequency domain). Required vibration analyzers in the 2nd

stage to provide vibro diagnosis, which uses the Fast Fourier Transformation vibration signals. The Fast Fourier Transformation (FFT) of time-domain relatives based on acquired data from experiments to frequency domain relatives is considered also.

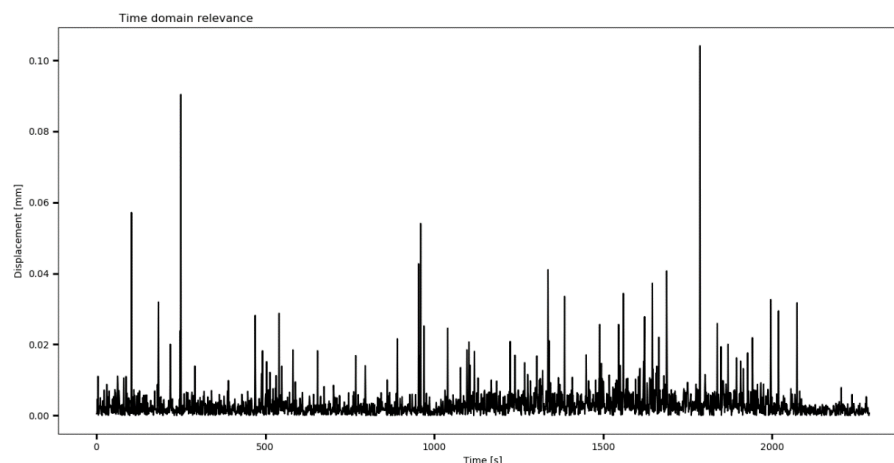


Fig. 2. Graph of vibration signals in the time domain for 40 minutes.

It is very difficult to determine the classification of various structures without errors using signals in the time domain. This problem studied by Fourier transform of the received values of general frequency signals. The main idea of this article is to provide static analysis of vibration signals and their high derivatives [15].

Conclusion: Various types of stresses created in the details of the units that are under the influence of static, dynamic and alternative loads during operation. These units work in critical processes under the influence of aggressive and abrasive environments. Many units operate at high and variable temperatures. All these facts reduce the service life of the units and cause failures. If we can determine the cause of failures at an early stage, we can eliminate these causes and increase the service life of the units. In this case, in order to reduce the number of machine failures and maintain their normal operation, we need to monitor and evaluate the technical condition of the units. We calculated the values of general vibration signals and plotted them. The obtained data and graphs make it easy to assess the basic technical conditions of the object, to describe the reality of the technical condition. Comparing the experimental values obtained with the base reference date, we can determine the technical condition of the installation. At the same time, according to several scientific works, taking into account the classification of defects in rotating machines, we can estimate the actual technical condition of the machines and their individual parts using graphical methods. As mentioned above, all the jumps in the graphs of Fig. 2 were caused by adjustments by the experimenter, and these are the results of hydraulic shocks. Knowing the pressure values and other parametric data from the measurement of changes in hydraulic forces, we can establish a relationship between a possible high amplitude of vibration signals and hydraulic forces.

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QUALITY ISSUES: QUALITY PLANNING AND MONITORING IN TEACHING AND LEARNING PROCESS

Rena Binnatova

Head of Registration, evaluation and monitoring department, Sumgayit Technical Collage under Sumgayit State University. Email: baku_2007@mail.ru

ABSTRACT

The article is dedicated to the quality and evaluation, monitoring and quality planning issues in teaching and learning process. The concept of quality and evaluation in teaching and learning process has gained a higher degree of public significance in higher education over the past few decades. This is due to several factors, first of all, to the undeniable reality of constant pursue by the developing nations to bring their social life standards close to those of the well-established democracies. Education often opens the list of the spheres where change and reform is considered most vital. While the concept of academic quality assurance has become a popular educational agenda issue in the world, and is often placed in the context of the so-called "Bologna Process", some caution is probably necessary to take so that the concept is not devalued to become a definition for a mechanical tool for and arbitrary measuring of random processes or superficial tendencies.

Quality measures, as created in individual cases or as a good-will initiative of the Ministry of Education or Universities, is still vulnerable and subject to disruption or degradation. First and foremost, it is connected with the socioeconomic status of the teaching personnel.

Application importance: this material can be used in seminars, lectures in higher education institutions.

Keywords: quality, teaching and learning process, quality planning, monitoring.

Introduction: Education system – from the highest levels of government right down to the classroom – needs to deliver the knowledge and skills that students need, and to respond as those needs change. Quality tools and processes can help. Some starting points:

Accountability: Methods are needed to judge the performance of processes within the system.

Accountability means establishing:

A systematic method to assure stakeholders (educators, policy-makers and the public) that schools are producing desired results.

Common elements that are applied to all participants. These should include clear goals, progress indicators, measures, analysis of data, reporting procedures, help for participants not meeting goals, and consequences and sanctions.

From accountability methods, the need for continuous improvement can become clear.

Alignment: A curriculum must match relevant testing programs' evaluation measures and requirements.

- **Federal view:** Student requirements have been determined by the federal government in the No Child Left Behind act:
 - Annual progress is needed to meet proficiency standards for all students mandated by 2013-14.

- This accountability system is based primarily on assessments, but also can include other reliable and valid indicators, such as graduation rates from high school.
- Academic Achievement Standards are the goals and report cards are the reporting procedures.
- Seeks to ensure that students are performing at grade level.
- **State view:** State criteria and assessments are in place and are responsible for ensuring:
 - The criterion or standard of performance is communicated clearly to local agencies, districts and schools.
 - Students are performing at grade level.
- **District view:** District standards and assessments need to be in place to ensure:
 - Schools have measurable objectives, intermediate goals and a collection of baseline data.
 - What they are asking of the students aligns with the criteria or standards of performance.
 - The criteria or standards of performance are communicated clearly to the schools and students.
 - Students are performing at grade level.
- **School view:** Principals and teachers translate district standards into student-friendly language and effective teaching and learning. Through achievement, attitude or competency tests, they are:
 - Create a common assessment based on standards for all students around certain areas of the curriculum.
 - Ensure students are performing at grade level.
- **Grade, classroom and student view:** Teachers of individual grades and classes work with criteria and assessments from higher levels to ensure that students are performing at grade level and provide additional assistance/service to students who are not.

Assessment: Schools need measures for assessing how well students are doing. These measures should incorporate feedback from students, parents, the community and other stakeholders.

Types of assessment include:

- **External assessment**, such as state or district tests, communicates what the state or district considers important to teach and learn in school.
- **Classroom assessment**, the day-to-day assessment of students by teachers in the classroom, communicates to students and parents what the school and teacher value in student performance.
- **Alternative assessments** are not typical standardized tests. Instead, they involve practices such as demonstrating a skill, answering open-ended questions, assembling portfolios of work and instructor observation of students.

Read about selecting the best measurements: Eight Steps to a New Performance Measurement System, from *Quality Progress* magazine, February 2002.

Student requirements: Businesses speak of “customer requirements” – what it takes to satisfy the people who consume the product or service being offered. Some of the same methods for achieving customer satisfaction in the business world apply in education as well.

Organizations offering more resources for accountability, assessment, alignment, and student requirements:

The American Association of School Administrators, a 13,000-member organization for educational leaders.

The National Education Association, an organization of 2.7 million members at every level in education, from pre-school to graduate programs.

The North Central Regional Educational Laboratory, dedicated to providing high-quality, research-based resources to educators and policymakers, particularly in Midwestern states. See for example the NCREL report **Skills and Competencies Needed to Succeed in Today's Workplace** [1].

While the concept of academic quality assurance has become a popular educational agenda issue in the world, and is often placed in the context of the so-called "Bologna Process", some caution is probably necessary to take so that the concept is not devalued to become a definition for a mechanical tool for and arbitrary measuring of random processes or superficial tendencies. Nor should it be allowed that quality in education becomes tantamount to a technical, business-like deprived of any kind of emotional coloring. Some recent literature discusses academic quality assurance as a phenomenon that ends an era associated with enthusiasm and that begins an era more characterized by realism in the field. But progress in education always takes a certain degree of enthusiasm. Many educational problems especially in the developing world cannot be solved if such factors as enthusiasm, dedication, risk, sacrifice etc. are not in place. So maybe procedures should be developed in the framework of quality assurance to measure such non-quantifiable factors [2].

Quality planning is a process of setting quality goal and standards for an institution or organization and developing resources to meet these goals. The most important conditions for the effectiveness of quality planning is the continuous process of evaluation. Evaluations minimize or completely eliminate defect through continuous improvement process. Planning represents a number of activities at the design and product development stage, resulting in final product or service quality.

The main reasons for quality planning are;

- quality planning makes a decisive decision on institutional, organizational or customer satisfaction,
- quality planning prevents the occurrence of disagreements in the implementation of the product and its use,
- removing disagreements during product quality planning requires only a fraction of the costs we would spend on disaster relief during product implementation and use,
- the correct implementation of quality planning is an important attribute of the organization's competitiveness.

The preliminary analysis is very important in order to bring quality planning into desired results.

These preliminary analysis includes following items:

- Defining and explaining the aims and tasks of quality plan,
- establishing general guidelines for the quality planning activities,
- determining how to plan and appoint the persons responsible for this process,
- analyzing of the number of available resources that can be allocated for the implementation of the planning process,
- elaborate on operational procedures by which planning will run,
- establishing of the work schedule,

- determining the anticipated effects [3, p.395].

Monitoring is one of the key elements of quality. It is regular and ongoing process to collect and analyze information on the functioning of structures and processes or the progress of projects over time. In a timely manner, strengths and weaknesses could be determined by the monitoring. At the same time, according to result of this analysis can be quickly and directly fed back to the planning process. If monitoring systems are working well, evaluation of the achievement of goals is much easier to carry out. In order to reach objectives and improve effectiveness, evaluation should be implemented by determining the value and outcomes of activities through systematic, regular research.

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DEVELOPMENT OF MATHEMATICAL MODELS OF THE PROCESS OF COLD PRESSING OF POROUS BODIES IN AN ELASTIC-PLASTIC MEDIUM

T.G. Jabbarov

Azerbaijan State Oil and Industry University, Department of Mechanical and Materials Science Engineering, Azerbaijan. Email: tahir-cabbarov@asoiu.edu.az

ABSTRACT

When developing technological processes for obtaining cold-pressed sintered parts from iron-iron glass of low porosity, special attention is paid to the mechanism of density variation. The article deals with research on the compaction of a porous body consisting of an elastic-plastic medium of iron-iron glass under conditions of limited passive deformation. Based on the concept of root-mean-square stresses and strain rates in a porous body, a model of the plastic behavior of porous bodies consisting of their elastically plastic medium is proposed. In contrast to existing models, this model makes it possible to characterize the behavior of plastic deformation of a porous body not only by its current porosity, but also by the measure of plastic deformation accumulated in the base material. It was found that at sufficiently large radial compressions of the porous body, the volume change is negligible, that is, as the radial deformations grow, the porosity practically does not change.

The process of formation of a sintered porous body from iron-iron glass occurs in two stages. On the first of them, there is a change in both the shape and volume of the body, and on the second - only a change in shape, that is, the body does not compact. At the first stage of formation, the ratio of volumetric and radial deformation is of great importance.

Radial reduction of porous iron-glass bushings, hardened in a rigid mandrel, is an energetically more favorable process. It was found that during radial compression of porous bushings in a rigid mandrel, the density of the body being compacted is uniformly distributed along the radius. The result obtained in this case can be regarded as an initial approximation to the true solution of the problem.

Keywords: elastic-plastic medium, porous body, radial compression, compaction, longitudinal deformation, closed mold, iron-cast iron glass.

Introduction: Two directions are characteristic of the theories of plastic deformation of compressible powder media [1-9]: the creation of deformation theories and theories of plastic flow. The equations of the deformation theory are relatively simple and convenient for calculating the stress-strain state. However, the area of their application is limited by small elastoplastic deformations and a certain class of loading paths (proportional paths and paths of small curvature) [9]. These conditions do not preserve the validity of the theory for most technological processes of compaction of powder and porous materials. The equations of the theory of plastic flow are free from a number of disadvantages inherent in the theories of elastoplastic deformations. At the same time, there is currently no consensus on the shape of the loading surfaces, a hypothesis, the existence of which is one of the main postulates of the flow theory. [10]

Expansion of theoretical and experimental studies of compaction processes during plastic deformation of compressible media is the basis for calculating and optimizing technological parameters for manufacturing products from powder materials.

Purpose of the study: The purpose of this article is to develop mathematical models of the process of cold pressing of porous bodies in an elastic-plastic medium.

Solving the problem: For the theoretical evaluation of the compaction of the elastic-plastic medium, we used a charge consisting of powders of special gray cast iron, iron and vacuum glass. The content of the components of the charge was distributed as follows, wt.%: Cast iron powder - 2.5; vacuum glass - 5 and iron powder - the rest. This state of the components provided an elastic-plastic medium. After cold pressing under a pressure of 700 MPa and sintering of compacts at a temperature of 1150 °C in an endothermic gas medium, a porous body with a porosity of 12% was obtained. In [8], a model of the plastic behavior of porous bodies consisting of an elastically plastic medium is proposed. In contrast to existing models, this model allows one to characterize the behavior of plastic deformation of a porous body not only by its current porosity, but also by the measure of plastic deformation accumulated in the base material. Thus, the theory of plasticity of a porous body proposed by V.V Skorokhod in [11] takes into account the geometric and physical factors of hardening of this medium. Since this model is closed and mechanically correct, its basic relationships can be used to analyze the stress-strain state that occurs during various technological processes of processing porous bodies with pressure.

Let us draw the basic relationships between the model and the form that takes into account the geometric conditions in which all the analyzed processes are considered. Since the stress-strain state is asymmetric, the stress tensors σ_{ij} and strain rates $\dot{\epsilon}_{ij}$ will have the form:

$$3p = \sigma_z + \sigma_r + \sigma_\varphi ; \quad (1)$$

$$\tau_2 = \left(\sigma_z - \frac{1}{3}\sigma \right)^2 + \left(\sigma_r - \frac{1}{3}\sigma \right)^2 + \left(\sigma_\varphi - \frac{1}{3}\sigma \right)^2 + 2\tau_{iz}^2 \quad (2)$$

$$\dot{\epsilon} = \dot{\epsilon}_z + \dot{\epsilon}_r + \dot{\epsilon}_\varphi ; \quad (3)$$

$$\gamma^2 = \left(\dot{\epsilon}_z - \frac{1}{3}\dot{\epsilon} \right)^2 + \left(\dot{\epsilon}_r - \frac{1}{3}\dot{\epsilon} \right)^2 + \left(\dot{\epsilon}_\varphi - \frac{1}{3}\dot{\epsilon} \right)^2 + 2\dot{\gamma}_{rz}^2, . \quad (4)$$

The components of the velocity vector v_r, v_z are related to the components of the strain rate tensor by the following relations:

$$\dot{\epsilon}_z = \frac{dv_z}{dz}; \dot{\epsilon}_r = \frac{dv_r}{dz}; \dot{\gamma}_{rz} = \frac{1}{2} \left(\frac{dv_r}{dz} + \frac{dv_z}{dz} \right);$$

$$\dot{\epsilon}_\varphi = \frac{v_r}{r}; \quad (5)$$

In accordance with the general methodology of continuum mechanics, the components of the strain rate and stress tensors that describe the macro state of the investigated elastic-plastic medium must satisfy the basic conservation laws.

Therefore, the equilibrium equation holds

$$\frac{d\sigma_z}{dz} + \frac{d\tau_{rz}}{dr} + \frac{\tau_{zz}}{r} = 0. \quad (6)$$

$$\frac{d\sigma_r}{dr} + \frac{d\tau_{rz}}{dz} + \frac{\sigma_r - \sigma_\varphi}{r} = 0. \quad (7)$$

and the continuity equation

$$\dot{\varepsilon} = \frac{1}{\rho} \frac{d\rho}{dt} = \frac{\dot{\theta}}{1-\theta}. \quad (8)$$

The basic conservation laws (6) - (8) and geometric relations (5) are supplemented by relations characterizing the mechanical properties of iron-cast iron glass. In accordance with [11, 12], the loading surface equation has the form:

$$\frac{\tau^2}{\varphi(\theta)} + \frac{p^2}{\varphi(\theta)} - (1-\theta)\tau_0^2(\gamma_0) = 0, \quad (9)$$

and the flow surface

$$\varphi(\theta)\dot{\gamma}^2 + \psi(\theta)\varepsilon^2 = (1-\theta)\dot{\gamma}_2^2, \quad (10)$$

where - γ_0 is the measure of the accumulated plastic deformation of the deformation, and - τ_0 is the yield stress of the base material of the porous body according to [8]

$$\varphi(\theta) = (1-\theta)^2; \psi(\theta) = \frac{2}{3} \frac{(1-\theta)^3}{\theta}; \quad (11)$$

According to [11], strain rates are related by an associated law, which leads to the relationship between the coaxiality of stress deviators and strain rates

$$\frac{\dot{\varepsilon}_z - \frac{1}{3}\dot{\varepsilon}}{\sigma_z - \frac{1}{3}\sigma} = \frac{\dot{\varepsilon}_r - \frac{1}{3}\dot{\varepsilon}}{\sigma_r - \frac{1}{3}\sigma} = \frac{\dot{\varepsilon}_\varphi - \frac{1}{3}\dot{\varepsilon}}{\sigma_\varphi - \frac{1}{3}\sigma} = \frac{\dot{\gamma}_{rz}}{r_{rz}}, \quad (12)$$

and also, to the equation

$$\dot{\gamma} p \phi(\theta) = \dot{\epsilon} \tau \psi(\theta). \quad (13)$$

The last equation (13) characterizes the compression of a porous elastic-plastic medium irreversibly change its volume. This ratio shows that the material is compacted only in the case when the hydrostatic pressure is not equal to zero, although it can also take place when P . If the material is non-porous, $\dot{\epsilon} = 0$ then the ratio.

Let's consider the first of the tasks. The z -axis of the cylindrical system, the coordinates are aligned with the axis of the compressible porous cylinder. The equation of boundary conditions has the form:

$$\sigma_z|_{z=0} = \tau_z|_{z=h} = 0; \quad \tau_{rz}|_{r=a} = 0, \quad (14)$$

where- h is the current height; a - is the current radius of the porous cylinder.

Direct substitution into equations (6) - (8), (5), (12) and the boundary conditions show that the system of functions

$$\sigma_z = 0; \quad \tau_{rz} = 0; \quad (15)$$

$$\sigma_\phi = \sigma_r = \sigma_r(\theta); \quad \epsilon_\phi = \epsilon_r = \epsilon_r(\theta); \quad \epsilon_z = \epsilon_z(\theta). \quad (16)$$

is the solution to the problem. And $\sigma_r = \sigma_\phi$, $\epsilon_r = \epsilon_\phi$, ϵ_z , γ it is necessary to determine from the relations (9) - (13). Based on (15) and (16), the expressions for the invariants of the stress and strain rate tensors are simplified and take the form:

$$P = \frac{2}{3} \sigma_r; \quad \tau = -\sqrt{\frac{2}{3}} \sigma_r; \quad \dot{\epsilon} = 2\dot{\epsilon}_r + \dot{\epsilon}_z; \quad \dot{\gamma} = \sqrt{\frac{2}{3}} (\dot{\epsilon}_z - \dot{\epsilon}_r). \quad (17)$$

First let's define the deformed state. For this, we substitute (17) into (13), after simple calculations, given considering (11), we obtain

$$\dot{\epsilon}_z - \dot{\epsilon}_r = -\frac{\dot{\theta}}{\theta}; \quad (18)$$

Together with the expression

$$\dot{\epsilon}_z + 2\dot{\epsilon}_r = \frac{\dot{\theta}}{1-\theta};$$

Relation (18) constitutes a system of linear differential equations of the first order, which is easily integrated and has a general solution

$$\begin{aligned}\varepsilon_z &= \frac{1}{3} \ln \frac{1-\theta_0}{1-\theta} + \frac{2}{3} \ln \frac{\theta_0}{\theta}; \\ \varepsilon_r &= \frac{1}{3} \ln \frac{1-\theta_0}{1-\theta} - \frac{1}{3} \ln \frac{\theta_0}{\theta};\end{aligned}\quad (19)$$

where θ is the initial porosity of the elastic-plastic medium.

The definition γ_0 is not difficult either. In the case under consideration, the flow surface equation (10) is reduced to the form:

$$\dot{\gamma}_0^2 (1-\theta) = (1-\theta)^2 \cdot \frac{2}{3} \frac{\dot{\theta}^2}{\theta^2} + \frac{1}{2} \cdot \frac{4}{3} \frac{(1-\theta)^3}{\theta} \cdot \frac{\theta^2}{(1-\theta)^2}.$$

By further transforming it by integration, we obtain

$$\gamma_0 = \sqrt{\frac{2}{3}} \ln \frac{\theta_0}{\theta}. \quad (20)$$

Let's move on to the definition of stresses, namely, the only nonzero component. Substituting the loading surface equation (9) into (17) and solving the resulting equation for σ_r , we find its final expression

$$\sigma_r = -\sqrt{\frac{3}{2}} \tau_0 (1-\theta)^2 \quad (21)$$

In accordance with what was said earlier, τ_0 - there is a value characterizing the stress state of an elastic-plastic base during its transition to a plastic state and associated with the indicated dependence with γ_0 .

If the relationship between stress and strain σ_0 under uniaxial compression of a non-porous material is taken in the form $\sigma_0 = a + b\sqrt{\varepsilon_0}$, then the law of strain hardening of an elastic-plastic base in invariant form will be written as:

$$\tau_i = \sqrt{\frac{2}{3}} \left(a + b \sqrt{\frac{2}{3} \gamma_0} \right) \quad (22)$$

From (21), considering (20) and (22), we find the final expression of pressure as a function of the initial and current porosity.

As an example, stresses and strains are calculated for a given current and different initial porosity of sintered iron-iron glass.

In [12], the porosity dependence of the ratio of the transverse and longitudinal components of the strain rate tensor (Poisson's ratio) was determined for the case of uniaxial compression under conditions of a macrohomogeneous state:

$$\frac{\dot{\varepsilon}_r}{\dot{\varepsilon}_z} = \nu = \frac{2-3\theta}{4-3\theta}. \quad (23)$$

In the same work, an expression was obtained for the yield point under uniaxial compression of a porous body depending on the porosity for the non-strengthening component of the base

$$\sigma_z = -\sqrt{6} \frac{(1-\theta)^2}{\sqrt{4-3\theta}} \cdot \tau_0. \quad (24)$$

In the same way as it was done above for the case of radial compaction, explicit expressions for ε_r and ε_z can be obtained from the continuity equation and (23) for uniaxial compression. For deformation components, there are formulas

$$\varepsilon_z = \frac{1}{3} \ln \frac{1-\theta_0}{1-\theta} + \frac{4}{3} \ln \frac{\theta}{\theta_0}; \quad \varepsilon_r = \frac{1}{3} \ln \frac{1-\theta_0}{1-\theta} - \frac{2}{3} \ln \frac{\theta}{\theta_0} \quad (25)$$

With their help, from (3), (4) and (10) we calculate γ_0 for this case, which is not expressed in terms of elementary functions

$$\gamma_0 = \sqrt{\frac{2}{3}} \int_{\theta_0}^{\theta} \sqrt{1 - \frac{3}{4}\theta} \cdot \frac{d\theta}{\theta}$$

Taking into account the law of strain hardening (22), the dependence of the yield point on the initial and final porosity was determined.

The given formulas were used to calculate the compaction of sintered porous iron-iron glass with different initial porosity (Figure 1). During the transition from the scheme of porous uniaxial compression to radial, some decrease in the acting stresses was observed, all other things being equal. For the rest, the character of the dependence of the acting stresses on porosity in both cases was similar - they increased, approached the current yield point of the porous body substance, taking into account strain hardening.

Indeed, in the case of radial compression, the force F is calculated by the formula:

$$F = 2\pi\sigma_r ha;$$

where h - is the current height; a - is the radius of the cylinder.

From (19) and the definition of true deformations it follows that h and a are related to their initial values h_0 and a_0 , initial θ_0 and current porosity θ by the dependences

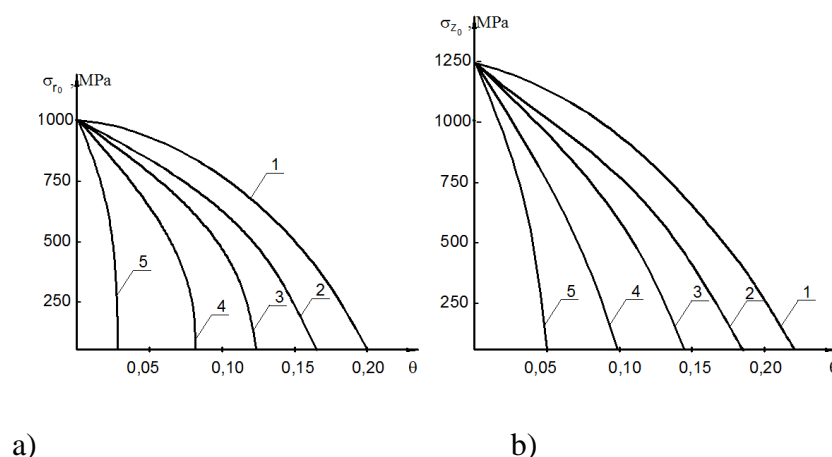


Fig. 2. Calculated curves of compaction of sintered porous iron-iron glass with different initial porosity at free radial (a) and simple uniaxial compression (b) of a porous cylinder.

$$\theta_0: 1 - 0.4; 2 - 0.3; 3 - 0.25; 4 - 0.15; 5 - 0.12$$

$$h = h_0 \sqrt{\frac{(1-\theta_0)\theta_0^2}{(1-\theta)\theta^2}}; \quad a = a_0 \sqrt[3]{\frac{(1-\theta_0)\theta}{(1-\theta)\theta_0}} \quad (26)$$

The product ha increases indefinitely as $\theta \rightarrow 0$. A similar situation takes place in the case of uniaxial compression.

In this case, the effort is calculated by the formula $F = 2\pi a^2 \tau_z$, and the current radius- a from the expression

$$a = a_0 \sqrt{\frac{[(1-\theta_0) \cdot \theta_0^2]}{[(1-\theta)\theta^2]}}.$$

In the process of free deformation of a porous body, both compaction and a change in its shape can occur. To qualitatively analyze the contribution of each of the indicated types of deformation of a porous body for both types of stress state, it is necessary to construct a relationship between longitudinal ε_z and radial ε_r deformation (Figure 2).

In analytical form, this dependence is expressed by the following formula:

$$\varepsilon_z = -2\varepsilon_r + \ln \left[\theta_0 e^{3\varepsilon_r} + (1-\theta_0) \right], \quad (27)$$

is obtained from expression (19) after eliminating θ from both formulas. This also implies that

$$\frac{d(\varepsilon_z + 2\varepsilon_r)}{d\varepsilon_r} = 3\theta \quad (28)$$

Axial deformation as a function of radial deformation, contains the initial porosity θ_0 as a parameter. If we take $\theta_0 = 0$ we obtain the well-known equation from the theory of incompressible media

$$\varepsilon_z + 2\varepsilon_r = 0$$

which reflects the fact that the volume remains unchanged.

The impulsive property of radial compression is found by directly analyzing equation (27). At a sufficiently large radial deformation $\theta_0 \varepsilon_r^3$ ($\varepsilon_0 < 0$), it becomes sufficiently small, and therefore this equation has the asymptote

$$\varepsilon_z = -2\varepsilon_r + \ln(1 - \theta_0)$$

This result has the following meaning: for sufficiently large radial compressions, the volume change is negligible, that is, as the radial deformations grow, the porosity practically does not change (Fig. 2). Starting from some values of ε_r ($\varepsilon_r = \varepsilon_{r\text{kp}}$), the graphs are straight lines, also the slope angles of which are close to two. The exit to the volume invariance mode is determined by the initial porosity. The less θ_0 , the earlier it happens. Up to $\varepsilon_r = \varepsilon_{r\text{kp}}$ cr, the dependences of ε_z on ε_r are nonlinear. Therefore, the values ε_r cr conditionally divide the process into two stages: at the first of them ($\varepsilon_r < \varepsilon_{r\text{kp}}$), both the shape and volume change, and at the second ($\varepsilon_r > \varepsilon_{r\text{kp}}$) - only a change in shape.

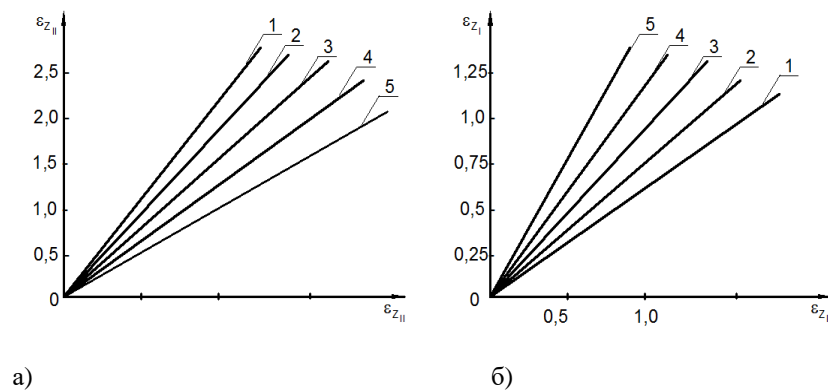


Fig. 2. The relationship between the longitudinal and transverse components of deformation at simple uniaxial (a) and free radial compression (b) of a sintered porous cylinder with different initial porosity θ_0 : 1 - 0.4; 2 - 0.3; 3 - 0.25; 4 - 0.2; 5 - 0.

Comparison of this result with the one obtained for radial reduction allows us to conclude that in the range of porosity variation $1/3 < \theta < 2/3$ the conditions for compaction of the material with radial reduction are more favorable than with uniaxial.

Conclusions: Mathematical models of cold pressing of porous bodies made of iron-iron glass in an elastic-plastic medium have been developed. It was found that at sufficiently large radial

compressions of the porous body, the volume change is negligible, that is, as the radial deformations grow, the porosity practically does not change.

The process of forming a sintered porous body from iron-iron glass can be divided into two stages. On the first of them, there is a change in both the shape and volume of the body, and on the second - only a change in the shape, that is, the body does not become denser. At the first stage of formation, the ratio of volumetric and radial deformation is of great importance.

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ENERGY COOPERATION BETWEEN THE EU AND THE REPUBLIC OF AZERBAIJAN

Gulshan Zeynalova

PhD of history of the Institute of History of the National Academy of Sciences of Azerbaijan.

Email: gulshee@hotmail.com

ABSTRACT

The European Union carries out multilateral multilevel cooperation with many countries of the world. The ties of the European Union between Azerbaijan are in the maintenance of economic and political reforms, the creation of the East-West transport and communication corridor (TRACECA), the development of infrastructures and other areas. [1]

Since 1991, the European Union has financed a new TACIS program for the implementation of democratic reforms in independent states, the creation of market economy infrastructures, the development of interstate trade, transport and a network of customs checkpoints. [2]

Within the framework of this program in 1993 in Brussels on the initiative of the European Union the project "Transcaucasian Transport Corridor Europe-Caucasus-Asia" (TRACECA) was put forward. This project was discussed with the participation of representatives from Azerbaijan, Georgia, Kazakhstan, Kyrgyzstan, Uzbekistan, Turkmenistan, Tajikistan and Armenia. Following the discussion, the Brussels Declaration was adopted and a decision was made to restore the East-West Silk Road with the prospect of establishing transport and communication infrastructures.

Keywords: East-West Silk Road, transport and communication infrastructures, TRACECA.

Introduction: Azerbaijan and the European Union have maintained positive relations for many years and have become more closely linked. Currently, Azerbaijan is part of the European Neighborhood Policy and the Council of Europe, and receives assistance and investment in the economy from the European Union. After gaining independence, the young state joined the United Nations in 1992 within the framework of the UN and public policy, reached out to the international community, especially to Europe, and opened up its economy.

Formal relations with the EU began in 1996, when a Partnership and Cooperation Agreement (PCA) was signed between Azerbaijan and the EU, which entered into force in 1999. This agreement has become the main positive relationship between the Republic of Azerbaijan and the European Union. Azerbaijan also strengthened its relations with Europe, becoming the 43rd state to join the Council of Europe on January 25, 2001. Since joining Azerbaijan, it has ratified 50 treaties and is actively participating in the work of the Council.

Thus, since 1993, Azerbaijan has been actively developing relations with the European Union. In 1996, the President of the Republic of Azerbaijan Heydar Aliyev signed the "**Agreement on Partnership and Cooperation**" prepared by the EU. Since that time, the report of the official cooperation of Azerbaijan with this structure begins. [3] The program provided for material and technical assistance from the European Union to the implementation of a number of structural reforms aimed at developing the market economy of Azerbaijan, privatization programs, and the implementation of infrastructure projects.

In September 1998, an international conference on the TRACECA program, organized by the European Union Commission, was held in Baku. It was attended by representatives of 32 states, as

well as representatives of 13 international and regional structures. At the final meeting of the conference, the Commission of the European Union, the leaders of the participating countries signed an important document entitled **"Multilateral Agreement on the Development of Transport and Communication Corridor Europe-Caucasus-Asia"**. Moreover, the conference participants adopted the Baku Declaration, which reflects the basic principles of comprehensive cooperation and regional integration between the Eurasian countries. It was decided to open a special "headquarters" in Baku.

It should be noted that the European Union cooperates with Azerbaijan not only within the framework of the TRACECA project and the "Partnership and Cooperation Agreement", but also within the framework of the general regional cooperation project in the South Caucasus, as well as other programs aimed at ensuring peace, stability and economic progress in Europe.

According to analysts, the European Union represents an alternative to the Russian program **"Eurasian Integration"**. The EU's TRACECA program and other European Union initiatives in Eurasia, and in particular in the South Caucasus, clash with the geopolitical interests of Russia, which seeks to keep the region within its sphere of influence. At the same time, the European Union demonstrates that it will not remain indifferent to the processes taking place in the region, which is of particular geopolitical importance for it.

In 2001, the European Union invested over 100 million euros in the Republic of Azerbaijan. [4]

In 2003, the EU adopted the Wider Neighborhood: A New Framework Initiative with Eastern and Western Neighbors. [5] In January 2004, the European Commission instructed the European Union Foreign Ministers to prepare proposals for the inclusion of the South Caucasian republics in the New Neighborhood Policy program. Within the framework of this program, the Republic of Azerbaijan, together with the European Union, received the opportunity to implement many political, economic, legal and administrative reforms with the financial and technical support of the European Union. In addition, the EU allocated the Republic of Azerbaijan a quota for access to its internal markets, free circulation, opportunities related to labor, goods, services, investments, etc.

Effective cooperation of the Republic of Azerbaijan with the EU contributes to the expansion of economic ties with European countries, the creation of preferential trade and credit regimes, streamlines and simplifies migration, promotes joint efforts to combat drug trafficking and organized crime, creates favorable conditions for attracting investments, etc.

In 1993-2004, the European Union provided the Republic of Azerbaijan with significant material and technical assistance and, within the framework of emergency and humanitarian assistance programs, reconstruction and technical projects, structural reforms, etc., carried out work worth more than 100 million euros. [6]

European Union programs INOGATE, ECHO and others finance important projects in our country. INOGATE is one of the longest running technical assistance programs funded by the European Union. It started in 1996 and works within the framework of the Baku Initiative and Eastern Partnership policy. INOGATE is working with 11 partner countries to support reducing their dependence on fossil fuels, improving the security of their energy supply and reducing overall climate change. INOGATE Partner Countries are located in 3 geographic regions and are supported by 3 INOGATE Regional Secretariats:

- Eastern Europe: Belarus, Moldova and Ukraine oversees the Secretariat in Kiev
- Caucasus: Azerbaijan, Armenia and Georgia are supervised by the Secretariat in Tbilisi
- Central Asia: Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan oversees the Secretariat in Tashkent.

Azerbaijan has been a partner country of INOGATE since 1996 and the program continues to maintain an energy dialogue with Azerbaijan in the context of regional energy cooperation between the countries of the European Union. Increased attention is being paid to sustainable energy as the energy source of the future. This includes increased investment in the sector, such as conducting geospatial mapping of renewable energy efficiency and providing a utility to visually support the investment dialogue between policymakers, potential investors and renewable energy supplies. INOGATE continues to support the security of energy supply by providing comprehensive research on the state of the art technology to reduce gas losses. Other key areas for further INOGATE support include the development of an energy statistics system and the establishment of technical committees for gas and electricity to consistently and efficiently agree on specific standards. Thus, we see that the Republic of Azerbaijan is successfully participating in regional projects of the European Union, being an advanced economic state in the South Caucasus. [7] The Republic of Azerbaijan is developing new forms of bilateral relations with the EU, demonstrating the desire to integrate into the common European space of economy, politics and security.

First, the Republic of Azerbaijan supports the EU's plans to strengthen regional integration.

Secondly, the Republic of Azerbaijan demonstrates a desire for peace and cooperation in the region. Since 1992, the priority direction of the foreign policy of the Republic of Azerbaijan has been integration into Europe. Active cooperation with the European Union has become a step towards this.

Thirdly, reforms (economic, political, legal and social) that meet EU standards are being implemented in the Republic of Azerbaijan.

Azerbaijan, together with Western states, participates in global energy and transport projects. The Republic of Azerbaijan is a strategically important state for the European Union, which is on the way to expanding Europe to the east.

Fourthly, despite the fact that the Muslim population prevails in Azerbaijan, the Azerbaijani society is oriented towards European values, tolerant in its historical and mental components.

Thus, the Republic of Azerbaijan is an important strategic partner of the EU, both within the framework of joint participation in oil projects and within the framework of the EU's New Neighborhood Policy program, being the leading state in the South Caucasus on the path of integration into the European Union.

On May 26, 2008, Poland and Sweden submitted proposals to the EU foreign ministers to create a single forum for their eastern neighbors - the Eastern Partnership. It included 27 states of the European Union, as well as Ukraine, Moldova, Georgia, Armenia, Azerbaijan and Belarus at the expert level. At its meeting on June 20, 2008, the Council of Ministers of the European Union approved the creation of the Eastern Partnership program and a plan for the development of regional cooperation with eastern neighbors, including at the bilateral level. Within the framework of this structure, negotiations were planned on a visa regime, the introduction of free trade zones, and the conclusion of strategic agreements. Small projects will also be carried out on student exchange, environmental protection, and energy supply.

The accession of the states of the South Caucasus to the European Union is possible, under the terms of the EU, only after the elimination of internal conflicts, abandonment of territorial claims and ethnic separatism, in the presence of good-neighborly relations of all Caucasian states with each other.

Since May 2004, the European Union has allocated 255 million euros for the implementation of the policy of "good neighborly relations", and has been pursuing an active policy of integration and reconciliation of the states of the South Caucasus. [8]

It should be noted that the countries that have joined the EU program must demonstrate to the EU institutions their intention to respect human rights, observe the rule of law, organize transparent governance, adhere to the requirements of a market economy and international law. [9]

By the order of the President of the Republic of Azerbaijan Ilham Aliyev dated June 1, 2005 "On the establishment of the State Commission for the Integration of the Republic of Azerbaijan into Europe", the following tasks are guided for action:

- ensuring effective and coordinated work to strengthen ties between the Republic of Azerbaijan and the European Union,
- development and implementation of the Action Plan of the European Union related to the Republic of Azerbaijan.
- creation of working groups for cooperation with the European Union in the political, economic, transport, energy, legal, humanitarian, scientific and educational spheres, as well as in the field of security, human rights and democratization of society. [10]

To comply with the standards of the European Union, the Republic of Azerbaijan must carry out reforms in the political, economic, and social spheres, comply with the requirements of globalization, to which developed Western countries have joined. The Republic of Azerbaijan, having joined this program, agreed to conduct an open door policy, strive for complete liberalization of the domestic market, production and services, etc.

The settlement of the Armenian-Azerbaijani, Nagorno-Karabakh conflict is an indispensable condition for integration into a single system of cooperation and security.

In addition to eliminating ethnic conflicts in the South Caucasus, an indispensable condition for integration into the European Union is:

- the introduction in all three republics of the region of a unified system of legislative, executive and judicial power,
- the formation of a unified military command, a unified monetary system,
- opening borders for the purpose of integration,
- creation of a unified customs system that creates conditions for the free movement of goods, labor and other labor resources, etc. [11]

In a word, the integration of Azerbaijan, including other countries of the South Caucasus, into the European Union goes through the improvement of their relations, internal integration and completion of the process of democratization of society in accordance with Western standards.

If we draw historical parallels with the past, we can note that the end of the Cold War era radically changed the existing system of international relations. [12]

The post-Soviet countries began to conduct a dialogue with the Western world, the political and economic model of which they wanted to follow and from which they expected real help. Since the late 1980s and early 1990s, Western states have been responding directly to the shocks in eastern Europe by promoting positive change in these countries and providing multimillion-dollar loans to reform their infrastructures. Thus, the former East-West relationship is disappearing to give way to

mutually beneficial cooperation. At the same time, the global changes that took place on the European continent as a result of the collapse of the USSR, on the one hand, made it possible to create a new architecture of European security based on the principle of a united, peaceful and democratic Europe, on the other hand, new risks arose in the post-confrontation space and danger. At the turn of the second and third millennia, the world faced such security threats as organized transnational crime, arms smuggling and drug trafficking, racism, aggressive separatism and terrorism. [13]

These global risks require the adoption of joint coordinated measures by states and governments, regardless of their political and ideological predilections. At the same time, the end of the military confrontation between the two blocs of states has led to the fact that security problems are increasingly giving way to economic problems as priorities for world development. The international positions of states are increasingly beginning to be determined not by their military, but by their economic, scientific and technical potential. All these trends have breathed new life into the processes of European integration, dramatically intensified the activities of European international structures, led the leading European institutions, such as the Council of Europe, the European Union, the Organization for Security and Cooperation in Europe, to quantitative and qualitative renewal. One of the fundamental aspects of the construction of the future building of United Europe is the fact of gradual but irreversible integration with the European structures of the new independent states that were formed after the collapse of the USSR.

Of these states, the greatest interest for Europe is Azerbaijan as a country geographically located at the junction of Europe and Asia, which has the second proven oil reserves in the CIS after Russia and has chosen the path of active and systematic integration into Western European political and economic structures. What is happening in Western Europe is important for Azerbaijan from the point of view of both new prospects (or new difficulties) of interaction with Europe and integration through it into the world economy, and the model of economic and social order that is being formed in Europe, and which has become one of the benchmarks of the reform policy in Azerbaijan. According to Professor L. Glukharev, “the formula “two worlds - two systems”, according to which Europe lived in the post-war period, is becoming a thing of the past, but centuries-old traditions of various cultural and historical types of society - civilizations - remain. Our new era of geopolitical changes, the search for new socio-political models and institutional forms of development on the scale of the European continent, a new quality and range in the development of the common European process and our desire to create a new architecture of Greater Europe raise the question of developing a new geopolitical thinking, modifying and deepening the general theory integration. Scientific thought is looking for new forms of interaction between the West and the East of Europe, a model of common European accord”. [14]

Some conclusions can be drawn on the process of integration of the Republic of Azerbaijan into European structures. Azerbaijan, due to its pro-Western orientation and largely due to the oil boom raised around this republic due to large oil contracts with foreign companies, has received a solid credit of trust from European partners, which can contribute to Azerbaijan's integration into the European community. In conclusion, I would like to quote the words of Professor JI. Glukhareva on the prospects of European integration: “There are four civilizations in Europe - European (Western), Atlantic, Eurasian and Islamic. All of them are involved, albeit to a different extent, in the processes of European integration. The 21st century will be the century of their growing cooperation and mutual penetration. But at the same time, each culture is characterized by the

desire for self-preservation, the rejection of external influences. The interaction of the two noted tendencies will cause tension and create conflicts. All this complicates the processes of interaction between civilizations. European integration is, first of all, the brainchild of European civilization. Following the historic changes in Europe at the turn of the 1980s and 1990s, the prospects for integration changed radically. It is becoming truly European. The upcoming accession to the EU of the countries of Central, Eastern and Balkan Europe, the Mediterranean and, probably, Turkey, as well as the development of partnership and the possible creation of a free trade zone with Russia, Ukraine and a number of other CIS countries means an increasingly active inclusion in the integration processes of the Eurasian and Islamic civilizations ". [15]

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Orlov State Institute of Economy and Trade. Volga Branch of The Federal State Budget Educational Institution of Higher Professional Education

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Lecturing in informal associations and the publication of scientific articles on the Internet. Participation in research seminars in the "SLU University" and "Washington University", Saint Louis

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