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POTENTIAL AND OPPORTUNITIES FOR GROW THE SPRING NAKED OATS VARIETY "MINA" (AVENA NUDA, L.) IN THE CONDITIONS OF ORGANIC FARMING IN SAKAR AGRO REGION

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Abstract: From all cereals the oats is the culture that due to dietary and healthy impact on the human body becomes more sought after in the market. The residual products of oats after harvesting the grain such as straw and chaff are sought after for animal feed. The aim of this research is to test the potential opportunities of the spring naked oats variety "Mina", Bulgarian selection, grown on the principles of organic farming. The research is carried out in real ecological environment under field conditions of Sakar agro-ecological region. In ecological environment and without using of pesticides and mineral fertilizers the vegetative development of the spring naked oats variety "Mina" passes normally. The duration of the vegetation period ranges from 93 to 115 days. For this period the oats grew by an average of 69.7 cm. Under the ecological conditions of Sakar agro-region average yields of grain are 1292.830 kg/ha, and the quantity of straw is 1515.500 kg/ha. The yields of grain of spring naked oat variety "Mina" grown in ecological conditions are lower compared to the average yields of oats in the country for the same period with 452.50 kg/ha. This difference is not alarming considering the fact that the production of this variety oats is ecological clean and there is market demand for dietetic foods.

Keywords: spring naked oat, ecological environment, vegetative development, growth in period of vegetation, productivity, grain, straw, Sakar region.

1. INTRODUCTION

The oats is a cereal which is very well known in Bulgaria. Most of grown varieties of oats are spring. Scientists work to diversify the spring varieties and in the direction of creating new varieties of wintering oats [9]. The naked oats is not a new culture and for it should not be talking like a modern form of oats which is product of biotechnology or genetic engineering. The Russian botanist Vavilov writes about the naked oats as a species known from the wild flora and as a species genetically connected with European cultivars of oats [12]. Successful is the selection of varieties of naked oat in many European countries (Finland, Germany, Great Britain, France, Poland, Sweden, Ukraine, Russia, Belarus), as well as in the United States, Canada and Australia [6].

Attention of the researchers and users is drawn from the fact that the naked oats is sought after for food for people and for feed for animals. The content of amino acids, crude protein and fiber are higher than those of the wheat and the other crops [3]. In addition to the improved biochemical properties of the grain of naked forms of oats is it's unpretentious to growing conditions. So with the years this form of oats began to be sought from producers and processors. The first spring naked oat variety Mina is zoned in Bulgaria in 1994. It is selection made by scientists from IPGR "K. Malkov" in Sadovo [1]. Significant are the research in direction of cultivation, productivity and quality of naked oats [4, 5, 10]. With the
years and due to the established principles of healthy eating, began research work on organically cultivation of cereals and other crops [2]. This research was conducted to investigate the potential of spring naked oat variety "Mina" grown on the principles of organic farming. The influence of soil and climatic indicators on the germination, the vegetative growth, the growth rate in the vegetation period and the productivity are tracked. Reported is the dynamics of growth of the naked oats, as in every 10 days was measured the height of 10 marked for this purpose plants. Morphological analysis of plants was made. Reported are the duration of the periods between phases of growth, the duration of the vegetation period and the yields obtained from grain and straw (kg/ha).

2. MATERIAL AND METHODS

The scientific research was conducted under natural field conditions of Sakar agro-ecological region. Studies were carried out in three consecutive years (2009, 2010 and 2011), in properly done preparation, sowing and harvesting of spring oat varieties. The soil type on which was carried out the experiment is a leached cinnamon forest soil (Chromic Luvisols), with acidic reaction and content of humus about 2%. The predecessor, after which was sown oats is peas. According to the requirements for proper farming of the spring oats, after harvesting of predecessor was carried out deep plowing for burying of the residues of peas. The choice of predecessor peas is not accidental and is done to enrich the soil with nitrogen. After the 20 of February at the earliest opportunity to enter in the test area was made disking and cultivating. Sowing was done with sowing norm of 180 kg/ha. The experiment was carried out according to the method of the blocks in three repetitions and size of the experimental area of 20 m² (2x10 m). The harvesting was carried out in technological maturity. The sowing and harvesting were carried out manually. The experiment was carried out in ecological environment and mineral fertilizers and pesticides were not used.

3. RESULTS AND DISCUSSION

Most important for the vegetative growth and the productivity of crops grown on the principles of organic farming are the soil type, the proper farming practices and the manifestation of climate indicators. Oats is a culture of temperate climate, which is not pretentious to the soil and can successfully be grown on light sandy and heavier soils. Compared to other cereal crops, it can be grown and on acid soils with reaction of soil in the range of pH 5-6. The oats is a bit pretentious of moisture, but if the treatments are carried out on time and is sown on time, there is a guarantee for normal development and getting real yields. A curious fact is that from the three types of fertilizers (nitrogen, phosphorus and potassium) the oat reacts more sensitively to nitrogen fertilizers and insignificantly of phosphorus and potassium fertilizers [11]. This suggests that the oat could be grown successfully on the principles of organic farming. From this stems the need in such an environment, the predecessors of oats to be leguminous crops. Sakar agro-ecological region, in which the experiment was carried out, falls within the continental-Mediterranean area in southeast Bulgaria. The characteristic features of this region are specific microclimate conditioned by the Mediterranean influence and the soil type represented mostly by leached cinnamon forest soils. Compared to many other regions in Bulgaria, this region is remained ecological clean. According to the report of the municipality of Topolovgrad for development of the municipality in the period 2007-2013 in the region there isn't chemical contaminated land and the whole area is suitable for produce of ecologically clean production [8]. More than twenty years significantly decreased the use of mineral fertilizers and pesticides. This positively affects the
natural recovery of soils. The agricultural soils in the region occupy 64% of the total territory of the municipality of Topolovgrad.

The manifestation of the climate indicators is result of the location, topography and mainly from the combination of the two subregions – North Tundzha and Sakar-Dervent Mediterranean sub regions. In this region the winter is mild, with short snowfalls and snowdrifts on the northern slopes, which are retained for a longer time. Spring begins relatively early, in the first half of the month of March and is relatively well secured with moisture. Summer is hot and dry, almost without rain in July and August. The autumn is warmer and quite often drier than spring.

During the years of the experiment the indicators rainfall and temperature vary and have significant deviations from the established norms for the region. For the period from March to July the amount of rainfall in the first and third year is less than the norm for the region, and in the second year is with 78.2 mm more than the norm (Figure 1). In the months of February and March of the first and second years and the month of April of the third year there is moisture over and above the norm. With insufficient rainfall are the months of April in the first and the second years and the month of May of the second year. With little rainfall are the months of February, March, June and July of the third year. The data on the average temperature indicate vastly warming expressed in a higher average temperature for all three years. The increase compared to the norm for the region is with 0.2 - 1.2 °C. The average monthly temperature only in April of the third year is much lower than the norm for the region. In all other months the temperature is close to the norm for the region and well above it.

In these conditions the sowing in the second and the third years was carried out on time. In the first year because of over-moisture and difficulty of mechanized equipment to enter the field and to prepare the area, sowing was carried out later. The oats germinates on the 13 – 16 day after sowing. The phases of growth are with different duration. Shortest are the periods between phases of growth in the early stages of development - between “Emergence application”/“Third leaf” – “Third leaf”/“Tillering”, about 6 – 8 days. Longest are the periods “Third leaf”/“Tillering” – “Tillering”/“First node” and “Tillering”/“First node” – “First node”/“Inflorescence emergence last spikelet visible” – about 18 – 19 days.

Figure 1. Amount of rainfall and average air temperature during the period III-VII month in the years of research (2009-2011) and norm for the region
Table 1. Dates of sowing and germination, duration of the growing season and growth for the growing season

<table>
<thead>
<tr>
<th>Year</th>
<th>Date of sowing</th>
<th>Date of germination</th>
<th>Germinates on...</th>
<th>Duration of the growing season, days</th>
<th>Growth for the growing season, cm</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>22.III</td>
<td>4.IV</td>
<td>13 day</td>
<td>93</td>
<td>69.9</td>
</tr>
<tr>
<td>2010</td>
<td>3.III</td>
<td>16.III</td>
<td>13 day</td>
<td>108</td>
<td>74.2</td>
</tr>
<tr>
<td>2011</td>
<td>1.III</td>
<td>17.III</td>
<td>16 day</td>
<td>115</td>
<td>64.9</td>
</tr>
</tbody>
</table>

The duration of the growing season of this variety of oats varies from 93 to 115 days. Here the climatic indicators have decisive role. Relatively shorter is the growing season in the first year. It is due to the less quantity of water during the months of April, May and June and higher temperatures during the months of May, June and July. In this case, the later date of sowing has no effect, the oats germinates on time and the vegetative developing is normally. The longest growing season is explained by the delay in germination, which is a consequence of low water availability during the months of February, March, June and July and lower temperatures in April. The duration of the growing season varies in not large borders, but no observed effect on the growth of naked oats for vegetation period (Table 1). Naked oats is the highest in the second year, when it reached 74.2 cm (Figure 2). Relatively least it grew during the third year. The difference of 9.3 cm is not large and could not affect the development of the generative organs, if weather conditions do not prevent this.

![Figure 2. Growth for the vegetation period in the years of research and average for the period](image)

The morphological features of naked oats variety "Mina" describe it as appearance and are important for its economic qualities. The root system is fibrous, well developed with many primary and secondary roots. One third of the roots penetrate deeper, have a very good absorbability and deliver to the plant water from the lower layers. The stem of this variety of oats is round, smooth and hollow, and stands firmly upright (Figure 3). The bending down is not inherent for the stem. Panicle is located one-sided as its nodes are located on one side.
In the terms of Sakar region the length of the panicle is 19.5 – 22.7 cm (Table 2). The number of grains in one panicle varies from 28 to 33. The grain of oat variety "Mina" is naked, light and is not wrapped in typical oats weeds. The weight of the panicle is between 1.42 – 1.84 g. The weight of 1000 grains is from 20.9 to 23.5 g.

Table 2. Structural elements of the yield of naked oat variety "Mina" in the years of research and an average for the period

<table>
<thead>
<tr>
<th>Year</th>
<th>Length of panicle, cm</th>
<th>Number of grains in 1 panicle</th>
<th>Weight of the panicle, g</th>
<th>Weight of 1000 grains, g</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>20.8</td>
<td>28</td>
<td>1.42</td>
<td>20.9</td>
</tr>
<tr>
<td>2010</td>
<td>22.7</td>
<td>33</td>
<td>1.84</td>
<td>23.5</td>
</tr>
<tr>
<td>2011</td>
<td>19.5</td>
<td>30</td>
<td>1.61</td>
<td>22</td>
</tr>
<tr>
<td>Average 2009-2011</td>
<td>21</td>
<td>30</td>
<td>1.62</td>
<td>22.1</td>
</tr>
</tbody>
</table>

The productivity of a culture is influenced by a many factors. When it is grown in condition of organic farming the predominantly influence have the soil moisture and the air temperature. In these circumstances the grain yields of naked oat variety "Mina" are unstable and vary from 1095 to 1475 kg/ha (Table 3). The highest yield of grain is obtained in the second year of research when the moisture is the highest.
Table 3. Yields of grain of naked oat variety "Mina" by years and an average for the period of research 2009-2011 for Sakar region and the country

<table>
<thead>
<tr>
<th>Place</th>
<th>Yields by years</th>
<th>Average 2009-2011</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>kg/ha</td>
<td>%</td>
</tr>
<tr>
<td>In Bulgaria</td>
<td>1536</td>
<td>100</td>
</tr>
<tr>
<td>In Sakar region</td>
<td>1095</td>
<td>71.29</td>
</tr>
</tbody>
</table>

In Bulgaria: 1536 to 1976 kg/ha. In Sakar region: 1095 to 1309 kg/ha. The average yield of grain is 1263 kg/ha. Obtained yields of oats are 1536 to 1976 kg/ha, which is higher on average by 27.62% of those obtained in Sakar region (Figure 4).

The straw from cereals is a waste product and usually with the main tillage of soil is buried. Oat straw, however, is a valuable food product that is not reasonably being buried, but it’s good to be used to feed the animals. Except that oat straw has a good nutritional value, it has medicinal properties and is used in folk medicine [7]. In cases where oats are grown in ecological conditions, oat straw has better indices and increased demand. The yield of straw in the years of research ranges from 1390 to 1600 kg/ha (Fig. 5). It is higher than the yield of grain an average with 252.5 kg/ha.

Figure 4.
Average yields of grain in Sakar region and in the country for the period 2009-2011

The straw from cereals is a waste product and usually with the main tillage of soil is buried. Oat straw, however, is a valuable food product that is not reasonably being buried, but it’s good to be used to feed the animals. Except that oat straw has a good nutritional value, it has medicinal properties and is used in folk medicine [7]. In cases where oats are grown in ecological conditions, oat straw has better indices and increased demand. The yield of straw in the years of research ranges from 1390 to 1600 kg/ha (Fig. 5). It is higher than the yield of grain an average with 252.5 kg/ha.
4. CONCLUSIONS

From the three-year research on the opportunities for growing of spring naked oat variety "Mina" in ecological environment under the conditions of Sakar agro-ecological region can make the following conclusions:

1. When the soil preparation and sowing are carried out on time, the spring naked oats variety "Mina" grown in ecological environment is developing normally.

2. The climate indicators in combination with the soil type are the most important factors from which the vegetative growth and productivity of spring naked oat variety "Mina" depend.

3. The length of growing season on this variety of oats is 93 to 115 days. During this time it grows to 64.9 – 74.2 cm.

4. In conditions of Sakar agro-ecological region the length of the panicle reaches 22.7 cm, the number of grains in a panicle is up to 33 and the weight of 1000 grains is maximum 23.5 g.

5. The yields of grain are in the range of 1095 to 1475 kg/ha, and of the straw from 1390 to 1600 kg/ha.

6. The yield of grain in ecological conditions of Sakar region is lower with 27.62 % than in Bulgaria for the same period.

5. REFERENCES


ACHIEVEMENT OF THE HIGHEST LEVEL OF SAFETY AND HEALTH AT WORK AND THE SATISFACTION OF EMPLOYEES IN THE TEXTILE INDUSTRY

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Abstract: Safety and health at work involves the exercise of such working conditions that take certain measures and activities in order to protect the life and health of employees. The interest of society, of all stakeholders and every individual is to achieve the highest level of safety and health at work, to unwanted consequences such as injuries, occupational diseases and diseases related to work are reduced to a minimum, and to create the conditions work in which employees have a sense of satisfaction in the performance of their professional duties. Textile industry is a sector with higher risk, because the plants of textile industry prevailing unfavorable microclimate conditions: high air temperature and high humidity, and often insufficient illumination of rooms and increased noise. The whole line of production in the textile industry, there is a risk of injury, the most common with mechanical force, or gaining burns from heat or chemicals. All of these factors are present in the process of production and processing of textiles and the same may affect the incidence of occupational diseases of workers, absenteeism, reduction of their working capacity and productivity. With the progress of the textile industry production increases in the number of hazardous and harmful substances that may pose a potential danger to the employee in this branch of the economy as well as the harmful impact on the environment. Therefore, it is important to give special attention to these problems.
Keywords: textile industry, health, safety, like conditions, employee satisfaction.

1. INTRODUCTION

Health, safety and general working conditions are very important field of research and the operation of human resource management. Knowledge about the factors that affect the health and safety of employees is crucial and therefore attitudes of employees on these issues must be taken into account when planning the program for the protection of the health and safety of employees [1]. Safety and Health at Work means organizing such working conditions that are largely reduce injuries at work and professional diseases and diseases related to work. They create the prerequisite for full physical, mental and social well-being of employees, which is required by the provisions of the Law on Safety and Health at Work.
System safety and health at work means mutual influence of different factors such as legislation, inspection, insurance, technical knowledge and solutions, occupational health services, health, information, education, research and others. Problems related to diseases and accidents at work seriously jeopardize the working potential of employees and therefore represent one of the important topics of human resource management. They simultaneously affect the costs of the organization, motivation and satisfaction of employees, but they also have an ethical dimension, which stems from social responsibility. All this has an impact on the survival and success of the organization in a competitive market [10].
The employer is obliged to organize the work of ensuring the protection of life and health of employees, in accordance with the law and other regulations [2]. Management organization bears full responsibility for creating safe and respectful working conditions for the preservation of physical and mental health of employees.

Working conditions in the global textile industry are very poor because employees in most developing countries have no labor rights established by law. Many employees in companies of the textile industry in the world work in unacceptable conditions, which negatively affects the health and safety of workers. Workers are exposed to many dangers and hazards, and the most toxic substances used in textile-treatment preparations of chlorine, organic solvents, aniline dyes, various acids and salts of chromium, copper and zinc, and organic dust and noise impact (often over 95 dB). Eye strain, fatigue and frequent occupational injuries occur because of poor ergonomic conditions. Also, reproductive health, especially women, may be affected if employees are exposed to chemicals, high temperatures working environment, noise and other harmful factors [15].

The technological processes of textile industry used a number of different groups of chemicals primarily different types of organic dyes, solvents, bleach, heavy metals and the like. Toxic effects of heavy metals on human health are well known today, it is necessary to control their presence during the production and processing of textile materials [9].

2. ROLE OF MANAGEMENT HUMAN RESOURCES PRESERVATION OF HEALTH AND SAFETY WORK IN ORGANIZATIONS

The question of protecting the health and safety of employees at work in organizations is realized through the establishment, control, operation and maintenance of the system of health and safety at work, whose primary role is the implementation of human resource management. The same can be seen as a subsystem of the quality system of the organization.

In modern organizations, health promotion has a very important role, given that the success of the organization depends on whether she has a well-qualified, motivated and healthy employees are ready to face new challenges.

There are numerous positive effects for the performance of the organization resulting from the successful health promotion in the workplace. Here primarily thoughts on:

- increased productivity,
- reducing absenteeism,
- reducing the number of civil cases due to accidents and ill health caused by mistake,
- better selection of staff and fewer personnel changes,
- improved relationships between employees,
- lower level of professional stress,
- improving the working environment,
- improving the image of the company.

Preserving the high level of health and safety at work is an important human aspect, which shows the ethical and social development level of the organization. Increasing the level of safety and health at work, the creation of favorable conditions of work and labor relations, optimization of working processes affect the achievement of a high degree of employee satisfaction, achieving general welfare of employees and achieving organizational objectives [4].

The obligation of the management of the organization is to provide conditions for safe and healthy work employees. They are required by law to systematically monitor and eliminate any potential hazards in the workplace. For an organization to function effectively in terms of security and protection of health workers, it is important that employees are informed about...
the dangers that exist in all of their organization and that they are aware of the protective measures and first aid if a hazard occurs.

3. EFFECT OF SPECIFICS OF TEXTILE PRODUCTION AND CONDITIONS OF WORK ENVIRONMENT HEALTH AND SAFETY OF EMPLOYEES

There are many factors in the working environment that may affect human health. Under the working environment factors include all material factors that workers receive work activity. Physical factors include physical and technical conditions of the working environment. Therefore, they can be grouped into two basic groups.

The first group of these factors make up the physical factors of the working environment, which, in a sense, represent the environmental conditions. These include: [5]

- air and microclimate (temperature, humidity, air circulation),
- lighting,
- noise and vibration, and
- radiation.

While the second group of factors are those factors that arise from the operation of machines, use tools and effects of electricity on employees. Currently or permanently functioning of those influential factors, causes harmful effects on humans, depending on the intensity of this impact and the number of circumstances which should primarily be counted: the strength of the fact, resistance and protective measures. The most widespread are the consequences: injuries and accidents at work and occupational diseases.

Textile and clothing sector in Europe has changed over the years as a result of technological developments and changes in economic conditions and increasing competitive pressure [6] which caused the company restructuring, modernization and adaptation to technological change. Development of technical and industrial products, influenced also on employment in the textile sector, where there has been a change in patterns of employment (e.g., the conclusion of sub-contracts), as a result of the applied techniques, there has been a change in the hazards and risks which today workers are exposed in the process of industrial production [13].

Textile industry is technically and technologically very demanding. Manufacture of textiles basically requires several stages of machining, such as spinning, weaving, knitting and garment production, and chemical processing such as dyeing, printing and finishing of textile materials and finishing garments.

Most of the processes and products of the textile industry, which are part of modern life have a negative impact on the environment because of the presence of a number of chemical substances used in the technological processing of materials. To meet these demands, it is necessary to employ a qualified skilled workforce which possesses the necessary competence [7], knowledge and skills and is willing to answer all the challenges that are posed by the presence of large fluctuations and rapid changes in the market [8, 3].

In areas of the textile industry prevailing unfavorable microclimate conditions: High air temperature (over 30°C) and high humidity (90%), and often insufficient brightness of the rooms. On the whole production line from design to the production of yarn fabric, there is a risk of injury, the most common mechanical force, or gaining burns from heat or chemicals. All of these factors are present in the process of production and processing of textiles and may affect the incidence of occupational diseases of employees, absenteeism, reduction of their working capacity and productivity. It is for the foregoing reasons, the textile industry is assessed as a sector with an increased risk [16].
Many employees in companies of the textile industry in the world work in unacceptable conditions, which negatively affects the health and safety of workers. It is known that a number of factors that threaten the man in the workplace and outside it - physical factors: microclimate (temperature, humidity and air velocity), lighting, noise, vibration, and radiation and factors arising from the operation of machinery, equipment, use of tools and the hazardous effects of electric current, chemical and biologically active agents.

Textile industry consists of a large number of processes which are required for the conversion of fibers into the fabric or clothing. The main safety and health problem in the textile industry can be divided into:

- leaving the textile dust,
- exposure to chemicals,
- exposure to loud noise,
- ergonomic problems.

Employees in direct production working on processing and spinning of cotton are exposed to significant amounts of cotton dust. They are also exposed to pesticides from soil particles. Exposure to cotton dust and other particles can cause severe respiratory diseases textile workers. The disease is caused by cotton dust is still described in the seventeenth century, but only the last 40 years has become a global problem in the textile industry.

Workers in the textile industry are exposed to a large number of chemicals, especially those engaged in dyeing, printing and finishing of textiles. In various production processes use chemicals based on benzidine, organic solvents and chemicals, which are used in anti-crease finishing emit formaldehyde, protect against flammability used organophosphorus compounds or organobromine then also used antimicrobials in various textile operations. Studies have revealed the relationship between exposure to formaldehyde and lung cancer and brain, as well as leukaemia. Skin damage resulting activity of harmful agents in the working environment represents a group of the most common occupational diseases in the textile industry. Representation of professional dermatoses caused by the activity of chemicals in relation to other occupational diseases, ranges from 20-70%.

High levels of noise exposed workers were engaged in the textile industry in developing countries. Exposure to noise over a long period can damage the eardrum and can cause hearing loss. Other problems such as fatigue, absenteeism, agitation, anxiety, reduction of work capacity and efficiency, changes in heart rate and blood pressure, and sleep disturbances are also observed in the continuous exposure to noise. A lack of effective maintenance of machinery is one of the main reasons for the increase noise levels in most of the manufacturing units of the textile industry. Although noise exposure in textile factories causing serious health consequences, often ignored because its effects are not immediately visible.

Ergonomic problems were observed in most of the work units engaged in activities linked to the production of textiles and clothing. Employees in textile plants are unsafe and unhealthy working environment because they face big problems: inadequate furniture, inadequate ventilation and lighting, as well as the lack of effective security measures in case of emergency. Workers in such production units are at risk of developing a variety of occupational diseases [12].

On the basis of statistical sources can be pointed out that the sector of the textile industry in recent years, in the developed countries of the world, stands 3-4% of total investment in new resources to work in the production process. In the nineties of the twentieth century, textiles became an important market for top industry such as robotics, electronics, computer science, which is still influenced to a significant increase in the productivity of companies in the industry, and literally to the technical revolution. All this affected the increase in the annual production of fabrics. Speed, open end spinning "loom, new looms in the air and water jets and missiles, increased by 10 times compared to the traditional way of spinning looms with...
shuttle looms. Modernization of the equipment, in addition to increasing the quality of products has led to changes in the technical aspect of production, starting with reducing the number of stages of production, to process automation and transportation of products to the warehouse with the entire production line, as well as to the use of multipurpose machines. Microprocessors are installed in all types of machinery and computerized production, optimize the production of drawings, fabric and shape. Modern fashion industry is constantly seeking new products to encourage research and innovation in this sector and encourage the discovery of new materials better characteristics. More and more weight making fibers of smaller thickness, acting on the molecules of which it is composed. [14] Textiles, textile products, modern textile industry as a combined material, expands the field of work of the textile industry, connecting the construction industry (concrete firmness) and medicine, shall be biodegradable tissue in the human body - eg. textile reinforcement in plastic surgery [16]. These changes in the production process in the textile industry development, however, did not significantly affect the reduction of workplace injuries and occupational diseases of employees in the industry. Each process of textile production was traditional or contemporary higher or lower degree contains risks to the safety and health of employees affected by the emergence of a professional team conquer technique and diseases related to work. What can be noted is that in recent years greatly increased the activity of their managers of human resources in safeguarding the safety and health of workers and the active participation of the management of health promotion at work in this segment of industrial production. Environmental pollution caused by excessive creation of textile waste as well as high consumption of natural resources, oil and other raw materials used in the further production of textile materials, require finding possibilities for their reuse. The laws and environmental standards stipulate strict criteria for processes in the textile industry in accordance with the laws of the European Union. Also, the textile industry emits a wide range of pollutants at all stages of processing fibers into textile material. All these substances and hazards in the working environment and working environment, be sure to exposed workers employed in this sector.

4. CONCLUSION

Safety and health at work involves the realization of the working conditions in which they undertake certain measures and activities in order to protect the life and health of employees. The interest of society, of all stakeholders and every individual is to achieve the highest level of safety and health at work, to unwanted consequences such as injuries, occupational diseases and diseases related to work are reduced to a minimum, and to create the conditions work in which employees have a sense of satisfaction in the performance of their professional duties. For the realization of this aim, a systematic approach to preventive action and connect all entities who are holders of certain obligations and activities. The management system of health and safety at work, as part of the management of the organization, has the task of developing and implementing a policy of health and safety and risk management of health and safety at work. With the progress of industrial production increases in the number of hazardous and harmful substances that may pose a potential danger to the employee and his environment. It is therefore very important that these problems special attention.

Safety and health measures play an important role in any industry, including the textile. It is important that employees in the textile industry should be aware of different occupational risks. At the same time, it is essential that management take the necessary steps to protect workers from potential dangerous situations and raise awareness of the health problems in the organization and their economic importance. Bearing in mind that the concern about the employee one of the most important aspects of socially responsible business organization,
motivation of employees, their satisfaction, mid-career training and development are both personal as well as the success of the organization. One of the factors that greatly affect the satisfaction of employees considered is the safety and health of workers at work, which is closely related to the conditions of the working environment. Download all measures in order to eliminate the risk of possible injuries and occupational diseases is the main activity of management of modern organizations.

5. ACKNOWLEDGEMENTS

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6. REFERENCES

MATHEMATICAL APPARATUS USED IN “METHOD OF MODELS” FOR THE STUDY OF SLIDER-CRANK MECHANISM (RRRP)

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Abstract: „The method of models” is a graphical method for determining kinematic characteristic of links and points of polycontoured mechanism. It allows solving the problem only for the desired link or point. For this purpose must find their images in “secondary” and “tertiary” model of mechanism. In present paper mathematical apparatus, replacing graphical work with analytical calculations is proposed, to analyze slider-crank mechanism (RRRP).

Keywords: method of models, kinematic characteristics, slider-crank mechanism, mathematical apparatus.

1. INTRODUCTION

Method of models is proposed by Piperkov [1] and writes up by Tenchev [2]. Through it can be determined kinematic characteristics of random links and points on links of polycontoured mechanism without calculate it for previous ones. Only need to determine displacement function- must be drawn a mechanism for chosen value of the input parameter, which is assumed to be “primary model”. Rules are defined, which is carried out graphic representation of “secondary model” (for determining velocities) and “tertiary model “ (for determining accelerations) of mechanism. Advantage of this method is that it can obtain correct results for trigonometric functions for angles \( \varphi = k.\pi/2 \) (\( k=1,2, \ldots \)). The indefiniteness of arcsin functions is being avoided. The disadvantage of this method is great graphics work. Usually this method is used to analyze 12 positions of the mechanism or to clarify “conflict” positions obtained by analytical methods.

Most often polycontoured mechanisms are constructed from elementary four-linkage mechanisms, sequent connected. The slider-crank mechanism (RRRP) is one of many used in practice. In this work mathematical apparatus is available for determining the coordinates of the characteristic points of the slider-crank mechanism in its models without graphic representation. This enables research to be conducted for any number of positions of the mechanism.

2. NATURE OF “METHOD OF MODELS” FOR SLIDER-CRANK MECHANISM (RRRP)

Mechanism is built for the desired position. The centre of the model has been selected, as it is the axis of rotation of input link (for RRRP) – point O (picture below)

2.1. Secondary model

Assume, that input link (crank 1) has angular velocity \( \omega_1 \) and angular acceleration \( \varepsilon_1 \).

1’. Input link of mechanism 1 and its secondary image 1’ coincide, i.e. \( 1 \equiv 1’ \) and \( A \equiv A’ \).
2'. The secondary image of the link that carried out rectilinear translation (slider 3) on the stationary link (carriage), is a point lying on the line that passes through the center point O and is perpendicular to the direction of sliding.

3'. If points A and B lying on the link, that performs plane motion (rocker 2), and if image A' of point A is known, then secondary image B' of point B locates on line, which passes through A' and is parallel to line AB. Points A' and B' determine the position of secondary image of the rocker 2. Velocity $V_B = \omega_1 . OB'$ of point B is perpendicular to segment $OB'$ with direction corresponding of $\omega_1$ relative to the center O. The magnitude of the angular velocity of the rocker $AB$ is $\omega_{AB} = \frac{A'B'}{AB} . \omega_1$. If directed segments $AB$ and $A'B'$ are unidirectional, then angular velocity $\omega_{AB}$ has direction of $\omega_1$. If they are not, angular velocity $\omega_{AB}$ has opposite direction of $\omega_1$.

Secondary image $C'$ of third point C of the rocker $AB$ is determined through triangle $A'B'C'$, which is similar and equally oriented with triangle $ABC$. Velocity of point C is: $V_C = \omega_1 . OC'$. Velocity of point C is perpendicular to segment $OC'$ with direction corresponding of $\omega_1$ relative to the center O.

![Figure 1. Graphic constructions for Secondary and Tertiary model](image)

2.2. Tertiary model

1°. If the primary link 1 has angular velocity $\omega_1 = \text{const}$ ($\varepsilon_1 = 0$), then link 1 and its tertiary image $1''$ coincide, i.e. $1 \equiv 1''$ and $A \equiv A''$. The points and $A''$ determine tertiary image of input link in the tertiary model of the mechanism. If $\varepsilon_1 \neq 0$ input link 1 and its tertiary image $1''$ do not match. Image $A''$ of point $A$ is shifted perpendicularly to the segment $OA$. The magnitude of this displacement is: $AA'' = \frac{\varepsilon_1}{\omega_1^2} . OA$, but the direction is opposite to the acceleration $\varepsilon_1$.

The points $O$ and $A''$ determine position of tertiary image of the crank 1. Acceleration of point $A$ is directed from $A''$ to $O$ with magnitude $a_A = \omega_1^2 . OA''$. 

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2”. The tertiary image of the link, which performs translation (slider 3) on the motionless link (carriage), is a point, which lies on a line passing trough the center O and is parallel to the direction of sliding.

3”. Points A and B located on the rocker which performs pure motion. If the tertiary image A" of point A of the rocker is known, then tertiary image B" of point B lies on line q which is perpendicular to segment AB at a distance A"N₁ from the image A". The segment A"N₁ is determined by formula \( A"N₁ = \frac{(A'B')²}{AB} \). The direction from A" to N₁ corresponds to the direction from A to B. The points A" and B" determine position of tertiary image of the rocker in tertiary model of mechanism. Acceleration \( \overrightarrow{a}_b \) in the tertiary model has direction from B" to O with magnitude \( a_B = \omega^2 \cdot OB" \). If the segment B"N₁ consider as a vector \( \overrightarrow{B'N}_1 \) and observes rotation of segment A"B" on it about point A", then it is the direction of angular acceleration \( \varepsilon_{AB} \) of the rocker. The magnitude of this acceleration is \( \varepsilon_{AB} = \frac{B'N_1}{AB} \cdot \omega^2 \).

Tertiary image C" of third point C of the rocker is obtained through triangle A"B"C", which is similar and equally oriented with triangle ABC. The acceleration of point C has direction from C" to O with magnitude \( a_C = \omega^2 \cdot OC" \).

2.3. Graphic constructions

a. Primary model: The mechanism is built for the desired position in scale 1 : 1 (Picture above). Coordinate axis Ox is chosen parallel to the direction of sliding n-n.

b. Secondary model: The line \( m \perp Ox \) is plotted through point O; segment AB is extended to its intersection with \( m \); Intersection point is point B'; The line \( p \parallel BC \) is constructed trough point B', as trough point A line q (segment AC extension); line q and line \( p \) do intersect at point C'.

c. Tertiary model: segment AA" \perp OA \) is plotted; line \( k \parallel AB \) is plotted trough point A"and segment A"N₁ is noted. Through point N₁ the line \( h \perp AB \) is plotted; line h intersect coordinate axis Ox at point B" which is tertiary image of point B; Triangle A"B"C", is built which is similar to triangle ABC.

3. MATHEMATICAL APPARATUS FOR DETERMINING CHARACTERISTIC POINTS OF THE MECHANISM

From the primary model displacement function \( x_p = x_B(\varphi) \) and \( \sigma = \sigma(\varphi) \) is determined. Coordinates of the characteristic points of the mechanism are:

Point A: \( x_A = OA.\cos \varphi \quad y_A = OA.\sin \varphi \)

Point B: \( x_B = OA.\cos \varphi + AB.\cos \sigma \quad y_B = e \)

Point C: \( x_C = OA.\cos \varphi + AC.\cos(\alpha + \sigma) \quad y_C = OA.\sin \varphi + AC.\sin(\alpha + \sigma) \)

3.1. Secondary model

- Coordinates of p. A': \( x_{A'} = x_A \quad y_{A'} = y_A \)
- Slope of the lines:
\[ AB \rightarrow K_{AB} = \frac{y_B - y_A}{x_B - x_A} \quad OA \rightarrow K_{OA} = \frac{y_A}{x_A} \quad AC \rightarrow K_{AC} = \frac{y_C - y_A}{x_C - x_A} \quad BC \rightarrow K_{BC} = \frac{y_C - y_B}{x_C - x_B} \]

- Coordinates of the intersection point between the rocker \( AB \) and coordinate axis \( Ox \):

\[ x_P = x_A - \frac{y_A}{K_{AB}} \quad y_P = 0 \]

- Coordinates of point \( B' \): \( y_B' = x_P \cdot \tan(-\sigma) \quad x_B' = 0 \)

- Coordinates of point \( C' \):

\[ x_C' = \frac{K_{AC} \cdot x_A - K_{BC} \cdot x_B' + y_B' - y_A}{K_{AC} - K_{BC}} \quad y_C' = y_B' + K_{BC} \cdot (x_C' - x_B') \]

- Length of the segment \( OC' \): \( OC' = \sqrt{x_C'^2 + y_C'^2} \)

3.2. Tertiary model

- Length of the segment \( AA'' \): \( AA'' = \frac{e_1}{\omega_1} \cdot OA \)

- Coordinates of point \( A'' \):

\[ x_{A''} = x_A + AA''.\cos\left(\frac{\pi}{2} - \varphi\right) \quad y_{A''} = y_A + AA''.\sin\left(\frac{\pi}{2} - \varphi\right) \]

- Length of the segment \( A'B' \): \( A'B' = \sqrt{(x_{A'} - x_{B'})^2 + (y_{A'} - y_{B'})^2} \)

- Length of the segment \( A''N_1 \): \( A''N_1 = \frac{A'B'}{AB} \)

- Coordinates of point \( N_1 \):

\[ x_{N_1} = x_{A''} + A''N_1.\cos\sigma \quad y_{N_1} = y_{A''} + A''N_1.\sin\sigma \]

- Slope of the line: \( K_{N_1B'} = \frac{1}{K_{AB}} \)

- Coordinates of point \( B'' \): \( x_{B''} = x_{N_1} + \frac{y_{N_1}}{K_{N_1B'}} \quad y_{B''} = 0 \)

- Slope of the lines: \( A''B'' \rightarrow K_{A''B''} = \frac{y_{A''}}{x_{A''} - x_{B''}} \)
\[ A'C' \rightarrow K_{A'C'} = \frac{K_{A'B'} + \tan(\alpha)}{1 - K_{A'B'} \cdot \tan(\alpha)}; \quad B'C' \rightarrow K_{B'C'} = \frac{K_{A'B'} - \tan(\beta)}{1 + K_{A'B'} \cdot \tan(\beta)} \]

- Coordinates of point \( C' \):

\[
x_c' = \frac{K_{A'C'} \cdot x_A - K_{B'C'} \cdot x_B - y_{A'}}{K_{A'C'} - K_{B'C'}};
\]
\[
y_c' = K_{B'C'}(x_{C'} - x_B')
\]

- Length of the segment \( OC' \):

\[
OC' = \sqrt{x_{C'}^2 + y_{C'}^2}
\]

With so designate coordinates of the points and length of the sections are calculated kinematic characteristics of any link and point of the mechanism.

4. CONCLUSIONS

This article provides mathematical apparatus for determination of kinematic characteristics of links and points on them of the slider-crank mechanism. Apparatus is based on the “method of models”, retaining its advantages and avoids the extensive graphic work. Presented equations are simple and can be implemented in a computer program. Mathematical apparatus allows studying the mechanism for a desired number of positions.

5. REFERENCES

MATHEMATICAL APPARATUS USED IN “METHOD OF MODELS” FOR THE STUDY OF FOUR-BAR LINKAGE MECHANISM (RRRRR)

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Abstract: “The method of models” is a graphical method for determining kinematic characteristics of links and points of polycontoured mechanism. For this purpose must find their images in the “secondary” and “tertiary” mechanism’s model. In present paper mathematical approach, replacing graphical work with analytical calculations is proposed, to analyze four-bar linkage mechanism.

Key words: method of models, kinematic characteristics, four-bar linkage, mathematical apparatus.

1. INTRODUCTION

Method of models is proposed by Piperkov [1] and developed by Tenchev [2]. Through it can be determined kinematic characteristics of random links and points of polycontoured mechanism without calculate it for previous ones. Only need to draw a mechanism in the desired position, which is assumed to be “primary model”. This is displacement function for selected value of the input parameter. Graphic representation of “secondary model” / for determining velocities/ and “tertiary model” / for determining accelerations/ of mechanism is carried out according to certain rules. Advantage of this method is that it can obtain correct results for trigonometric functions for angles $\varphi = k \cdot \pi/2$ (k=1,2, ...). The indefiniteness of arcos functions is being avoided. The disadvantage of this method is great graphics work. Usually this method is used to analyze 12 positions of the mechanism or to clarify “conflict” positions obtained by analytical methods.

Typically polycontoured mechanisms are constructed from elementary four-linkage mechanisms.

In this work mathematical apparatus is available for determining the coordinates of the characteristic points of the four-bar linkage mechanism in its models without graphic representation. This enables research to be conducted for any number of positions of the mechanism.

2. NATURE OF “METHOD OF MODELS” FOR FOUR-BAR LINKAGE MECHANISM.

The mechanism is built for the desired position. The centre of the model has been selected, for RRRR it is the axis of rotation of input link – point O (picture below).

2.1. Secondary model

1’. The main link of the mechanism 1 and its secondary image 1’ coincide, i.e. 1 = 1’ and A = A’.

2’. If the secondary image A’ of point A of the rocker is known, then secondary image B’ of point B is located on the line which passes through A’ and is parallel to line AB. Points A’B’ determine the position of the secondary image of the rocker in secondary model of the
mechanism. The velocity \( V_B = \omega_1 OB' \) of point \( B \) is perpendicular to the segment \( OB' \) and is with direction corresponding of \( \omega_1 \) relative to the center \( O \). Angular velocity of the rocker \( AB \) is: \( \omega_{AB} = \frac{A'B'}{AB} \cdot \omega_1 \). If directed segments \( AB \) and \( A'B' \) are unidirectional, then angular velocity \( \omega_{AB} \) has the same direction as \( \omega_1 \). If they are not, angular velocity \( \omega_{AB} \) has opposite direction of \( \omega_1 \).

Secondary image \( M \) of third point \( M \) on the rocker \( AB \) is obtained by triangle \( A'B'M' \), which is similar and equally oriented with triangle \( ABM \). Velocity of point \( M \): \( V_M = \omega_1 OM' \) is perpendicular to the segment \( OM' \) with direction corresponding of \( \omega_1 \) relative to the center \( O \). Secondary image \( C' \) of point \( C \) of the rocker coincide with center \( O \), and secondary image \( B' \) of point \( B \) lies on line that passes through the center \( O \), parallel to the line \( BC \). Points \( C' \) and \( B' \) determine the position of secondary image of the rocker \( BC \) in the secondary model of the mechanism. The magnitude of the angular velocity of the rocker \( BC \) is: \( \omega_{BC} = \frac{C'B'}{CB} \cdot \omega_1 \). If directed segments \( CB \) and \( C'B' \) are unidirectional, then angular velocity \( \omega_{BC} \) has direction of \( \omega_1 \). If they are not, angular velocity \( \omega_{BC} \) has opposite direction of \( \omega_1 \).

Figure 1. Graphic constructions for Secondary and Tertiary model.
2.2. Tertiary model

1". If input link 1 has angular velocity \( \omega_1 = \text{const} (\varepsilon_1 = 0) \), then link 1 and its tertiary image 1" coincide i.e. \( 1 = 1" \) and \( A = A" \). Points \( O \) and \( A" \) determine tertiary image of primary link in the tertiary model of the mechanism. If the acceleration of the primary link 1 is \( \varepsilon_1 \neq 0 \), tertiary image \( A" \) of point \( A \) is shifted at a distance \( AA" = \frac{\varepsilon_1}{\omega_1^2}.OA \). Directed segment \( AA" \) is perpendicular to the segment \( OA \) with direction opposite to acceleration \( \varepsilon_1 \).

2". If tertiary image \( A" \) of point \( A \) on the rocker is known, the tertiary image \( B" \) of point \( B \) lies on line, perpendicular to segment \( AB \) at a distance \( A"N_t \) of image \( A" \). Segment \( A"N_t \) is defined as \( A"N_t = (A'B')^2/AB \). The direction from \( A" \) to \( N_t \) corresponds to the direction from \( A \) to \( B \). Points \( A" \) and \( B" \) determine position of tertiary image of the rocker in the tertiary model of the mechanism. Acceleration \( \overrightarrow{a}_M \) in tertiary model is directed from \( B" \) to \( O \) with magnitude \( a_M = \omega^2 OB" \). If the segment \( B"N_t \) is considered as a vector \( \overrightarrow{BN}_t \) and observes rotation of segment \( A"B" \) on it about point \( A" \), then it is the direction of angular acceleration \( \varepsilon_{AB} \) of the rocker. The magnitude of this acceleration is \( \varepsilon_{AB} = B"N_1/AB \cdot \omega^2 \).

The tertiary image \( M" \) of third point \( M \) on the rocker is obtained by triangle \( A"B"M" \), which is similar and equally oriented with triangle \( ABM \). Acceleration \( \overrightarrow{a}_M \) in tertiary model has direction from \( M" \) to \( O \) with magnitude \( a_M = \omega^2 OM" \).

3". The tertiary image \( C" \) of point \( C \) of the rocker coincide with center \( O \), and tertiary image \( B" \) of point \( B \) lies on line which is perpendicular to the segment \( BC \) at a distance \( C"N_2 \) from the center \( C" \equiv O \). The magnitude of \( C"N_2 \) is determined by the formula \( C"N_2 = (CB)^2/BC \). The direction from \( C" \) to \( N_2 \) corresponds to the direction from \( C \) to \( B \). Points \( C" \) and \( B" \) determine the position of tertiary image of the crank in the tertiary model of the mechanism. If the segment \( C"N_2 \) is considered as a vector \( C"N_2 \) and track rotation of segment \( C"B" \) on it about point \( C" \), then it is the direction of angular velocity \( \varepsilon_{BC} \) of the crank with magnitude \( \varepsilon_{CB} = C"N_2/BC \cdot \omega^2 \).

2.3. Graphic constructions

a. Primary model: Mechanism is built in desired position in scale 1:1 (picture above). Coordinate axis \( OC \) is assumed to coincide with the segment \( OC \).

b. Secondary model: through the point \( O \) line \( m \parallel BC \) is plotted, segment \( AB \) is extended to its intersection with \( m \); intersection point is \( p \). \( B" \); Line \( p \parallel BM \) is plotted through point \( B" \), through point \( A \) line \( n \) (extended segment \( AM \)); intersection point between \( m \) and \( p \) is point \( M" \).

c. Tertiary model: position of point \( A" \) is located; position of point \( N_1 \) and \( N_2 \) are located and through them lines \( k \perp AB \) and \( q \perp BC \) is plotted; its intersection point is \( B" \); lines \( s \) and \( t \) are built so that \( \triangle A"B"M" \) is similar to \( \triangle ABM \).
3. MATHEMATICAL APPARATUS FOR DETERMINING CHARACTERISTIC POINTS OF MECHANISM

From the “primary model" the coordinates of characteristic points is determined:
Point A: \( x_A = O_A \cos \varphi, y_A = O_A \sin \varphi \)
Point B: \( x_B = O_C + C_B \cos \psi, y_B = C_B \sin \psi \)
Point C: \( x_C = O_C \)

The angle \( \xi \) between rocker \( AB \) and coordinate axis \( Ox \) is determine from primary model of mechanism or \( \cos \xi = \frac{x_B - x_A}{AB} \).

3.1. Secondary model

- Coordinates of p. \( A' \): \( x_{A'} = x_A, y_{A'} = y_A; \) coordinates of p. \( C' \): \( x_{C'} = 0; y_{C'} = 0 \)
- Slopes of the lines, determined by segments: \( OA \rightarrow K_A = \frac{y_A}{x_A}; CB \rightarrow K_B = \frac{y_B}{x_B - OC} \)

\[
AB \rightarrow K_{AB} = \frac{y_B - y_A}{x_B - x_A}; \quad AM \rightarrow K_{AM} = \frac{y_M - y_A}{x_M - x_A}; \quad BM \rightarrow K_{BM} = \frac{y_M - y_B}{x_M - x_B}
\]

- Coordinates of p. \( P \) (intersection point between line defined by segment \( AB \) and coordinate axis \( Ox \))

\[
x_P = x_A - \frac{y_A}{K_{AB}}
\]

- Length of the segment \( OB' \): \( OB' = OC \cdot \frac{x_P}{x_P - x_C} \)

- Coordinate of the p. \( B' \): \( x_{B'} = OB' \cdot \cos \psi; y_{B'} = OB' \cdot \sin \psi \)

- Length of the segment \( A'B' \): \( A'B' = \sqrt{(x_{A'} - x_{B'})^2 + (y_{A'} - y_{B'})^2} \)

- Slope of the line, determined by segment \( A'M' \) is the same as \( AM \).

- Slope of the line, determined by segment \( B'M' \) is the same as \( BM \).

- Coordinates of p. \( M' \): \( x_{M'} = \frac{K_{AM} \cdot x_A - K_{BM} \cdot x_{B'} + y_{B'} - y_A}{K_{AM} - K_{BM}}; y_{M'} = y_{B'} + K_{BM} \cdot x_{M'} - x_{B'} \)

- Length of the segment \( OM' \): \( OM' = \sqrt{x_{M'}^2 + y_{M'}^2} \)

3.2. Tertiary model

- Length of the segment \( AA'' \): \( AA'' = \frac{\xi_1}{\omega_A^1} \cdot OA \)

- Coordinates of p. \( C'' \): \( x_{C''} = 0; y_{C''} = 0 \)

- Coordinates of p. \( A'' \): \( x_{A''} = x_A + AA'' \cdot \cos \left( \frac{\pi}{2} - \varphi \right), y_{A''} = y_A - AA'' \cdot \sin \left( \frac{\pi}{2} - \varphi \right) \)
- Length of the segment $A^*N_1$: 
  
  $A^*N_1 = \frac{(A'B')^2}{AB}$

- Length of the segment $ON_2$: 
  
  $ON_2 = \frac{(OB')^2}{CB}$

- Coordinates of points $N_1$ и $N_2$

  $x_{N1} = x_A + A^*N_1 \cdot \cos \xi$  
  $y_{N1} = y_A + A^*N_1 \cdot \sin \xi$

  $x_{N2} = ON_2 \cdot \cos \psi$  
  $y_{N2} = ON_2 \cdot \sin \psi$

- Coordinates of point $B^*$:

  $x_{B^*} = \frac{1}{k_{AB}} x_{N1} - \frac{1}{k_{BC}} x_{N2} - y_{N2} + y_{N1}
  
  $y_{B^*} = y_{N1} + \frac{1}{k_{AB}} (x_{N1} - x_{B^*})$

- Slope of the lines, determined by segments $A^*B^*$, $A^*M^*$ и $B^*M^*$:

  $K_{A^*B^*} = \frac{y_{A^*} - y_{B^*}}{x_{A^*} - x_{B^*}}$  
  $K_{A^*M^*} = \frac{k_{A^*B^*} + \tan \alpha}{1 - k_{A^*B^*} \tan \alpha}$  
  $K_{B^*M^*} = \frac{k_{A^*B^*} - \tan \beta}{1 + k_{A^*B^*} \tan \beta}$

- Coordinates of point $M^*$:

  $x_{M^*} = \frac{K_{A^*M^*} x_{A^*} - K_{B^*M^*} x_{B^*} + y_{B^*} - y_{A^*}}{K_{A^*M^*} - K_{B^*M^*}}$
  
  $y_{M^*} = y_{B^*} + K_{B^*M^*} (x_{M^*} - x_{B^*})$

- Length of the segment $OD^*$: 
  
  $OD^* = \sqrt{x_{D^*}^2 + y_{D^*}^2}$

4. CONCLUSIONS

This article provides mathematical apparatus that maintains the advantages of "method of models" and avoids voluminous graphics work. Presented equations are simple and can be implemented in a computer program. Mathematical apparatus allows studying mechanism for a desired number of positions.

5. REFERENCES


STUDY OF PRECISION CAPABILITIES OF MOVABLE TWO-BLADE SKIVING BLOCK WITH INSERTS SHIFTED ON THE AXIS

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Abstract: This article investigated the possibility of providing preliminarily elastic characteristic of movable two-blade skiving block with axially displaced inserts for achieving high accuracy, which does not depend on the diffusion of the allowance of machining.

Keywords: skiving of hydraulic cylinders, movable two-blade block with axially displaced inserts.

1. INTRODUCTION

Tools for combined processing by cutting and surface plastic deformation (SPD) are widely used for mass processing of the openings of the hydraulic and pneumatic power cylinders [3]. Toward their working surfaces are laid down high requirements for quality in terms of accuracy of diametrically size and roughness. The roughness is achieved by deforming part of the combined instrument and the precision provided by the cutting part. It performs skiving most often with the help of two-blade block with oppositely arranged cutting inserts. During operation, the block is self-established in the radial direction as a result of the dynamic equilibrium between the radial cutting forces, guaranteed by its mobility in the direction of their effect.

2. EXPOSE

The movable two-blade block (MTB) is adjusted on the dimension in advance and dimension of the static adjusting \( L_H \) does not correct during all work cycle. Therefore, by treating a batch details, the relation between tolerance of the opening diameter of the workpiece \( 0_{TD} \) and that of the treated surface \( T_{TD} \) depends on the stability of the technological system, which in this case includes only the workpiece and MTB. If the elastic deformation of the last mentioned is neglected the precision after skiving is so much higher, many as the higher is its strength in the radial direction. There are structures of MTB in which the above conclusion is not valid. Their cutting inserts are displaced in the axial direction, i.e. their main cutting edges (homonymous points thereof) do not lie in a plane perpendicular to the axis of rotation. Displacement \( X \) leads to increasing of the diameter of threatened opening the dimension \( L_H \) as a result of radial displacement \( \Delta \) of MTB toward lagged insert and it is characterized by a limit value \( X_{\text{up}} \), after which the displacement receives constant maximum value \([5, 6]\). The reason for this is the self-establishment of the block to satisfy the dynamic equilibrium and the beneficial effect from this is the removal of the tool from the processed hole without scrapes on its surface.

It has been found theoretically that the axial displacement of the inserts \( X \geq X_{\text{up}} \) and non-deformable MTB Field of the dissipation of the workpiece can be reduced three times \([1, 6]\). Its precision capabilities is increased by increasing its amenability, whereby it is possible to...
determine an elastic feature in which the variance of allowance of machining for skiving will not impact on the obtained diameter [5, 6]. Basis for this assertion is the deduced theoretical dependence

\[ TD = \frac{TD_0}{3} - \frac{4}{3}(E_r - E_M), \]  

where \( E_r \) and \( E_M \) are respectively large and small elastic deformations of MTB obtained by maximum and minimum allowances of machining for skiving, generating relevant cutting forces (\( F_p^{\text{max}} \) and \( F_p^{\text{min}} \)).

It is obvious the existence of the theoretical possibility \( TD = 0 \), if the difference between elastic deformation satisfies the condition

\[ \Delta E = E_r - E_M = \frac{TD_0}{4} = \frac{\Delta Z}{2}, \]  

where \( \Delta Z \) is the unilateral increasing the allowances of machining.

This condition determines the type of the elastic characteristic of the body of MTB for the preparation of which is necessary to be known the cutting forces which provoke the above deformations. The connection between them can be seen from the dependencies:

\[ E_M = \frac{F_p^{\text{min}} \Delta E}{\Delta F_p}; \quad E_r = \frac{F_p^{\text{max}} \Delta E}{\Delta F_p}. \]  

Methodology for determining the elastic characteristics of the MTB comprises the following steps:

- The field of dispersion of the diameter of the workpiece (by measuring of the batch cylinders before the combined treatment) is determined

\[ TD_0 = D_0 - D_0', \text{ mm}. \]  

where \( D_0'^{\ell} \) and \( D_0'^{\ell} \) are respectively upper and lower limit dimensions of the opening of the workpiece.

- The minimum and maximum depths of cut depending on the variation of allowances of machining are calculated

\[ a_p^{\text{min}} = \frac{D^\ell - D_0'}{4}, \text{ mm} \]
\[ a_p^{\text{max}} = \frac{D^{\ell} - D_0'^\ell}{4}, \text{ mm} \]

where \( D^{\ell} \) and \( D^{\ell} \) are respectively upper and lower limit dimensions of the opening after machining.

- The radial cutting forces corresponding to the minimum and maximum depths of cut are calculated:

\[ F_p^{\text{min}} = 549 + 3970.a_p^{\text{min}}, N \]
\[ F_p^{\text{max}} = 549 + 3970.a_p^{\text{max}}, N \]

Used dependencies are the result of a single factor experiment. The necessary difference between the maximum (\( E_r \)) and minimum (\( E_M \)) elastic deformations corresponding to \( F_p^{\text{max}} \) and \( F_p^{\text{min}} \) is determined and under condition (1) it must be

\[ \Delta E = \frac{TD_0}{4} \]
The desired elastic characteristic of MTB $F_p = f(E)$ is determined (may be presented graphically) as a straight line equation $F_p = kE$, in which
\[ k = \tan \frac{\Delta F_p M_F}{\Delta E M_E}, \]

where $\Delta F_p = F_p^{\text{max}} - F_p^{\text{min}}$;
$M_F$ и $M_E$ - the scale of the introduction of the corresponding values of $F_p$ and $E$ on the axes of Cartesian coordinate system (figure 1).

After preparation of MTB a test is done to determine whether its structure has stability which satisfying the built elastic characteristic. For this purpose MTB is loaded in the plane of action of the radial cutting forces with any force $F_p$ within the range $F_p^{\text{min}} \leq F_p \leq F_p^{\text{max}}$, that, the measured deformation $E_p$ should have size magnitude $E_p M_E = \frac{F_p M_F}{k}$ or is determined by equations (3). If this condition is not satisfied, actions to alter the stability of MTB are made to its implementation.

The size of static adjustment $L_{HL}$ is determined (the distance between the corner of the cutting inserts in a plane perpendicular to the axis of rotation of the workpiece) by the relation:

\[ L_{HL} = \frac{3D^F + 4E_p + D_t^3}{4} \]  

Figure 1. Regulated elastic characteristic of MTB

Cutting conditions of the SPD is selected.
3. METHODOLOGY FOR EXPERIMENTAL STUDY

3.1. Purpose of the study

Purpose of this study is the established theoretical dependence between the stability and accuracy of MTB after skiving openings with axial displacement of the cutting inserts, equal to or greater than the limit to be verified.

3.2. Test specimens

Test specimens are made in a manner consistent with the implementation of the production method for determining the stability of the technological system [4]. In this case it is used to determine the variance of the diameter after skiving with MTB with regulated stability in a predetermined dispersion of the opening diameter of the workpiece. Three identical specimens were prepared. Its design (shown in Figure 2) is consistent with the need to be established on the machine.

After the regulation of the cutting and deforming parts the samples are processed by single pass in direction indicated by $f$, whereby the allowance of machining of step 1 is insignificant (0,05 – 0,1mm), and the steps 2 and 3 are respectively with minimum and maximum allowance, which is the result of the actual field of dissipation of the diameters of the batch workpieces. Obtained diameters of steps 2 and 3 after the combined treatment are measured by a bore gauge with graduation 0,001mm.

![Figure 2. Test specimen for studying the impact of the stability of the MTB on accuracy of skiving with axially displaced inserts at a distance $X_0 \geq X_{rp}$](image)

Cutting part of the Instrument for combined processing contain MTB with prismatic cross-section (Figure 3and integrated elastic element with regulated characteristics defined by the above procedure. The cutting inserts have the following geometry: $\alpha_2 = 10^\circ$; $\gamma_2 = 0^\circ$; $\lambda_2 = 0^\circ$; $r_c = 0.2 \, mm$; $\kappa_r = 7^\circ$; $\kappa_r' = 1^\circ$.

The deforming part of the instrument is adjusted for work with tightness 0,1 mm toward the expected dimension after cutting part. All three steps of the test specimens are machined, relying on the function of vibration damping of the deforming part. The allowable dispersion
of steps diameters 2 and 3 of the individual specimens before the test is 0,2 mm. The experiments were carried out without coolant and for ejecting the chips before the instrument is used compressed air.

![Figure 3. Movable two-blade block](image)

3.3. Terms of carrying out the examinations and obtained results

The conditions for carrying out the examinations cover three groups of parameters - dimensional, power and regime. Dimensional parameters include tolerances and limit values of the hole diameter the before \( D = 90H8 = 90^{0.058} \) and after \( D_0 = 89^{0.5} \) combined treatment. The power parameters are obtained through the methodology, exposed above and are determined the regulated stability of MTB. Regime parameters include elements of cutting condition \((a_p, f, V_c)\) and of SPD (tightness \(-C\)).

All parameters and results of the tests are shown in Table 1.

<table>
<thead>
<tr>
<th>Test specimen No</th>
<th>Diameters after combined treatment, mm</th>
<th>Difference between 2 and 3</th>
<th>Roughness (R_a, \mu m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>step 2</td>
<td>step 3</td>
<td>mm</td>
<td>% to TD</td>
</tr>
<tr>
<td>1</td>
<td>90,063</td>
<td>90,070</td>
<td>0,007</td>
</tr>
<tr>
<td>2</td>
<td>90,057</td>
<td>90,067</td>
<td>0,010</td>
</tr>
<tr>
<td>3</td>
<td>90,049</td>
<td>90,055</td>
<td>0,006</td>
</tr>
</tbody>
</table>

Table 1. Conditions for carrying out and results of the examinations
4. ANALYSIS OF RESULTS

The test results show a relatively high degree of overlapping of theoretically justified expectations of the capabilities of the PSUR with axially displaced cutting inserts to exhibit insensitivity to the dissipation of the machining allowance, when the elastic characteristic which expressing its stability is obeyed a certain dependence between radial forces and deformations, i.e. is regulated. Reason for such an opinion is little difference between the diameters of steps 2 and 3, which indicates reduction of the tolerance of the workpiece from 50 to 80 times. Besides, the diameters of the steps are about the upper limit or a little exceed it. One of the reason for this could be the expected enlargement of the opening in result of SPD, which generally does not exceed 0,01 - 0,02mm.

The fixed difference between the steps of the specimens ranges from 11 to 18%, which is within the acceptable error in carrying out experimental studies of processing by cutting. The measured roughness entirely satisfies the requirements of the cylinder opening surfaces.

5. CONCLUSIONS

- With known (allowable) fields of the dispersing of the diameters of the openings before and after skiving with MTB with axial displacement of the cutting inserts $X_0 \geq X_{zp}$ and reliable correlations for determining the cutting forces, it is not difficult to create a design feature so that the body of MTB to possess regulated elastic characteristics (condition 1) for achieving high accuracy with minimal depending on the fluctuation of the allowance of machining for skiving.
- Using of the MTB with regulated elastic characteristic of its body required in the construction of the tool for combined processing to exist a device to change the dimension of the static setting at the beginning and end of stroke which should be larger than the upper limit of the diameter of the processed opening and it is not possible removal of the tool without scratching the treated surface.

6. REFERENCES

COMBINED TOOL WITH POSSIBILITIES FOR ONE-TIME MACHINING OF OPENING OF HYDRAULIC CYLINDERS

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Abstract: The present article is suggested new design of the cutting part of the combine tool for treatment the holes of hydraulic cylinders in which the cutting inserts of the movable two-blade block are axially displaced. As a result of this removed allowance of machining increases and provides high accuracy and productivity.

Keywords: skiving of hydraulic cylinders, movable two-blade block with axially displaced inserts.

1. INTRODUCTION

Operational reliability of hydraulic cylinders is determined by the tightness of their knee-joint compounds and its provision imposes typical quality requirements cylinder opening, which are particularly high for roughness of their working surfaces. Their nomenclature is characterized by great diversity of lengths and diameters of the opening, due to the demands of users.

A major manufacturer of hydraulic cylinders in Bulgaria is "Hydraulic elements and systems” – PLC, Yambol, where our developments of combined tools have industrial deployment and with them are experimented for production of new technical solutions.

From the analysis of the production programs of the company we found that the highest annual volume occupied cylinder opening with diameters 90 mm and 110 mm. Different lots cylinders differ in length and external design, but the technological process for obtaining opening is the same and is implemented in terms of batch production. Different lots cylinders differ in length and external design, but the technological process for obtaining holes is the same and is implemented in terms of batch production. [5]

2. EXPOSE

Existing tools for combined processing consist of cutting and deforming parts. The cutting part is crucial for the performance of the processing and the accuracy of the diametric dimensions. Accuracy is achieved by using movable two-blade block (MTB) for skiving with oppositely arranged inserts. It has very high stability (hardness) at pressure and productivity by cutting inserts with very small adjusting angles \((\kappa_s < 10^\circ; \kappa_p < 1^\circ)\) [1, 3], which allow feed speed to \(f = 4 \text{ mm/rev}\). If the corresponding points of the main cutting edges lie in planes perpendicular to the axis of rotation there is a restriction about size of the received allowance of machining \((0.5 - 0.7 \text{ mm})\). This requires preliminary skiving of the workpiece which prolong technological process or the use of expensive pipes with higher precision of the openings.
The mentioned problem could be overcome to a large extent if the inserts of MTB become dislocated in the axial direction at a distance of in which the sections of the shear layers do not interfere [2, 3]. This allows for a double increase the addition and for a single treatment of the tubular workpiece (without preliminary skiving). Since in this case, the precision opportunities of MTB are limited (theoretical three times decreases the dissipation field of the workpiece). To be fully compensated this limitation the maximum stability of the block is replaced with regulated [4].

An important requirement to the tools for combined processing is their cutting part to have constantly guided (basing) along the treated surface. It is implemented by non-metallic guides, which together with the deforming part perform functions to reduce vibration, too.

Other requirement, which is essential for the applicability of tools is their going out (return) through processed opening to do not cause the appearance of traces or injuries mirrored appearance of the surface formed by the deforming part of the instrument.

2.1. Description of the developed construction of combined instrument

The construction of instrument for combined processing openings with a nominal diameter of 110mm, conforming to the conditions described above is shown in Figure 1. [5]

The cutting part includes a body 3, cover 1, centering pin 2, screws 33, non-metallic guides 35 and movable two-blade block 32 (its structure is described separately) housed in a channel of the body with square section. This part is joined to the supporting shaft 31 by key coupling and is rigidly secured thereto by means of front screws which are not visible in the figure. Non-metallic guides are firmly fixed in the four channels of the body 3, which are centered in such a way that the diameter of the circle described around them is greater than the processed opening and its axis coincides with the axis of the tool.

Deforming part consists of deforming tapper rolls 5 housed in the separator sleeve 7, bearing pins 6 and bearing tapered bushing 29, mounted to the support shaft 31 by key coupling. Separator sleeve 7 is assembled by screws 9 to the hub 8 which is mounted on the shaft by means of radial 28 and axial 10 bearings.

The hub 8 is connected to the threaded sleeve 25 by a nut 26 which is rigidly fixed relative to the hub by means of screws 12. The threaded sleeve 25 is assembled to the shaft 31 by key coupling with possibilities for free axial movement. It is realized through the adjustment nut 14, assembled rotatably to the flange 17 through nut 16. The flange 17 is joined to the shaft with a clearance, but it is fixed toward to shaft thanks to the three studs 18 passing freely through holes in the bottom of the coupling nut 20. The studs press the flange 17 to the front face of the nut 20 under the action of spring 23, support 21 and screws 19. The rod 30 is connected to support 21 by a thread connection and lock nuts 22. At its free end is mounted special screw 34.

Adjusting of the deforming part is implemented by axial movement of deforming rolls 5 toward the bearing tapered bushing 29. For the purpose the locking screws 15 are loosened and in the rotation of the adjustment nut 14 the threaded bushing 25 drives hub with bearing that moves separator sleeve to taper sleeve 29. On the front surface of the nut 20 has a graduated scale from which one division corresponds to the change of the diameter of the circle described about the rolls (working-adjusting dimension) with 0,005 mm. In Figure 1 the position of rolls corresponds to the minimum adjusting dimension. Their adjusting dimension should be larger than the dimension of static adjusting of the block with 0,15÷0,25 mm.
Figure 1. Tool for combine processing with regulated stability of MTB, self-established through translation. Basic parts: I - cutting; II - deforming; III - coupling.
Smaller values are applied for smaller diameters. The coupling part of the tool contains a nut 20 to which is rigidly connected a supporting shaft 31 and by which the tool is established at the end of the boring bars being fastened by thread with a large pitch.

2.2. Description of the movable two-blade block

The construction of MTB is shown in Fig.2. It consists of two identical prismatic bodies 1, assembled to each other through the corresponding sides using screws 3 and guide keys 4. The method of assembly provides mobility of the bodies, relative each other. In the outer end of each of them is fixed mechanically inserts 2 with special shape and geometry. The insets are based in rectangular channels and are fixed by screws 7, thanks to elastic deformation of the bodies in the weakened sections, formed by holes 9 and 10 slots. The position of the inserts is determined by the supporting pins 8 and screws 13 so as to ensure the necessary axial displacement and the presence of minor cutting angle.

![Two-blade block for skiving with regulated stability](image)

The dimension of static adjustment is controlled using a micrometer and is adjusted by screws 5 and 6 as the distance between the tops of the cutting inserts. It can be made easier and more accurate with a device designed specifically for this purpose. Its use in axial displacement of the inserts is unavoidable.

The adjusting dimension is maintained constant by the action of springs 11 suspended so as they act for drawing closer the inserts against which counteracts stepped support 14 contacting the foreheads of adjusting screws 5 and 6. After adjusting the dimension the last mentioned are tightened to each of the bodies by screws. The stepped support 14 acts as a wedge, which through its lowest rung provides a smaller adjusting dimension in order to pull out the instrument without scratches on the workpiece. This is accomplished by axial shifting of the wedge in the direction of feed at the end of the working toolpath. The working adjusting dimension of the block is recovered by returning the wedge to starting (working) position after the fast reverse toolpath.

The stepped support 14 performs another important function - providing regulated stability of the MTB. For the purpose the support constructed as dynamometer device, type tuning fork (figure 3) and is dimensioned so that it has the required elastic characteristic.

Actions by adjusting the dimension and changing the inserts is carried out when the block is located outside the cutting part of the tool.
2.3. Description of the operating cycle of the tool

In initial (adjusted) position the tool, which is established toward the boring bar, is located inside the specially crafted adjusted unit which acts as a back reversing center of universal lathe and more precisely in the opening of the guide sleeve which appears continuation of back center. The circular primary motion is transmitted to the workpiece from the front to the reverse centre and the feed movement is realized by longitudinal carriage. The processing of the surface finishes when deforming rolls leave the outgoing head of the workpiece. During the stroke the cutting fluid is fed copious through the back center, the bulk of which passes through holes made on the hub 8 and taper sleeve 29 transporting chips to the front center. Through central clear opening of boring bars is actuated push rod that reaching the support 21 moves it in the direction of feed movement, shrinking tensioned spring 23 and by the studs 18 and flange 17 this movement is transmitted to the whole range of details relating to the separation bushing 7. At the same time and the same distance the rod 30 moves too. It enters with its front end between the two equal parts 1 (Figure 2) of the block and two-step support 5 is moved so that it stands on its lowest rung against the adjusting screws. In this situation, cutting and deforming parts of the instrument occupy sizes smaller than adjusting and the tool returns in a quick move to the starting position contacting with the treated surface with its non-metallic guides that protect it from sag. After the rapid move the push rod is retreated and the spring 23 restores the adjusting position of the both machining parts. In two-blade block this is carried out by returning the two-step support to the starting position by means of the rear end plane of the special screw 34 (Figure 1). The last mention passes with clearance through the opening of the two-step support, within which it the block has the necessary and sufficient freedom to self-establish freely during the work.

3. CONCLUSION

With the described design of the instrument is solved serious technical problem accompanying the combined processing of deep holes - pushing out the instrument of the processed opening at a quick move without the formation of unacceptable traces on its mirror surface. Its important advantages are:

- the possibility of removing the two times greater allowance of machining in comparison with existing similar instruments;
- high accuracy of the diametral dimension of treated surfaces;
- high productivity of the processing.
The first two advantages are resulted respectively from the axial displacement of the cutting inserts and the regulated stability of the MTB. The third advantage is due to the opportunity to work with great feed which is created by the special geometry of the used inserts.

4. REFERENCES

AN INNOVATIVE APPROACH FOR TRAINING IN PROGRAMMING USING VIRTUAL LABORATORIES

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Abstract: The paper describes and analyses the computer programming educational technology in Faculty of Technics and Technologies of Yambol, using traditional methodologies, e-learning and virtual laboratories. It reviews the characteristics of computer programming education, focusing on animation and simulations created by other higher education institutions on algorithm visualizations. The innovative approach has connected with using Moodle Virtual Lab and the Open Judge System for automatic students’ assessment and testing. In addition, the Virtual Laboratory for Training in Programming (VLTP) provides a virtual environment with animations, simulations and visualizations of the basic terms, algorithms and data structures in programming sphere. 

Keywords: Virtual Laboratory, training in programming, Moodle Virtual Programming Lab, Open Judge System, automatic testing, self-testing programming source code.

1. INTRODUCTION

Training in programming includes absorption of theoretical knowledge and achievement of practical skills for understanding and using of algorithms and data structures in a specific programming language and creating a programming code. Theoretical knowledge is related to the basic concepts in the programming area, most of which are abstract and their assimilation requires overcoming some difficulties and the need for understanding and comprehension by students. Practical skills for describing and application of algorithms require development of a new type of thinking – algorithmic. It allows describing the sequence of actions that will be implemented by a computer and therefore need to be extremely precise, clear and formal.

In the training on programming in Informatics course, the most challenging for students is self-test (debugging and testing their own programs). Further validation of the performance of educational tasks by teacher is the most time-consuming part of the learning process and it involves the elaboration of methods of estimation of expected future solutions. If the test solving theoretical problems focused on the analysis of solutions and corrects the course of the answers, the situation is different in solving practical problems. Test examination of the curriculum program aims to verify the correctness of the working program in all supposed practical situations specified in the condition of the task and to evaluate their effectiveness. The verification of this program without the direct student participation has developed only if the task is clear and full. We pay particular attention to the description of the formats of input and output data, the type of input parameters and output in the condition of tasks. The inclusion of test examples in input and output data in the task condition is useful. This allows the student to check if he properly understand the task condition [6].
2. METHODS AND TECHNOLOGY OF TRAINING IN PROGRAMMING AT FACULTY OF TECHNICS AND TECHNOLOGIES OF YAMBOL

We applied mixed form of education at Faculty of Technics and Technologies of Yambol. It is a combination of traditional, e-learning and virtual laboratory. For E-learning lecturers use virtual learning environment MOODLE, which has personalized for the needs of Trakia University - e-TrUni [5]. In e-TrUni there is developed C++ programming course, which offers students: syllabus curriculum, training and assessment technologies, vocabulary, videos, lectures, presentations, practical exercises designed to methodological guidance for use. In this environment, the training of students carries out as follows:

Students attend lectures to learn the theoretical material in C++ programming or prepare the material independently using textbooks and presentations offered in the e-learning course "Programming and Computer use - Part II." The theoretical material has presented with demonstration and explanation of the source code of the sample programs. The students have the opportunity to participate directly experimenting with examples of their computers, to ask questions, to discuss and to debate.

The participation in the practical exercises is mandatory. The students developed programs on already assimilated theoretical material in them. Upon completion of this part of the training, they must have learned and acquired practical skills for implementation of data types, operators, structures and basic algorithmic structures – chain, branching, cycle, sets and sets operations, symbol data and operations with them. In e-TrUni there are developed themes of all practical exercises with task conditions, block diagram algorithm for each of them and questions at the end of each exercise. This can be useful for the students who require additional training for self-study, for midterm or the final exam.

Each thematic unit has additional conditions of tasks for self-study, which are suitable for improving skills in programming. For the more difficult topics in C++ programming in the course are integrated video tutorials. There are indicated resources of Internet, which can be useful for personal independent learning.

Teaching technology in C++ programming includes Course work development which each student has to prepare and to attach his file in e-TrUni. At the end of the semester, the students have to defend his Course work. During the semester, students can do a test on the training material. The test aims to examine depth knowledge of the material and contains questions of different types, incl. fragments of programs, for which the lecturer expects introduction of the results of their performance by the keyboard. The similar test students have to do during the final exam.

They received also a ticket with three tasks with different levels of difficulty. After development tasks with C++ programs they save the source code of the program and a screenshot with the results of the implementation of the program. After the presentation of their programs, the code has discussed with the lecturer and he asks specific questions about its implementation. The evaluation has based on the average score of test results, source code of the tasks and the Course work. A certain number of bonus points bring them active participation in the lectures, exercises, and shown results during the semester.

The existing training system combines the traditional approach and uses the advantages offered by e-learning. E-TrUni allows identifying and administering forums, leaving messages and run videoconferencing communications. The disadvantage is the lack of opportunity to check the source code during the self-training students. To overcome this disadvantage in learning we apply innovative approach using virtual labs: Virtual Lab in Moodle and Open Judge System.
3. DISCUSSION AND RESULTS

3.1. Specific features of the training in programming

At introduction to the main concepts in the C ++ language program for better understanding of the material, the teacher’s explanation is supported with practical examples that can be presented graphically in a presentation or with animation. The term "variable" may be presented as a box with a label ("variable" name) and content - ("variable" value). The absorption of operators for conditional statement - Conditional operator and multiple choice may use visualization block diagram to solve the task by checking the condition from the electronic textbook [7]. The student is able to introduce a variable to see which branch of the algorithm has executed.

The students understand the loop operators if we focus on examples and visualize the process through block diagram illustrating the implementation of the cycle gradually when put into reverse order the digits of one number [8]. In testing of loop operator with „managing variable“ it is correct through every step to derive the value of the „managing variable“ and the values of other variables in the cycle body. Thus, the students better understand this operator and its operation.

To justify the need for a new data structure as the array for processing the sequence of numbers, which to date has be done with a simple variable, the lecturer should place task in solving that students need examine the row more than once. For example, to exchange a minimum and maximum number in a sequence of numbers. In this situation, the lecturer can use animations for elements of the array, and the appropriation of their values. For the detection of differences between the index and the value of the elements, it is desirable in animation to stress on the index and displays of its name and its value [9].

In introducing to functions and recursion at the beginning, the lecturer has to make justification for the need to use functions. A good example is the task of finding the largest of three numbers as the lecturer twice uses the function of finding the larger of the two numbers. Suitable animation for acquiring the knowledge is the animation of David Galles [11] from the University of San Francisco. He creates it with canvas element of HTML5 and programming code written in JavaScript interactive animations for visualization of three recursive subprograms - to calculate n!, reversing a string and the task for n queens (The task is to arrange N queens on the chessboard NxN in a manner that no two of them can not endanger each other). The basic algorithms can be presented with short animations that displayed a similar example of the practice - for example, the algorithm for changing the values of two variables with the changing of content of the two glasses using a third empty glass (i.e. the third additional variable). The students perceive much more easily the algorithm for minimum or maximum number in a range of numbers by displaying in the virtual laboratory through animation, video or as the other algorithms, connected to the elements of an array, presented schematically as rectangles with different heights and comparing with the current minimum or maximum element. The lecturer visualizes the algorithm for consistently search an element in an array in VLOP in this manner: he marks by different colors: examined elements (yellow), unexamined elements (green), found elements (red) and searching elements (cyan) - (Figure 1).

In sorting bubble algorithm, we can show the values of the elements that we exchange or by the algorithm for sorting through selection to take the next minimum or maximum element, depending on which algorithm option we implement.
In the training on programming, we use the experience of other universities. For example, at the University of Komarno – Slovakia, they have created a rich collection of interactive animations for teaching algorithms and programming. It is available on the Internet at the addresses specified in [1] and [2]. These animations and visualizations represent clearly step by step each of the algorithms. They help students to percept easier lectures. Another advantage is the possibility to repeat many times, and it can be at convenient time and place for the user. The only disadvantage is that there is not possibility the user to enter his input data and to experiment with it, and users work with the same set of animations' authors.

For visualization of sorting algorithms, we can use interactive animations of David Galles from the University of San Francisco. [11]

We consider that a justification for using dynamic data structures of data is needed - saving memory, more efficient implementation of operations „adding and removing“ elements. David Galles from the University of San Francisco creates interactive animations to visualize the basic operations in work with dynamic structures [11].

There is a web-based system DSLearning for e-learning in Dynamic data structures in Bulgaria. It is available at www.dslearning.eu.

3.2. Innovative approach in training in programming

3.2.1. Virtual Lab in Moodle

There is integrated module Virtual Programming Lab (VPL) in e-TrUni to overcome the disadvantages. It checks the tasks' code whose conditions lecturers specify in advance. Moodle VPL- Virtual Programming Lab is an activity module that can develop evaluation of program code and has following main features [10]:

Element with value 30 is with index 1.
It allows editing the source code of the programs in the browser using the applet;

- The students can run interactively their programs in the browser;
- Students can run tests to check their programs;
- It allows searching of similarity program code between files of other students;
- It allows limiting editing functions and avoiding copying and insertion of external text as a code for the program.

This module has realized as plug-in of virtual learning environment Moodle. It is responsible for input, control and compilation of program code. It can work with Ada, C, C++, C#, Fortran, Haskell, Java, Octave, Pascal, Perl, PHP, Prolog, Python, Ruby, Scheme, SQL and VHDL. In FTT – Yambol we use C++ and Java.

The sequence of student's actions for a program execution and testing present in following steps: [10]

- There is prepared file with student's program.
- The lecturer also has prepared the file "Execution files", which has the same name as the student's name.
- Depending on actions (run, debug or evaluate) the lecturer prepares the script file. If there is no script VLP takes script by default that automatically recognizes the programming language based on the extension of the saved file;
- In case of assessing if there is no script, VLP adds evaluation program. The basis of the program is on input and output and requires specifying cases for testing in file "vpl_evaluate.cases".
- The student send accumulated files to the server for execution.
- The module VPL informs browser that the implementation has already begun.
- If the requirement is to evaluate when you complete the task, the result of the evaluation has extracted from the server for execution. The evaluation of VLP, together with the code of the program are in Figure 2.

![Figure 2. Source code of the program and test results.](image-url)
E-TrUni integrated module Virtual programming lab includes the following topics in two groups: Basic CPP (Data types, Variable types and scope, Constants; Operators, Basic Inputs-Outputs;Conditional statement; Loop types: for, while, do-while; Functions, Numbers, Strings; Arrays; Pointer, References;) и Data Structures and Algorithms (Stacks, Queues, and Recursion; Vectors, Lists, and Recursion; Trees; Priority Queues; Search Trees; Sorting and Selection; Graphs).

After saving of program in VPL the students can use next functionalities in the menu: Description, Submissions list, Similarity, Test activity, Submission, Edit, Submission view, Grade, Previous submissions list (Figure 3).

3.2.2. Open Judge System.

Further development of the idea of innovative training in programing has achieved by using Open Judge System. It has developed by Nikolay Kostov and implemented in www.bgcoder.com. There are the experiments in it. We will install it soon on a remote server and it will be launch from the virtual learning environment of e-TrUni.

OJS (Open Judge System) is a system with open code for online testing competitions for algorithm work. The lecturer uses it on competitive principle to test the knowledge of programming on five programming languages: C#, C++, JavaScript, Java, Python and PHP.

The system consists of few main elements [12]:
- Web based interface for users and administrators (ASP.NET MVC);
- Windows service for compiling, executing and checking the sent by the user files;
- Restrictions in the execution of the programs realized by Windows APIs;
- Checks the source code and compile the file [12].
The checking has realized with specially developed software scripts Checkers [3], which are the following types:

- Exact - the system result of the sent code result with the expected output symbol by symbol;
- Trim - the system removes the empty spaces before and after the result of sent code and then compares symbol by symbol with the expected output;
- Sort - the system sorts all lines in the sent code result and then compares symbol by symbol with the expected output;
- Case-insensitive - the system does not make difference between small and capital letters when comparing the sent code result with the expected output symbol by symbol;
- Precision N - the accuracy has checked for tasks with the result a decimal number.

Bgcoder is a competitive system with open code created and maintained by the authors of the Open Judge System. It performs automated assessment of each sent by students source code. The system compiles the code, compares the outcome of its implementation on a preset input data, and compares the resulting output with an expected result. For this purpose, we have created previously input and output tests. The users submit input tests to the test program, and the output tests have compared as strings with the result of the implementation of student code. In the statement of the task, the lecturer must give the exact format of output and at least one sample of input and output. The lecturer assigns in the system maximum operating time of the algorithm and limitations on the amount of RAM. A number of tests on an algorithm carries out the checking of the tasks. The lecturer adjudges relevant points based on the results. When the students upload the task the system, give them one of the following results:

- ✔ = Correct answer.
- ✗ = Wrong answer.
- ☐ = Time limit – Outstanding is the maximum operating time of the algorithm.
- ☐ = Run-time error – The program interrupts the execution of work and throws an exception (Error performance).

4. CONCLUSION

Virtual laboratory for training in programming is a not just a substitute for lectures and practical exercises in a computer room. It provides a virtual environment with animations, simulations and visualizations. It can present the implementation of the algorithm gradually and not just as sequence of numbers and text, but visually with the help of geometric shapes (e.g. rectangles of varying heights, proportional to the value of the number they figure). Implementation of innovative approach to training allows achieving visibility, lower level of abstraction during the learning process, the possibility of development of algorithmic thinking, independent verifying and checking of source code by the student and an immediate assessment of the proposed for assessment program. This approach of application of virtual lab creates the right conditions for more targeted independent study outside classes. It saves time for the lecturer to check the source code and allows students to assess the achieved level of preparation. It allows stimulating the students’ work and limits the number of attempts to compile the source code.
5. RESULTS

Because of the experience, underlying observations, studies and experiments in education in programming C++ we can make the following conclusions:
1. The application of new approaches to teaching and learning programming allows fuller absorption of the material and its understanding in depth.
2. Virtual labs and websites programming, created for training and learning have stimulating effect to enhance the students' knowledge.
3. The integrated module Virtual Lab in Moodle in the virtual learning environment of Trakia University - e-TrUni develops better conditions for self-study with functionalities for entering, editing, compilation and evaluation of the created source code.
4. Using Open Judge System introduces the competition principle in the preparation and presentation of students, which affects the increasing of their interest in learning programming and allow to check the created source code and to assess the achievements of the task.

The innovative approach will be fully apply in the Virtual laboratory for training in programming (VLTP). Any topic from the curriculum has presented in it by: theoretical material; source code; visualization, animation and simulation; opportunity for compilation and verification of such a task by testing; assessment the progress of the test result compilation.

We continue research the effects of the virtual laboratory approach on success and acquired practical students' skills.

6. ACKNOWLEDGMENT

This paper is a contribution to the implementation research project No2-FTT/30.04.2015 “Application of the virtual laboratories at the universities” of the Faculty of Technics and Technologies of Yambol, Trakia University (Bulgaria).

7. REFERENCES

SEGMENTATION OF MICROSCOPIC IMAGES OF BACTERIA IN BULGARIAN YOGHURT BY TEMPLATE MATCHING

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Abstract: The diagnosis of deviations in quality of yogurt is performed by approved methods set out in the Bulgarian national standard (BNS) and its adjacent regulations. The basic method of evaluation of the microbiological quality of the product is the microscopic. The method is subjective and requires significant processing time of the samples. The precision of diagnosis is not high and depends on the qualifications of the expert. The systems for pattern recognition in the most natural way interpret this specific expert activity. The aim of this report is to assess the possibility of application of a method of processing and image analysis for determination of the microbiological quality of yogurt. Selected method is template matching. A comparative analysis is made of the methods for template matching. The comparative analysis of available algorithms showed that the known ones have certain disadvantages associated with their rapid-action, the use of simplified procedures, they are sensitive to rotation of the object in the template. It is developed algorithm that complement these known and overcome some of their disadvantages.

Keywords: Yogurt, Bacteria, Template matching algorithm.

1. INTRODUCTION

The Bulgarian yogurt is fermented milk product by the action of yeast of Lactobacillus bulgaricus and Streptococcus thermophilus. The resulting product must contain live bacteria. In some countries rather than those fermented milks contain other bacteria [9].

For now, in our country the diagnosis of deviations in quality of yogurt is done by approved methods set out in Bulgarian national standard (BNS) and adjacent regulations. The basic method of evaluation of the microbiological quality of the product is the microscopic [23]. The evaluation of the microbiological quality of the yogurt is made by expert exclusively on the basis of visual assessments. The expert as a part of the rating methodology brings a subjective element depending on qualifications and experience, which makes technology irreproducible and relatively not sufficiently precise and effective.

The advantage of automated assessments, in which the human factor plays a minor role, is their objectivity, accuracy and performance. That is why the creation of effective automated technologies for assessing the quality of yogurt is an important and priority task.

The analysis of the recently published studies shows that for recognizing and determining the number of bacteria in biological products, the use of systems for receiving, processing and image analysis is important priority direction for the automatic determination of their specific characteristics. Explanation is that the systems for pattern recognition in the most natural way to interpret this particular expert activity [2, 3].

Creation of new and optimization of existing mathematical models and statistical methods, along with the realization of their algorithms for extraction, transformation and use of the information obtained in grading are the main areas in which work in the field of automated grading of dairy products. In automation, monitoring and management of these processes
require easy to use procedures relatively fast data processing, low requirements for technical realization of the developed systems [2, 4].

The aim of this report is to assess the possibility of application of a method of processing and analysis of images in determining the microbiological quality of yogurt.

2. EXPOSURE

The method for segmentation by template matching is one of the main, for the analysis and yield useful information about the practice from images. The techniques of this method are used in signal processing and pattern recognition to track objects, stereo vision, video compression, restoration of old photos [14].

In the method of segmenting by template matching, the belonging of the elements of the image to a certain image determines the degree of its matching with a rigid set of templates specified by the developer of the system [28]. The multitudes of representative points are formed most of the points located on the edges, contours and peaks of the corners of individual objects in the image because they bear the greatest information about its features. These characteristic points can be extracted from the source images in a variety of methods and algorithms, subject to various criteria.

![Figure 1. The principle of the search of template in image (Template matching)](image)

Figure 1 shows the principle of the method of segmentation by template matching. In this method, image template of object is compared with all possible points from a source image and calculate a numeric index showing the coincidence of the template with some part of the image. The comparison is pixel by pixel.

The actuality of the problem of object recognition by template matching can be shown with the number of scientific publications and citations in this area [19].

Figure 2 illustrates the relationship between the number of publications and citations of this when searching the Internet database ScienceDirect by keyword "template matching". Besides the large number of publications in recent years (2012-2016) reached more than 7000, the number citations in this area also increases. The correlation between these two indicators is above 0.8. This shows that the presented method is actively used for object recognition in images.
The problem of the search comes down to choice or synthesis of criterion for similarity and calculate its estimates and therefore quickly appear different search algorithms. The search is often placed in aggravating circumstances when the image is subjected to disturbing effects it as linear or nonlinear distortion, shifts, rotations, zoom and more. The real problem, however, comes from the fact that, in general, need to look no small template in quite large picture, which means that digital data that must be processed become too large in volume and many algorithms do not work in practice because of the large time required to perform the calculations. Thus arises a new problem - fast-action of the algorithms.

One of the main approaches to increase the speed of calculation is appropriate to reduce the volume of non-essential information [24]. The use of the method for segmenting of images using template matching for pattern recognition and counting the bacteria is appropriate when subjects have some similarities. The templates also need to provide the full range of options for the type, spatial, color, texture, the distance between them. The method is suitable for use when detected objects have relatively many differences between them.

Shimada et al [20] used a slightly different approach. They use the method of segmentation with template matching by using three-dimensional images obtained by grouping the two-dimensional ones. The method is used for counting nuclei in the cells recognized by voxels (three-dimensional equivalents of the pixels) which are used as templates.

Kothari et al [12] used for the same purpose spherical templates.

The advances in biotechnology led to the need to adapt the microbiological techniques in many fields of applied biology. “Color-Pro” software has functions that can be used for counting of bacterial colonies. Various parameters of the colony as intensity, size, shape, connectivity and color image can be determined in colony count.

Young et al [26] offer a solution to some issues arising from the use of the method of template matching in identifying the bacteria in microscopic images with differential interference contrast. The use of such images is complicated from a technical standpoint because of the way in which light affects the final image. Other problems in these images are different sizes and orientation of cells. Proposed by the authors method compensates these problems.

Mirosław et al [15] used correlation methods for automatic detection of mitotic cells. These are the cells, split into two separate cores, but with identical chromosomes. The receipt of color digital images is by a camera attached to the eyepiece of a microscope. Since the recognized cells are identical in shape and form and they are uniform, the authors have preferred method for segmenting by template matching. The templates are derived from...
three-dimensional data model. Then honed by the test images. Three-dimensional models differ depending on the type of cells. For example, in one type of cell as a template has been used black circle with a white brim, while others circle is white and the periphery – black. In his dissertation work Elshenawy [7] develops automatic image processing system to process and analyze embryo microscopic images by detecting cells in embryos and compares their properties as criteria is reimplantation. The main problem is the overlapping of the cells in the images, another disadvantage is the brightness and dimensions which vary within wide ranges. These problems are affected in the development of recognition algorithm. After define the perimeter of the embryo are applied several techniques to separate the edges – Sobel, Prewitt and Canny as preliminary operations for applying Hough transformation. Out of 94 are identified only 62 cells (65%). These poor results prompted the author to apply the method for segmentation by template matching using several different templates of different sizes as defined criterion by which to choose size, suitable for detection of objects studied. Used is the sum of absolute difference (SAD) and a normalized cross-correlation (NCC). The author reports that the second method gives better results than the first of the studied sites. Recognition accuracy was increased to 80%.

3. MATERIAL AND METHODS

Object of the survey are color digital images of micro-samples of yogurt. Subject to the study is the detection and enumeration of bacteria of the genus Lactobacillus in digital images. Micro-morphological characterization shows that dominate short, but there also are longer sticks. The location of the bacteria is in single formation, in pairs or in short chains. The observed morphology and the criteria by which is performed their selection shows their possible belonging to the genus Lactobacillus. The laboratory staging for capturing and analyzing of images include personal computer, microscope, camera and software for processing of data, is described in detail in [27]. Methods and tools of Matlab Statistics Toolbox and Data Analysis Toolpack of MS Excel are used in order to processing, analysis and visualization of data and results of this work. The collection, processing and analysis of images can be realized through various programming languages and software environments such as C, C++, Java. A programming platform Matlab is selected because it provides a programming language for high-level, interactive development environment algorithms, data visualization, data analysis calculations. Matlab is used in many areas such as signal processing, imaging, spectral characteristics, study of automatic control systems. There are many toll boxes containing built-in functions, including libraries for image processing. Vector and matrix operations are supported that are crucial in engineering calculations and image processing. This programming environment provides rapid development of algorithms that focus the user on solved problem, not in the details of the program code.

4. METHODS FOR SEGMENTATION BY TEMPLATE MATCHING

Basic methods for pattern recognition by template matching and their mathematical description are presented in Table 1. In formulas involved the main image f and the template t, described by their pixels. In addition to these basic methods in practice are used variants or combinations of different methods. For example, correlation and fast Fourier transform; correlation and inverse Fourier transform. In Table 2 the advantages and disadvantages of using of methods for segmentation by template matching are given. The next is short description of each method separately.
Table 1. Basic methods for template matching

<table>
<thead>
<tr>
<th>Method</th>
<th>Mathematical description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Correlation</td>
<td>( c(x, y) = \sum_{k=-W}^{W} \sum_{l=-H}^{H} f(x+k,y+l) t(k,l) )</td>
</tr>
<tr>
<td>Normed Correlation</td>
<td>( c(x, y) = \frac{\sum_{x,y} (f(x,y) - \bar{f}) (t(x,y) - \bar{t})}{ \left( \sum_{x,y} (f(x,y) - \bar{f})^2 \sum_{x,y} (t(x,y) - \bar{t})^2 \right)^{1/2} } )</td>
</tr>
<tr>
<td>Maximum Absolute Differences MAD</td>
<td>( d_p(f_i,t) = \lim_{\alpha \to \infty} \sum_{i=1}^{\alpha}</td>
</tr>
<tr>
<td>Sum of the Absolute Difference SAD</td>
<td>( c(x, y) = \sum_{k=-W}^{W} \sum_{l=-H}^{H}</td>
</tr>
<tr>
<td>Sum of the Squared Difference</td>
<td>( c(x, y) = \sum_{k=-W}^{W} \sum_{l=-H}^{H} \left</td>
</tr>
</tbody>
</table>

Table 2. Advantages and disadvantages of methods for template matching

<table>
<thead>
<tr>
<th>Method</th>
<th>Advantages</th>
<th>Disadvantages</th>
<th>Ref.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Correlation (Corr)</td>
<td>Reliable and easy to understand criterion</td>
<td>It requires large computational resources and is sensitive to light and noise in the image</td>
<td>[1,17]</td>
</tr>
<tr>
<td>Normed Correlation (NCC)</td>
<td>Reliable and easy to understand criterion</td>
<td>Requires large computational resources</td>
<td>[1]</td>
</tr>
<tr>
<td>Maximum Absolute Differences (MAD)</td>
<td>Resistant to noise</td>
<td>Slow method</td>
<td>[17]</td>
</tr>
<tr>
<td>Sum of the Absolute Difference (SAD)</td>
<td>Use of simplified operations. Facilitated analysis of results</td>
<td>It may be unreliable due to the effect of contextual factors such as changes in lighting, color, direction, size or shape</td>
<td>[17]</td>
</tr>
<tr>
<td>Sum of the Squared Difference (SSD)</td>
<td>A widely used method with simplified calculation procedures</td>
<td>Sensitive to changes of light and image noise</td>
<td>[8]</td>
</tr>
<tr>
<td>Fourier Methods (FFT)</td>
<td>It is resistant to highly correlated frequency-dependent disturbances</td>
<td>Slow operation of the algorithm</td>
<td>[1,8,10]</td>
</tr>
<tr>
<td>Convolution (Conv)</td>
<td>Simple, but secure algorithm for recognition</td>
<td>One of the slowest methods</td>
<td>[11]</td>
</tr>
<tr>
<td>Zero Mean normalized cross correlation (ZNCC)</td>
<td>Significantly reduces computation time</td>
<td>Requires large computational resources</td>
<td>[6]</td>
</tr>
<tr>
<td>Optimized Sum of Absolute Difference (OSAD)</td>
<td>Unaffected by the light and the angle of rotation of the object in the template</td>
<td>Influenced by the background image</td>
<td>[8]</td>
</tr>
<tr>
<td>Optimized Sum of Squared Difference (OSSD)</td>
<td>Unaffected by the light and the angle of rotation of the object in the template</td>
<td>Influenced by the background image</td>
<td>[8]</td>
</tr>
<tr>
<td>Pyramid sum of absolute difference (PSAD)</td>
<td>Reduces computation time and improves recognition accuracy</td>
<td>Not used directly for recognition</td>
<td>[11]</td>
</tr>
<tr>
<td>Sum of Hamming Distance (SHD)</td>
<td>Used primarily to determine the difference between signals</td>
<td>Not used directly for recognition</td>
<td>[6,8]</td>
</tr>
<tr>
<td>Asymmetric correlation (ASC)</td>
<td>Is not affected by noises</td>
<td>Slow method</td>
<td>[1]</td>
</tr>
</tbody>
</table>
Correlation (Corr). In the task of detection of a reference fragment in the image using a ratio of the normalized cross-correlation, the correlation is used as a measure for evaluating the degree of similarity. This classic and reliable criterion for assessing the similarity is quite labor intensive, so in terms of high speed requirements up to date problem in search capabilities, allowing to reduce the number of computational operations [18].

Normalized correlation (NCC). Using correlation to recognize from a Template has the main disadvantage that the process can’t take place in the presence of different lighting and image noise. Normalization consists of amending the intensity of the image and pattern size. A disadvantage of the method is that it requires large computational resources.

Sum of absolute difference (SAD). SAD is a sum of all the absolute values between the pixels of the image from which is sought with template. Since it applies only addition and subtraction may be applied not complicated operations. The small amounts of SAD indicate a high degree of match between the template and the main image. In full match the difference is 0 [1].

Sum of squared differences (SSD). SSD is probably the most popular method of measuring distance, including recognition from a Template, with good mathematical properties and efficient computational schemes. The method is sensitive to the change of light and image noise [5].

Maximum absolute difference (MAD). Metrics defined by MAD is a specified distance. Also, this method calculates the best position of the template [a22].

Fast Fourier Transform (FFT). In order to increase the speed of computation due to the different conditions that produce images, they have a noise which depends on the spectrum. In this case, preferred are the methods based on Fourier transform, instead of correlation methods. The image is presented in the frequency domain. Use a method for phase correlation based on the theorem of the Fourier shift. Calculated is the crossing spectra of both images and a peak is determined. The method is suitable for highly correlated frequency-dependent noise. Also, the method is suitable for processing large images as it requires less time for calculation [8].

Method by convolution (Conv). The method involves simple but fast algorithm for recognition from a template based on the correlation. The calculation of the correlation coefficient becomes with convolution. The goal is to find the limit of the Region of Interest (ROI) in the image. Using convolution increases the processing speed. This method is easy to understand, but it is one of the slowest [6].

Zero mean normalized cross-correlation (ZNCC). The method finds an optimal solution in the process of full search and this leads to a significant reduction of the computation time. The algorithm is a generalization of the technique boundary partial correlation. ZNCC offers an effective comparison of the template with the main image. It has a better performance compared to the NCC. It requires more productive computers, but significantly accelerates the identification [8].

Optimum sum of absolute differences (OSAD). The method is better compared to the NCC. It is not influenced by the darkness of the image, but on the other hand is influenced by changes in the background, for example in the case of objects that are not of interest for recognition. This leads to increase of the wrong detected objects [11].

Optimum sum of the squares of the differences (OSSD). As with OSAD, OSSD method is not affected by the lighting of the picture, but again influenced by the type of background and existing objects in it. Do not depend on the angle of rotation of the object in the template. The method is 3% more productive compared to OSAD. In modern stage are carried investigations into improve the performance of the algorithm in order to overcome the problems of the influence of the background [17].
Pyramid sum of absolute difference (PSAD). The function is not used directly for recognition. The purpose of its use is accelerating the computing process. It affects the overall performance of the main algorithm reduces computation time and improves recognition accuracy. It is especially suitable for images with noise. Using this feature also serves to exclude areas of the main image, are not relevant for recognition. It is suitable mainly in cases where the template and the main image have not degradation [6].

Sum of Hamming distances (SHD). The method has a low coefficient of location and calculates distance between the strings, instead of between matrices. Used primarily to determine the difference between signals [11].

Asymmetric correlation (ASC). The asymmetric Correlation function is sensitive to light of the image, but is resistant to the noises. It correlates with irregular pattern normalized version of each window from the main image in the frequency domain. The function is much more stable compared to the direct use of correlation coefficients. The direct use of asymmetric correlation is a slow process as the discrete Fourier transform is calculated for each window separately. To speed up the calculation process are developed algorithms working in the time domain and discrete Fast Fourier Transform is calculated only for windows for which it is necessary [8].

5. ALGORITHMS FOR SEGMENTATION BY TEMPLATE MATCHING

Algorithms for recognition by template matching are selected, that are readily available on the Internet and use basic methods as Corr, NCC, FFT etc. [13, 22]. The algorithms are used in their original form without modification. A description of the selected algorithms is made, as well as a comparative analysis by which can be determined their effectiveness.

Algorithm (A1). In algorithm 1 is used function normxcorr2 for normalized cross-correlation between matrices. An area with maximum correlation is Detected and the results are displayed graphically. In the algorithm is used B color components from RGB color model rather than as in most known ones that use levels of gray.

Figure 3 presents the performance of the algorithm 1. Appears main image, template and part of the main image, where the object is detected with the highest correlation with the template.

![a) main image](image1.png) ![b) template](image2.png) ![c) results of work of the algorithm](image3.png)

Figure 3. A work result of the algorithm 1

Algorithm 2 (A2). In the creation of the second algorithm, the authors use two transformations of images – In levels of gray and then to binary. Here is used a combination of Fourier transform and calculation of correlation. Operations to determine the size of the frame to be fenced the recognized object have only presentational character.
Figure 4 shows the performance of algorithm 2. The objects and template are visualized. It is presented three-dimensional graphics on correlations in different parts of the main image with the template. Finally has been observed the main image, conversion to black and white and the recognized object.

![Figure 4. A work result of the algorithm 2](image)

**Algorithm 3 (A3).** As with the first algorithm in the algorithm 3 is used B (RGB) color component. The typical here is that it is drawn a correlation matrix by two nested loops of type For-End. The correlation function is calculated by corr2 unlike the first algorithm, which uses the normalized correlation. Figure 5 presents the results of work of algorithm 3. By function “Colorbar” is displayed the correlation in all primary image with template. Then is displayed the template and finally the recognized object on the main image represented in its B(RGB) color component.

![Figure 5. A work result of the algorithm 3](image)

**Algorithm 4 (A4).** In algorithm 4 is used again the B(RGB) color component. The images are presented as signals. It is implemented Fourier transform. After conversion the results are normalized and it determines the peak value in the result. Figure 6 presents the performance of algorithm 4. Displayed are the main image and the template. Appears correlation in the entire image with template using the same functions for presentation as in algorithm 3, but here the color scheme is gray, realized by function colormap (gray). Finally is displayed portion of the main image by superimposed on its template.
Algorithm (A5). Algorithm 5 uses the function of normalized cross-correlation as the first A1. The difference consisted in the fact that the images are converted to gray, and then into binary, and not as in the first, third and fourth algorithms using color components. Figure 7 shows the performance of the algorithm 5. Here the authors of the algorithm preferred putting the results on a common graphic screen. Displayed are the main image and the background converted to black and white. The correlation is presented in levels of gray. Finally, it is presented the main image with template affixed on the recognized object.

Figure 7. A work result of the algorithm 5

Algorithm 6 (A6). Algorithm 6 uses the same functions as in algorithm 4. The difference is in the use of the conversion of the images to grayscale and then into binary. Added features highlight the recognized object that again as with other algorithms have only a presentational character. Figure 8 presents the performance of the algorithm 6. The correlation between various points of the image and the template is provided on the three-dimensional graphics. Displayed is a rectangle on the recognized object. Finally, it is presented a two-dimensional graph of the correlation.

Figure 6. A work result of the algorithm 4
In summary it can be said that some of the submitted algorithms are used color components and other conversion into grayscale. The latter is the preferred method for image processing, but it has some drawbacks. Conversion to grayscale requires mathematical apparatus that has multiple options for decision. Not all manufacturers of software tools provide information on what functions for conversion into levels of gray are used in their products. The transformation of the image into binary, regardless of the manner of processing facilities and the smaller the necessary computational resources also have some disadvantages. In this transformation, determining which pixels will be white and black which depends on the threshold of binarization. The use of loops of the type For-End, and the nested loops of this type considerably increase the time for processing the data. Each algorithm has its advantages and disadvantages. Some are more reliable than others. Third are easier to analyze mathematically. The choice of algorithm is a decision that may be influenced from many factors. The algorithm must meet several criteria. Examples of such criteria are: What will be used? How easy and convenient is the use of the algorithm? What load can bear the resources of the computer system? [16, 21, 25].

Table 3. Analysis of Algorithms

<table>
<thead>
<tr>
<th>Algorithm</th>
<th>A1</th>
<th>A2</th>
<th>A3</th>
<th>A4</th>
<th>A5</th>
<th>A6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of operations, Number</td>
<td>125</td>
<td>295</td>
<td>191</td>
<td>97</td>
<td>119</td>
<td>175</td>
</tr>
<tr>
<td>Maximum number of calls to an operation, Number</td>
<td>9</td>
<td>36</td>
<td>251028</td>
<td>14</td>
<td>7</td>
<td>16</td>
</tr>
<tr>
<td>Sensitivity to rotation of the object in the template, Yes/No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Use of color components, Yes/No</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Use of For-End loop in the main program, Yes/No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Nested loops in the main program, Yes/No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Used method, Method</td>
<td>NCC</td>
<td>FFT</td>
<td>Corr</td>
<td>FFT</td>
<td>NCC</td>
<td>FFT</td>
</tr>
<tr>
<td>Graphical visualization of the results, Yes/No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Table 3 presents the results of the analysis of the selected algorithms. The number of operations in the algorithm are within 97 to 295 while the number calls move in much wider range. This is due to the use of loops of type For-End in the main program. Of particular importance is the problem with using nested loops. For example, in algorithm 3 it causes an increase in the number of calls to a single operation to 251028. Another disadvantage of this algorithm is to use the basic function of correlation Corr, whose problems have been
discussed in previous sections of this work. In the other 5 algorithms the number of calls to an operation is up to 7-36. The number of operations performed visibly does not affect the other characteristics of the algorithm, but it must be proven by determining the time for execution of various algorithms.

In the available literature [8] states that in addition to the elements of the algorithm on its performance affects the size of the used template.

Figure 9 and Table 4 presents the results of the time of recognition of bacteria depending on the image size of the used templates. It is seen that the size of the template affects a significant impact on the execution time of various algorithms. It is seen that in the algorithms that use the loop of type For-End, the processing time is greater than the other. Such algorithms are 3 and 6.

![Figure 9. Execution time of the algorithm depending on the size of the template](image)

Table 4. Execution time of algorithm depending on the size of the template

<table>
<thead>
<tr>
<th>Algorithm</th>
<th>Template Resolution</th>
<th>25x30</th>
<th>55x70</th>
<th>100x115</th>
<th>155x155</th>
<th>205x205</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>1.03</td>
<td>1.20</td>
<td>1.58</td>
<td>1.73</td>
<td>2.04</td>
<td></td>
</tr>
<tr>
<td>A2</td>
<td>3.16</td>
<td>3.21</td>
<td>3.29</td>
<td>3.69</td>
<td>3.79</td>
<td></td>
</tr>
<tr>
<td>A3</td>
<td>20.49</td>
<td>25.02</td>
<td>31.59</td>
<td>36.63</td>
<td>40.35</td>
<td></td>
</tr>
<tr>
<td>A4</td>
<td>1.49</td>
<td>1.54</td>
<td>1.55</td>
<td>1.69</td>
<td>2.04</td>
<td></td>
</tr>
<tr>
<td>A5</td>
<td>2.34</td>
<td>2.47</td>
<td>2.71</td>
<td>2.95</td>
<td>3.23</td>
<td></td>
</tr>
<tr>
<td>A6</td>
<td>8.38</td>
<td>8.63</td>
<td>8.81</td>
<td>9.06</td>
<td>9.56</td>
<td></td>
</tr>
</tbody>
</table>

Table 5 presents the results of two-factor analysis of variance, which determines whether the execution time depends on the algorithm used. The value obtained at the level of significance \( p << 0.05 \) with a margin of error \( \epsilon = 0.05 \) shows that the impact on performance of the algorithm has a the number of calls to one operation. This number is the greatest in Algorithms 3 and 6, which are also as stated above using loops of the type For-End and nested ones.
Table 5. Results from two-factor Analysis of variance (ANOVA)

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>( F )</th>
<th>P-value</th>
<th>( F ) crit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rows</td>
<td>3259.79</td>
<td>5.00</td>
<td>651.96</td>
<td>63.94</td>
<td>0.00</td>
<td>2.71</td>
</tr>
<tr>
<td>Columns</td>
<td>64.12</td>
<td>4.00</td>
<td>16.03</td>
<td>1.57</td>
<td>0.22</td>
<td>2.87</td>
</tr>
<tr>
<td>Error</td>
<td>203.92</td>
<td>20.00</td>
<td>10.20</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>3527.84</td>
<td>29.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The same results were obtained when determining the correlation between the execution time of the algorithms and the number of operations. In the above initial conditions and set criteria is established correlation above 0.95 between execution time and the number calls to a single operation (Table 6).

Table 6. Correlation between execution time and number of operations in the algorithm

<table>
<thead>
<tr>
<th>Number of operations</th>
<th>Maximum number of calls to an operation</th>
<th>Time of execution</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.16</td>
<td>1</td>
</tr>
<tr>
<td>Time of execution</td>
<td>0.23</td>
<td>0.97</td>
</tr>
</tbody>
</table>

Development of algorithm for simultaneous recognition and counting of bacteria in microscopic images of yogurt. From the comparative analysis of basic recognition algorithms for segmentation using the method template matching is established that the to recognize of bacteria in yogurt is appropriate to use algorithms using color components, Fourier transformation and that not use nested loops.

Suitable for developing the algorithm for practical application of automated recognition and enumeration of bacteria in yogurt is algorithm 4. At its base are created software tools for recognizing and enumeration of bacteria by template.

The developed algorithm is implemented in the following sequence:

- Read the main image and the template;
- Extract B (RGB) color components of the main image and the template;
- Visualizing the two images;
- Applying the Fourier transform of both images and presentation as signals;
- Multiply the signal of the main image with complex transformations of the template;
- Valuation of the results;
- Applying the Inverse Fourier transformation;
- Determination of the maximum value;
- Determination of the position in the image, in which the maximum value;
- Visualization of results.
6. CONCLUSION

The diagnosis of deviations in quality of yoghurt in Bulgaria is carried out by established methodologies defined by Bulgarian national standard and additional regulations. The basic method of evaluation of the microbiological status of the product is the microscopic. The method is subjective and requires significant time for preparation and evaluation of the samples. Accuracy of diagnosis is not high and depends largely on the qualifications of the expert. These are the reasons to seek ways to partially or fully automate the process of monitoring and evaluation of production using more advanced methods. Such that mimic the visual assessment of the expert - based on analysis of digital images. The use of methods for image processing requiring a long time for a decision, and based on a large volume of computational procedures, is impractical in consideration tasks.

In the selection of an appropriate algorithm of recognition the main criteria to be observed are relevance, effectiveness and time, high enough accuracy. The method for segmentation by template matching is chosen because when searching and comparison with reference objects in the image, the process is not affected by its location. An advantage of the method is that it is resistant to noise and faster than other methods of identification. A comparative analysis is made of the more famous and accessible algorithms for segmentation by template matching in terms of their fast response and basic functions used for comparison. Besides the basic methods in practice are used variants thereof or a combination of different methods. Especially importance in recognition algorithms from a template is the problem with the use of nested loops. The number of operations performed visibly does not affect other characteristics of the algorithm. This is proven by analyzing the execution time of various algorithms. From the study it is found that in addition to the elements of the algorithms on their operation affects the size of the template used.
7. ACKNOWLEDGEMENTS

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8. REFERENCES


WORKPLACE STRESSORS AND MOTIVATION OF EMPLOYEES IN EDUCATIONAL INSTITUTIONS

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Abstract: The aim of this work is to analyse the causes which lead to the stress in educational institutions and see what is their connection to the motivation of the employees. The stress is the scheme of emotional and physiological reactions arising as a response to the demands set within or outside the organisation. Using the poll technique, it deals with the causes of stress among the employees in the educational institutions, as well as the level of their motivation. Specific relations between the features of stress and motivation should show the relation between the stress generated by different causes and the motivation of the employees.

Keywords: stress at work, motivation at work, educational institutions.

1. INTRODUCTION

Following significant changes in the environment resulting from the development of science and technology, education, as well as the overall educational system, succumbed to the reforms. In this way, social changes have influenced its reform, which included changes in the structure, functioning and efficiency of education, the network of educational institutions, educational programs, forms and content, as well as the objectives and methods of education. [1]

Motivation, like no other psychological variables, can not be measured directly. It is concluded from the behavior, size of commitment, perseverance and direction of behavior, or behavior whose results are achieved. It is an indicator of the performance of work, or the accomplishment of personal and organizational goals. On the other hand, if the job requirements are complex and not in accordance with the expectations, abilities, knowledge and skills of people, if they do not fit into the time available and the usual rhythm properly, if the conditions at work are outside the limits of physical and psychological tolerance and moral values without the opportunities for training and advancement, if the job is insecure, socially unrecognized, underpaid, filled with rejection and conflicts among the staff, the result is a destructive and unpleasant experience of the stress at work.

2. MOTIVATION AND CAUSES OF STRESS OF EMPLOYEES IN EDUCATIONAL INSTITUTIONS

In modern society characterized by frequent changes educational systems around the world search for the ways how to get more appropriate and effective responses to these rapid and complex changes. In order to keep pace with all the changes and modern trends of teaching and education in general there is a necessity for their training in the context of continuous professional development. The importance of a quality teacher is indisputable because it is directly connected to the quality of learning, ie. educational outcomes of students. [2]
The new role of students in the teaching process is determined by the degree of implementation of new technologies and the development of new learning methods. Practically speaking, students have more time for asking questions, absorbing knowledge, thinking, using acquired knowledge, researching, synthesizing of the acquired learning and imagination. [3]

Very little is known about the motivation of teachers, nobody deals with it or pays attention to it, and it is closely related to the efficiency of schools. Greater motivation means greater efficiency too, and greater efficiency leads back to greater motivation in work and vice versa. This is achieved provided that the motivational elements are implemented appropriately and in accordance with the needs of the school. [4] The motivation of teachers is an important determinant of student motivation. The motivation of teachers is essential for the course of teaching and transferring knowledge to students. Unmotivated teachers can reduce the motivation of students, whereas motivated teachers create a positive and friendly atmosphere in the classroom. There is a chain link between the style of leadership of school principals, school climate, the quality of teachers' motivation, style of teachers in the management of processes in the classroom, the quality of students' motivation and outcomes to be achieved in their school work and learning.

Various studies indicate that the motivation of teachers is influenced by attending professional meetings and other forms of training where they learn new skills and competences, where there is an exchange of information with colleagues, helping each other with their pieces of advice and practical examples. Every professional training financed by the employer is seen by a large number of teachers as a kind of reward and extra motivation. The diversity of work and the work with pupils or students are the main motivation for most teachers and employees in educational institutions. The overload of duties, the increased pace of modern life, dissatisfaction at work and personal difficulties seem stressful to students and teachers who face difficulties in finding solutions in adapting to these situations and look for new pedagogical solutions. [5] Therefore, the employees are less motivated for work and it makes it even harder for them to motivate pupils or students.

As a result of inadequate preparation for new roles and responsibilities imposed by the dynamic changes in education the stress can occur among teachers. The analysis of the main components of the sources of stress demonstrated that they could be described, for the most part, within four orthogonal factors: "bad student behavior," "poor working conditions", "lack of time" and "poor school ethos." [6]

The way in which the teacher faces with stress depends on his personal characteristics and capacities, with a distinct importance being his interpretation of a given situation. Many studies on stress and exhaustion at work indicate that younger teachers experienced larger emotional exhaustion in relation to the older ones, which the authors explained as their unrealistic expectations of the teaching profession that have been left unfulfilled, becoming a source of stress and frustration. [7] According to Goddard [8] the teachers beginners experience less stress because they are considered more capable than the older ones in the use of modern teaching methods, and some authors [9] showed that they are more satisfied with their work, which also can reduce the level of stress.

3. EXPERIMENTS AND RESULTS

The data needed for the analysis of stress and motivation at work were collected through a survey, on two samples:
- A sample of employees in college.
- A sample of employees in high school.
The research sample is 52 respondents.
To answer these questions, it was necessary to find out in the survey certain data on employees in these institutions: age, education, work experience and sex. Of the total number of employees in both educational institutions 55 are females (74% and 75%) and 3 respondents are male (26% and 25%).

Years of age are classified into 5 categories. In the first category are the employed up to 30 years (16%), 30 to 40 years make 46% of respondents. Most respondents are in the category from 41 to 50 years (65%).

Most respondents in both educational institutions are the employees whose work experience is from 21 to 30 years (35% and 41%), whereas the least respondents have more than 30 years of work experience (10% and 9%).

General conditions at work are assessed by the employees in both schools as "mostly good" - 52% in high school and 75% in college, Table 1.

![Figure 1. Distribution of respondents according to their age](image)

**Table 1. General conditions at work**

<table>
<thead>
<tr>
<th>General conditions at work</th>
<th>Extremely poor</th>
<th>Very bad</th>
<th>Average</th>
<th>Mostly good</th>
<th>Excellent</th>
</tr>
</thead>
<tbody>
<tr>
<td>high school</td>
<td>-</td>
<td>13%</td>
<td>32%</td>
<td>52%</td>
<td>3%</td>
</tr>
<tr>
<td>college</td>
<td>-</td>
<td>-</td>
<td>25%</td>
<td>75%</td>
<td>-</td>
</tr>
</tbody>
</table>

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Physical conditions have no particular impact on motivation but they have on job satisfaction, and according to Boris Petz the formula of the company performance related to the motivation and working conditions of employees [10] is:

\[
\text{success} = \text{ability} \times \text{motivation} \times \text{working conditions}
\]

Figure 3. How often do you understand the tasks related to your job?
Many authors suggest that there is a big problem concerning the tasks and activities of employees in many companies not being clear. Answers to the question "How often do you understand the tasks related to your job?" indicate that there are usually no such problems in educational institutions. The majority of respondents in both schools "always" (52%, 25%) and "almost always" (32%, 57%) understood their tasks at work, Figure 3.

The question in the survey "How often do you do the tasks that do not belong to you?" is set to indicate either good or bad organization of two institutions, but also the possibility of job dissatisfaction and causes of additional stress for employees. In high school 23% never do the tasks that do not belong to them, 10% almost never and 48% sometimes. In the college 33% of employees never do the tasks that do not belong to them, 9% almost always and 33% of employees still work on the tasks that are not in their job description (Figure 4).

![Figure 4. How often do you do the tasks that you do not belong?](image)

Answers to the question "How often do you work overtime?" are shown in Table 2. The obtained answers show that a large percentage of employees in education often work overtime due to the increased workload.

<table>
<thead>
<tr>
<th>How often do you work overtime?</th>
<th>Never</th>
<th>Almost never</th>
<th>Sometime</th>
<th>Almost always</th>
<th>Always</th>
</tr>
</thead>
<tbody>
<tr>
<td>high school</td>
<td></td>
<td>26%</td>
<td>61%</td>
<td>13%</td>
<td></td>
</tr>
<tr>
<td>college</td>
<td>33%</td>
<td>-</td>
<td>18%</td>
<td>-</td>
<td>49%</td>
</tr>
</tbody>
</table>

There are many methods of motivation (recognition, attention, applause, additional responsibility, certificates and trophies, interviews with employees, the emphasis on positive aspects of good work done with the support and encouragement, training, affiliations, socializing with employees, sporting events, competitions) that contribute to improving interpersonal relationships and building relationships of employees to the organization. [11]

Therefore, the survey asked the question how employers contribute to employees motivation through praise, bonus, promotion and salary increase. Figure 5 shows that the divided opinions about the impact of praise employer to employees' motivation. The highest percentage of respondents from high schools (52%), mostly agree that praise affect them, while 33% of respondents in the college in general do not agree with this view.
The majority of respondents in both schools finds that bonuses do not contribute to their motivation (59% in high school and 58% in college), Figure 6. Increasing wages would not affect the motivation of employees in high school (81%) and 50% of employees in college, where there are different opinions and 24% of respondents believe that this would affect their motivation.

The influence of family, health and social status of employees' motivation and general life satisfaction is very important, too. The motivation of employees in high school is mostly influenced by the health status (45%), and the least the financial situation (10%). Opinions are divided as to how the children of employees affect their motivation because 32% of respondents believe that they have no influence on their motivation, whereas 26% think they have a big influence on them. The health status has no influence on their colleagues in college (82%), and their motivation is mostly influenced by salaries of other family members (73%). Similar opinions are divided among the colleagues in high school concerning how much children affect the motivation. 33% of respondents believe that they have no influence on their motivation, while 31% think they have a big influence on them. Figures 7 and 8 are show their responses.
Social factors which include the degrees of satisfaction and dissatisfaction in the workplace are factors that managers who deal with the internal communication put great emphasis today. [11] The survey includes the issues related to socio-economic factors: interesting work, keeping a job, relationships, status and personal income of respondents. At work, most respondents are motivated by interesting work, status and having a permanent job among the respondents in both schools, and the smallest number by personal income and interpersonal relations.
Poor interpersonal relationships interfere with their work mostly of 19% of employees and sometimes 38% of employees of high school. At the college bad relationships interfere with the work mostly 40% and sometimes 40%.

The unfavorable conditions of work environment are noise, vibration, temperature, humidity, lighting, etc.. These factors adversely affect the efficiency and feeling of comfort at work. In certain circumstances, their impact can be subjectively perceived differently. The results presented in Figure 11 show that there is very little external influence on the work of staff in both schools.

Figure 9. What motivates employees in high school

Figure 10. What motivates employees in college
On the question "How often do you have a fear of losing the job?" and "How often do you think about leaving the job?" respondents from high school are almost never afraid of being redundant (36%), but 42% of respondents think about changing a job.

Respondents from college answered the same questions with: no fear of job loss (60%), and a large number think about changing jobs as sometimes 40% and always 40%, which shows the dissatisfaction of employees.
Most people occasionally find themselves in conflict situations. Respondents in both schools often attend conflict situations, Table 3. Due to emotional balance disorders a tired man often comes into conflict with the environment, is irritated and easily excited. Usually such conflicts result from misunderstanding, different personal beliefs and values, conflicting interests, and unmet needs or inabilities to express their own feelings and opinions.

<table>
<thead>
<tr>
<th>How often have you attended conflict?</th>
<th>Never</th>
<th>Almost never</th>
<th>Sometime</th>
<th>Almost always</th>
<th>Always</th>
</tr>
</thead>
<tbody>
<tr>
<td>high school</td>
<td>10%</td>
<td>10%</td>
<td>74%</td>
<td>6%</td>
<td>-</td>
</tr>
<tr>
<td>college</td>
<td>-</td>
<td>40%</td>
<td>30%</td>
<td>30%</td>
<td>-</td>
</tr>
</tbody>
</table>

Figure 13. Answers of the respondents from college

Figure 14. Impact of stress on work
The diagram of Figure 14 shows that 42% of respondents in high school and 40% in the college believe that stress affects their work. 33% of employees in the high school believe that stress does not directly affect the work, and about 10% in high school.

Fatigue is a phenomenon that accompanies each man’s activity, reduces operating effects and negatively affect the attitude toward work. Mental fatigue occurs while performing intellectual work, while physical fatigue is the result of physical exertion. These two types of fatigue overlap just the same as physical and intellectual work. Subjective signs may not be associated with a decrease in work performance and are reflected in a decline in the criticism at work, weakening of concentration, change in behavior and mood. Objective signs of fatigue are reflected in the reduction of work performance. Reducing the quality and quantity of work performance are direct indicators of fatigue. [12]

A large number of respondents answered that they often attend conflict situations, which shows that after work they feel emotionally and physically exhausted. In high school, depending on the daily activities at work they are sometimes emotionally (52%) and physically (48%) exhausted, and 36% of respondents are mostly exhausted from preparing and working with students, Figure 15.

Due to different work organization the employees in college are less physically exhausted (40% a little bit), but they are emotionally exhausted after work (50% of respondents), Figure 16. Exhaustion is not just a state of excessive stress, but is also a complex human reaction to a long exposure to stress.
4. CONCLUSION

Motivation for work is a very complex concept that people have been dealing with almost since the ancient communities. Scientific approach to motivation as the phenomenon began with the Industrial Revolution in the late 18th century and experienced its peak in the late 20th century. Today this phenomenon is given great importance due to improved efficiency, effectiveness, creativity and quality of work and humanization of working conditions. When speaking of motivation we can talk about the mechanisms of satisfying basic human needs and motives in a situation of performing some work. For motivation to work the situation itself is also important, as well as the activities through which it is manifested.

Stress represents a dynamic environment in which the individual is faced with opportunities, coercion or requests whose results are uncertain but are important for him. Stress is a plot of emotional and physiological reactions that occur in response to the demands placed inside or outside the organization, and can affect both positively and negatively on the individual. The advantage is that stress encourages the employee to do his best to achieve maximum results. The negative side of stress is reflected in coercion, restrictions and requirements.

This work analyzes the impact of stress and motivation of employees in educational institutions. The survey was carried out in high school and the college. The obtained results confirmed that employees in educational institutions, especially teachers have partially different motivation factors and causes of stress at work when working both with pupils and the students. The results indicate that respondents are more influenced by intangible factors (primarily by interesting work) than by material factors, especially working conditions. As for the causes of stress at work, they are generally exhausted from working overtime and from the organizational changes in recent years in the sphere of education and therefore a large number of respondents think about changing their job, i.e. the respondents are mostly affected by the organizational causes of stress.
5. REFERENCES


MEDIA TECHNOLOGIES IN TEACHING PHILOSOPHY

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Abstract: This article describes the experience of the Department of Philosophy of the South Ural State University (Russia) on the use of media technology in the teaching of philosophy. Media technologies are examined not simply as tools of knowledge translation to students, but they are comprehended as a media reality, which sometimes completely dissolve a human. Media philosophy which appeared as a new philosophical trend that meets the today realities, contemplates the nowadays situation of influence of mass communications on human's world outlook, on his self-identification, also on his body and feelings. The students are possessed to analyze a visual media material, because the foundation of media reality is a visual image.
Key words: philosophy of education, media reality, media technology, media philosophy.

1. INTRODUCTION

The realities of the 21st century require new approaches of modern man to understand himself and his activities. Therefore, in our difficult existence as never thought required a strictness of thought, criticality, and creativity of each individual. These qualities can give philosophy. A year ago this idea is clearly voiced in the letter of the General Director of UNESCO Irina Bokova on the occasion of World Philosophy Day: "Philosophy can make an important contribution to human well-being, the decision facing him the most complicated issues and the strengthening of peace". According to Irina Bokova, the philosophy is "an instrument of personal and collective liberation" of man. "We have as high as possible to raise the philosophy flag, - she writes, - to attach to it all the women and men and, especially, all girls and boys". Thus, the teaching of philosophy nowadays is very important. Moreover, in order to attract the attention of a wide audience, especially young people, is not enough to use only traditional academic teaching methods, cutting-edge technologies are also necessary.

2. METHODS

It should be noted that the teaching of philosophy traditionally is a complex task, coupled with the overall number of objective phenomena, such as:
- The fundamental ideological basis, developed in the consciousness of the individual;
- Type of mentality of students, due to national peculiarities of representatives of different countries (for example, students from Iraq represents "Eastern philosophy" and/or "religious philosophy, students from China - "Confucianism" and/or "Mao Zedong Thought ", etc.);
- The lack of a unified database of philosophical knowledge (for example, for Russian students the philosophy is a basic course, and in some countries this is the subject of selectable courses).
In last few years we have to add one more aspect for the complexity of educational practice in the field of philosophy. We are speaking about the of "media reality" describing the today's all-consuming and all-encompassing reality of technical intermediaries influencing the reality of experience and consciousness, which characterize a new stage of mankind development.

In addition in today's world the role of modern technology in the educational system grows incredibly. It is based on the media overcoming the boundaries and necessity of inclusion a modern student in multidisciplinarity, multitasking and modern learning. However, many scientists think that the philosophical reflection on the actual processes considerably delayed.

In this situation it is understandable emergence of new philosophical and cultural disciplines – media philosophy where its subject is media reality, given new technologies, includes both human conditions, means, and ends communication. Due to the fact that the foundation of media reality is a visual image that creates the image of the world that is indistinguishable from reality, we came to the conclusion that the time has come to study philosophy students include such forms of work, which is based on the visual media material. On the one hand, it is a direct, practical use during lessons diverse visual media material for discussion and understanding of its content, form and role in modern society. On the other hand, it is the very reflection on the modern medieval studies which is carried out in our university whole series of events.

Firstly, this is based on the philosophical club, working in our department, in which discussions are media philosophy goals and objectives, understanding of phenomena such as social networking, resource sites, and communities and so on. Secondly, it is a virtual scientific conferences and "round tables" in-line with the participation of undergraduate and graduate students. Thirdly, it is working on a new generation of textbooks, including the style of presentation of a block of information, visualization of theoretical material, introduction of electronic resources. Fourth, it cinema philosophical seminars, where the aim of the training course is the students' self-designation of the way through the philosophical understanding of educational and training practices of the future from the standpoint of philosophical-anthropological and socio-philosophical approaches;

Thus, we concluded that the integrity of philosophical knowledge can now be based only on the text of philosophical presentation material. Need navigation, giving the correct orientation in the media (network, electronic, web-resource, cinema, etc.). Hence, the most important component of the South Ural State University research project devoted to the Department of Philosophy postmodern forms of translation and representation of philosophical knowledge.

3. EXPERIMENTAL PART

During the year, we have formulated the concept and methodological foundations of activity Philosophy Club, where the subject of reflection of the participants is a postmodern phenomenon, designated "media reality" and reflection form, supporters of which are the organizers, representatives and members of the club at the moment is already formulated as media philosophy. It solves problems that previously belonged to the sphere of interests of the philosophy of science, culture, sociology, political science, aesthetics and theory of art, from the perspective of the impact of the results of high-tech person. In other words, she thinks the situation of human exposure, on his view of the world outlook, the identification method on his body and feelings of mass communications; it sharpens the issue as possible in the situation of human existence ever-increasing stream of tempting, addicting and, inevitably, dissolving it in himself media reality. Media philosophy inevitable as well as in their time were unavoidable metaphysics, epistemology, philosophy of science and technology,
philosophy, art, politics and law. It - an adequate and timely response to the challenges of modernity. A significant reason for turning to media philosophy is that traditional aesthetics expressed evaluative attitude to reality, but with regard to these forms of medial radio, X-rays, cinema photography, computer games, pop-scene, contemporary art, author videos, etc. It took a new means of analysis applicable to all the phenomena that are not grasped network aesthetic categories (Lambert Wiesing). Media philosophy analyzes the role of a media: a condition of its emergence, operation methods, distribution, and does not evaluate in the evaluation categories.

Basic media reality - visual image because the visual images create an image of the world, indistinguishable from reality. That is why the basis of analysis of the current material of our club is taken, first of all, visual media materials (videos, movies, video games, videos, screenshots, etc.). All this was reflected in the themes of the meeting of our club. For example, discussing the theme "Man in the fetters of social networks," the club members compared the different communities, isolated by their subjects, especially discussed the interaction space within the community and beyond its borders, trying to figure out the effects of their influence on the formation of the identity of the person. Of great interest the club's members caused a theme «YouTube phenomenon as a mirror of post-humanity». Discussion of this phenomenon was reduced to its different aspects: Video examinations like existence in video documental reflexing of everyday life, as a space for creative expression and cultural reflection, philosophical freedom of expression. In this academic year the club members, who include both students and teachers, and invited scientists from other Russian cities, continue their work. They discuss topics such as "normative core" media philosophizing", "Marginalia media philosophizing".

Another form of work are virtual conferences online that are attended by faculty and graduate students of our university, educational institutions of the city of Chelyabinsk and other Russian cities, as well as our foreign colleagues. A feature of this conference is that many participants do not leave the walls of their schools, and even homes, while being active participants in it. It does not require leave the work for a few days, the financial cost of the trip, allows you to feel with the maximum comfort. In April 2016 the Department of Philosophy of the South Ural State University in cooperation with the Department of Philosophy and Cultural Studies of the Chelyabinsk State Pedagogical University, carried out a joint project of the virtual round tables within the framework of the scientific-practical conference "The philosophical practice in the modern university: problems and forms of organization of philosophical partnership." The online discussion materials connected with the most interesting, non-standard approaches philosophical practice and possibilities of their use in the teaching of philosophy. Great interest was aroused discussion:
- What is philosophical practice?
- How to organize a philosophical partnership?
- How to reconcile with the interlocutor's own speech (the Socratic dialogue)?
- What is philosophy for children?

Along with professors and graduate students from Chelyabinsk these issues actively discussed the scientists of Moscow, Volgograd and other cities of Russia. Successful experience in the use of Internet capabilities in scientific conferences has led us to believe that virtually all research activities can and should be carried out in this format. Then, firstly, to the participants of these events will not be restrictions neither in space nor in time, and secondly, Internet technologies enable the presence of participants with a maximum for yourself the comfort that removes moment of excitement or a lack of material "at hand" and etc.

In our opinion, another important form of work devoted to postmodern forms of translation and representation of philosophical knowledge was the work of a new generation of textbooks, this textbook on the philosophy that students would not be frightened of the...
infinitely complex articles and adequately fit in the interests of their media reality. After analyzing numerous textbooks and manuals on the philosophy of Russian and foreign authors, we came to the conclusion that the hallmarks of modern textbook for students should be a block style of the information (including neurophysiologic aspects of perception of today’s college students, blocks of text may not exceed 15-20 lines) illustrate the theoretical material with examples from praxis (philosophy of life); Visualization of theoretical material when referring to culturological formation (reproduction, examples from literature, movies, etc.). But that is still very important, in our opinion, due to the prevalence in modern students’ visual perception of the type and strength of their proximity to the Internet; in the textbook should be an indication of the broad representation of the philosophical content on the Internet, familiarity with electronic resources for philosophy. We believe that it is this tutorial will focus on the younger generation.

Philosophical cinema seminary is one of the most traditional forms of work in our department. Discussion of films and movies allows students to identify the visual artistic images with their worldview. Since this form of training is their special interest, from the scattered workshops we aim to move to a separate cycles united by one theme. So, in the spring was a cycle of seminars on the theme “Dialogues of the four anti-utopias”. This cycle has been presented to view 4 cinematic dystopia and their subsequent discussion in outline certain conceptual ideas interdisciplinary format. Kinoseminarov authors sought to identify the problems of the modern Russian education by a philosophical understanding of the ideas expressed in science fiction movies, as well as to identify the means of education and training of modern man conducive to understanding its place and prospects in the education system.

4. RESULTS

Using media technology has allowed drawing students’ attention to the philosophy, despite the fact that its study, as mentioned earlier, causes certain difficulties. To date, members of the philosophical club are students of the University for the different faculties, both humanitarian and technical. Moreover, they are not passive listeners, along with teachers and organizers of the club are actively involved in research related to the problems of the issues discussed.

About markedly increase the interest in the philosophy of evidence and scientific-practical conference of students, the number of participant’s increases each year. So, in 2015 in a student conference was attended by 35 students from different faculties and courses in the current academic year, there were already 55. The next step - a student's Internet conference, which will involve the participation of a large number of students, not only of our university but also from other universities.

As Mahatma Gandhi said, “our whole philosophy is as dry as dust, if not immediately convert it into some live acts of service.” One of the directions of research work of the department was the further development of philosophical practice. Almost all the teachers of the department have been trained "Theory and practice of philosophical counseling", three young teachers took part in an international seminar on the philosophical practice of Oscar Brenif’e held in August this year in France. Thus, the staff of the department has a comprehensive joint research activities (at the junction of several fields - philosophy of science, technology, philosophy, philosophical anthropology and philosophy of education), dedicated to the analysis of the translation of philosophical knowledge in postmodern cultural space based on the latest modern media technologies, taking into account the effects that they generate.
5. CONCLUSIONS

The radically of the innovations of the XXI century has equally radical transformation of philosophical instruments, methodological approaches. Media philosophy inevitable as well as in their time were unavoidable metaphysics, epistemology, philosophy of science and technology, philosophy, art, politics and law. It is an adequate and timely response to the challenges, as sharpens the issue as possible in the situation of human existence ever-increasing stream of tempting, addicting and, inevitably, dissolving it in himself media reality. Thanks to her, the technology “tightening” the consciousness of modern man into a virtual web of web-worlds, in this case operate unconditionally positive role, forming an information space inter paradigmatic connections printed and web-resource measurements that correlate philosophical, scientific and educational patterns of modern subjects of knowledge.

6. LITERATURE

FORMATION AND DEVELOPMENT OF SKILLS FOR PROACTIVE DRIVING LICENCE (ACCORDING TO INSTRUCTORS)

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Abstract: In the system "man - environment - motor vehicle", the driver and his training are the main factors to overcome the negative trends of increasing the number of victims and injured in traffic accidents. The proactivity of the driver is associated with high levels of global purpose of drivers' training - with the strategic level, which includes personal characteristics, ambitions, values and choices of behaviour models. In the presented report we analyze the results of a survey conducted during the courses of periodic training of instructors from around the country in which were switched on the question for ranking the elements of the proactive driving according to the experience and perception of the trainers. Were analyzed the results obtained from 403 respondents from different size and geography settlements. We assume that all eleven components that we included and their arrangement in order of importance reflect the mind-set and attitudes of learners to proactive driving and correct actions which ensure personal and safety of other participants are manifestations of tolerance. We can conclude that at the forefront of arranging of the components of proactive driving, the respondents emphasize on those, that increase the traffic safety (manoeuvre planning, forecasting), but underestimate the knowledge of prior knowledge of the risk factors that increases the probability of road accidents.

Keywords: proactivity, components of to proactive driving, skills for proactive driving.

1. INTRODUCTION

In the system "man - environment - motor vehicle ", the driver and his training are the main factors to overcome the negative trends of increasing the number of victims and injured in traffic accidents. Based on scientific research and analysis of the reasons for road accidents in the European countries was developed a global objective for the preparation of the drivers and was added behavioural level, which is related to abstract-logical thinking with the attitudes and values of the individual and the community for defensive, proactive driving. Researchers and trainers of drivers point out that the preparation of a more responsible and confident in their competence drivers does not refer to the formation of skills and competencies for racing drivers, but also to develop skills for proactive driving. In some countries are offered courses not only for novice drivers, but also for those who have a long experience since the statistics show that participants in road transport accidents are also experienced drivers. Therefore, much attention is paid to the understanding of the drivers of proactive behaviour.

2. THEORETICAL TREATMENTS

The concept "proactive" means: an active and enterprising and also prescient, provident person. The definition which St. Covey gives is associated with high levels of global purpose of drivers' training - with the strategic level, which includes personal characteristics, ambitions, values and choices of behaviour models. The model of behaviour that we choose is connected and determined mainly by the choices and decisions we make and the
responsibility that we take, and the consequences of our decisions. [1, 2, 3, 4, 7] The competence related to the proactive approach reflects the natural interest of man to things, events and connections between phenomena in the world, the ability proactively to seek and discover new opportunities to do different activities, but also to change the environmental conditions, rules and regulations and to transform the surrounding reality.

The proactivity of the person connects to skills to anticipate and overtake an event with effective action, which is especially important for conditions of intensive traffic. We can accept that the principles of proactivity in the field of management and marketing can be valid and the training of drivers in the forming and developing of their skills and competencies. Contemporary trends are educational objectives to be placed together with the trainees, as they are associated with effective training and increasing the degree of autonomy and confidence of prospective drivers also in the basic training. It is important at the basic training prospective drivers to be motivated and understand that the goal of the training is important for them and that is not associated only passing of the exams and obtaining a certificate, but also with health and life as the highest values, continuous development of competencies to drive and the formation of transport culture. The components of the goal, related to the security, the safer driving and experience that brings satisfaction to the prospective driver, compliance of the current regulations should be adopted by the learner, and be compatible with their individual needs and interests.

For the development of skills for a proactive behaviour while driving the instructor needs to express clear goals that set, but also to enable the learner to determine his own purposes. This is a process that continues throughout the course, as closer targets that are associated with successful completion of the theoretical and practical exams are considered easier by the candidates. The most important components of goal related to the motives, attitudes, values and transport culture are more common and more difficult for expression and transformation in personal goals of the learners so that they can pursue them in the period of independent driving. Here we would like to emphasize the importance of the development of independent critical thinking among drivers so that based on statistics for road accidents trainees would be able to determine their own priorities in independent practice, they can find timely problems and weaknesses in the levels of development their own abilities and competencies. Of particular importance is the early detection of more dangers when driving in an intensive traffic on unknown routes and skills for risk analysis and taking preventive measures to prevent accidents, instead of overcoming the consequences of accidents. In order to stimulate the development of criticality, increase self-dependence and confidence of candidate driver, the instructor must not only set out its rules and forbiddings, and to seek the active participation of the trainees, while interaction give a joint response to the causal relations between various actions and behaviours of drivers to answer the question "Why should I do/act this way?".

We consider the defence driving as a complex skill to anticipate problems and conflicts before they happen, i.e. the possibility the drivers to be proactive while driving rather than passive observers. With a particular force on the training as proactive drivers we can point to part of the definition of Stephen Covey. The author regarded proactivity not only as an initiative but as a responsibility for our own lives and our behaviour as a function of our decisions, actions and behaviour. Once again the results from research of other scientists and our studies confirm that emotional intelligence is particularly important for the models of behaviour while driving. We accept the opinion of Covey and we came to the conclusion that behaviours of Drivers isn't determined by the conditions at the moment, but rather by their decisions, control and subjugation of the feelings on the hierarchy of the values and taking a personal responsibility for the consequences.

In most of the countries in training of drivers talk about defensive or protective driving, using it as synonymous with proactive driving. It is seen as an accepted standard that ensures
traffic safety, saves lives and saves money and time. Proactive approach means to engage outside the normal duties, to possess the ability to distinguish between emerging new opportunities to seek new alternatives and solutions and be able to overcome the difficulties. Driving as a very complex activity that requires the drivers to have the ability for monitoring of road transportation situations, to monitor arising of rapid changes in the traffic to overcome alone the difficulties, to react to developments and to be able to take alternative solutions. When driving, the proactive driver foresees the consequences and to think not only about themselves but also for the other road users. Proactive drivers must have the ability to seek and make its own decision to look for alternative solutions to complex non-standard situations to detect various changes and opportunities in the road traffic. If take into consideration the proactive approach in preparing of drivers of motor vehicles, it will improve the effectiveness of the learning process and traffic safety. By focusing efforts on the proactive driving will improve the safety in driving, but also road environment will be safer for all road users. [1]

The personality of proactive driver of the vehicle is obeyed to impulsive reactions and their own values. Drivers who are reactive are often dependent on their own feelings, the pressure of the passengers in the vehicle, the behaviour of other road users, the conditions of the road environment. A proactive drivers also have feelings, but they are emotionally intelligent and obey behaviour of personality recognized and accepted values, i. e. on them impact an external factors (physical, social, psychological), but their choice of mode of action, and behaviour model is based on important values. Proactive drivers show initiative and Self-initiative, they endeavour to guide their actions consciously, provide consequences and take responsibility for them. Proactive drivers have reached high levels of acquiring knowledge and skills, they can identify and solve problems by observing the principles and rules of traffic safety and be responsible drivers. It is very important in the complex conditions of intense traffic, the behaviour of proactive drivers to be not affected by social conditions of the environment and by the behaviour of the other road users. When the instructor determines to which type of drivers refers the learner, first of all, the focus of proactive candidate-drivers should be on the circles of influence, which can affect. They should direct their energy to what falls under their influence and their energy in order to be positive and to increase the impact on the depended terms. The characteristic of reactive people we can compare with that of reactivity and aggressive drivers who seek reasons for their failure or road accidents weaknesses in driving the other drivers in the external environment and circumstances which cannot be directly affected. Usually this manifests itself in the behaviour in the form of complaints, accusations against the other participants and supervisory authorities in presenting themselves as victims. Some authors point as an indicator to determine proactivity and reactivity in people's behaviour, their speech. This indicator can connect with the interactive personality-oriented training of drivers. Therefore on methodological guidance paying attention to the placing "open" questions, developing the skills to identify and formulate problems, to seek options and methods of solution to make responsible choices and to manage their feelings and interactions with other road users. [8]

3. DESIGN OF THE STUDY

In the presented report we analyze the results of a survey conducted during the courses of periodic training of instructors from around the country in which were switched on the question for ranking the elements of the proactive driving according to the experience and perception of the trainers. The survey was conducted through questionnaires as a part of the questions require answers for ranking according to their importance and according to personal professional and social experience of the instructors. Were analyzed the results
obtained from 403 respondents from different size and geography settlements. Were included data from the survey of Sofia, Varna, Veliko Tarnovo, Blagoevgrad, Yambol, Kyustendil, Lovech and Dupnitsa. The results are processed as we searched the influence of age and professional experience as instructors for the training of drivers for determining the significance of the main components of proactive driving. The data on demographic indicators were converted into results, the respondents were divided into age groups according to the classification developed by the researchers of the career Levinson (Levinson et al. 1986), Arnold and Feldman (Arnold and Feldman, 1986) and summarized by D. Iskrev: pre-career - 15-22 years, early career - trial 22-30 years, early career - setting 30-38 years, middle career - transition 38-45 years, middle career - growth 45-55 years, later career - keeping 55-62 years, late career - discontinuance 62-70 years.

The majority of respondents were in the age of the average career - growth, followed by instructors - later career - maintenance, late career - discontinuance from active professional activity. There is a trend that instructors remain active acting and over 62 years – they are the third largest group of the investigated. It is worrying the fact that a minimum number from the graduated young people with professional qualification "instructor" are at the stage of early career - "trial" and "establishment" and they are included in driver's training. The first two age groups (22-30 years and the 30-38 years) are only 11%. If we assume that the professional and social experiences are important for the enhancement of competence and the increase the effectiveness of training, the positive is the fact that the group of representatives of the average career is prevalent. The research tool contains basic conceptually displayed skills of a proactive/defensive driving, and the respondents had to rank on the first place the most important skill according to their opinion and on 11-th place the least important. The whole dataset is processed by software STATISTICA 7, as calculated the mode, and the median central tendency of each of the 11 assertions and was made frequency analysis of the places that received each of them.

In the analysis of results we look for connection and we will report the impact of the professional experience in the ranking of the main components of proactive driving. The surveyed Instructors were divided into 4 groups, the first group has a length of service up to

![Figure 1. Distribution of the instructors according to age groups](image-url)
five years and the next were by increments of ten years and over 25 years. For the first group, we are guided from the theoretical formulation that the first five years are regarded as entry into the profession and initial adjustment to the organization and activities. In the other groups still practice the adjustment process and improve the professional competencies that are associated with a change in the understanding and teaching technology training in proactive driving.

The data analysis of the studied 403 respondents shows that regardless of age, internship and the settlement, the surveyed have ranked with the forward positions the skill to distribute attention during driving. Approximately with equal rank the surveyed have indicated the skills to carry out maximum control over the car, the ability to see deep forward in traffic and making the right decisions. Next in the ranking is the complicated skill to predict the behaviour of other road users and detect potential threats or hazards. From the analysis of the results we can summarize that in the process of the training the instructors emphasize on the further development of attention and psychomotor performance, which is the basis of the safe driving. In addition, they understand the importance and role of higher levels of perception, analysis and summarizing of a traffic situation, early detection of the potential hazards and the role of the peripheral visual field for the safe driving. The respondents understand the importance of preventive activities during the preparation of drivers concerning knowledge of risk factors. It is not accidental that in many European countries and in projects related to driver training in the theoretical training and examination are included statistics on the most common accidents and the factors that lead to them.

At last two positions in the ranking are: detecting the causes of situations that lead to the loss of stability of the car and the knowledge, skills and experience for proper action on recovery control of the vehicle. These data we can explain because of the majority candidate drivers from various categories are included in the courses of basic training mainly in spring, summer and autumn in good weather conditions, visibility and mostly dry roads. The high-command skills to manage and control the vehicle in a situation of aquaplaning, icy and slippery road segment usually are acquired in the first months of their individual driving. The respondents who are on the stage middle career - transition believe that as a guiding element is the maximum control over the vehicle, followed by the ability to make the right decisions that skill show little difference from the predicting the behaviour of other road
users. The surveyed instructors in the age group 45-55 years (middle career - growth), as well as in the aggregated data have ranked on the first place distribution for the attention, followed by the ability to see deep forward in traffic, followed with little difference from the complex skills to take properly solutions in the dynamic and complex situations. In the next age group (55-62 years) in a manner of arrangement referred skill to distribute of attention, maximum control over the car, the ability to take the right decisions and deep vision forward in traffic.

The results from the survey of the instructors who are in the age of late career - withdrawal in ranking the skill to distribute of attention does not differ from general data in second place are placed, the ability to implement maximum control over the car, on the third - the ability to taking the right decisions and with a small difference the ability to look deep forward in the traffic flow.

In summary we can say that the role for the attention is particularly significant in driving. In the heavy traffic during the training and in the initial period from autonomous driving on the driver influencing various irritant. The incoming from the road transport environment stimuli differ by strength and duration of the impact on the senses and the driver can not react to all of them. Therefore the attention while driving is an extremely important factor because it determines the orientation of the psychological activity on the most significant impact from the surrounding environment or the traffic situation.

<table>
<thead>
<tr>
<th>Risk Factors</th>
<th>Early Career - Setting</th>
<th>Early Career - Trial</th>
<th>Middle Career - Transition</th>
<th>Middle Career - Growth</th>
<th>Later Career - Keeping</th>
<th>Late Career - Discontinuance</th>
</tr>
</thead>
<tbody>
<tr>
<td>restoring vehicle in control</td>
<td>8.3</td>
<td>8.5</td>
<td>7.3</td>
<td>7.1</td>
<td>9.2</td>
<td>7.7</td>
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<tr>
<td>causes of instability vehicle</td>
<td>7.8</td>
<td>7.4</td>
<td>7.7</td>
<td>7.7</td>
<td>7.1</td>
<td>7.8</td>
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<tr>
<td>precise actions</td>
<td>6.7</td>
<td>6.3</td>
<td>6.7</td>
<td>6.7</td>
<td>6.3</td>
<td>6.6</td>
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<tr>
<td>right decisions</td>
<td>4.8</td>
<td>4.7</td>
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<td>prediction</td>
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<td>searching a risk</td>
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<td>forward vision</td>
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<td>max. control</td>
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<td>central / peripheral vision</td>
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<tr>
<td>distribution of attention</td>
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<td>risk factors</td>
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In summary we can say that the role for the attention is particularly significant in driving. In the heavy traffic during the training and in the initial period from autonomous driving on the driver influencing various irritant. The incoming from the road transport environment stimuli differ by strength and duration of the impact on the senses and the driver can not react to all of them. Therefore the attention while driving is an extremely important factor because it determines the orientation of the psychological activity on the most significant impact from the surrounding environment or the traffic situation.
A positive fact is that representatives from all groups of respondents have put at the forefront the role for the attention and especially its distribution as one of its major features. Driving a car in modern conditions is a very complex activity and the Profession of the drivers' ranks as stressful after that of air traffic controllers and surgeons. While driving, drivers have to perceive many varied information from different objects and phenomena that influence with a different duration and strength. Also drivers done simultaneously several actions and operations (monitor the condition of traffic, carry out actions with the controls of the car, not only observe, but also need to anticipate the actions of other road users, etc.). In the analysis does not undermine the role of other basic features the attention - volume and switching that are important when driving. In an intensive traffic, drivers have to cover several objects simultaneously in dynamics for a short period of time, but they must also be able to redirect their attention within 2-3 seconds to watch in the rearview mirror in order not to miss the manoeuvre of another vehicle that could be a prerequisite for a conflict situation. 

When processing the received data according to the professional experience of respondents, grouped in 4 groups, on first rank is the distribution of the attention among the representatives of the third group (16-25 years’ experience), but with very similar average comes the ability to see deep ahead in the traffic, according to instructors who entering in the profession. The respondents from third, fourth and second group have indicated to the next position the role and importance of the attention and its features distribution as a leading, and the mean is very close for the representatives of the third and fourth group.
The importance of taking the right decisions, based on observation and perception, and the skills for the distribution and switching of the attention, and to predict the behaviour of the other road users, gives a second place to this skill according to the respondents from the first and third group. Regardless of teaching experience, with similar values as the main component of proactive / defensive driving is ranked the ability to carry out maximum control over the car by the representatives of the fourth, third and second group.

It is noteworthy that despite the professional practice and accumulated experience all respondents, they do not pay attention to the ability to actively search for potential risk situations and dangers, which is connected with analytical and logical thinking and grading on the level of significance of certain components from the road transport situation. Analogously all respondents do not consider that the good prior knowledge of risk factors is an important element of proactive driving. In some European countries in conducting of the theoretical examination of drivers of various categories it is necessarily to include an elements of statistical data on the reasons causing accidents in the related state. This assumes that knowing of the factors that adversely affect to the driving and causes that lead most frequently to accidents have preventive matter of traffic safety. High values of central tendency shows that the ability to take correct action to ensure personal and that of other road users safety is not enough appreciated by all groups of instructors. Perhaps they accept a priori that the formation of sensomotoric and psychomotor skills and habits started at the beginning of basic training and that without them we cannot talk about the formation of more complex skills and competencies. Regardless of the professional experience is confirmed the overall finding to all respondents that the final positions in the ranking are placed the skills to detect the reasons that cause the loss of stability of the car and the knowledge, skills and experience of correct actions return the vehicle under control.

In recent years, many companies that prepare drivers advertise the courses of proactive driving by incorporating different components. In one of the proposals the main components of proactive driving are grouped into three groups: knowledge, skills and attitudes. As skills they have indicated: full control of the vehicle, timely identification of threats and concentration on tasks when driving in specific situations. These components are included in our questionnaire, but the respondents pay attention primarily on the first component. We haven't include the component for concentration, but rather for distribution and switching of attention, as we think they are very important because of the high dynamics of the contemporary traffic. Another component of proactively driving of motor vehicles are knowledge related to understanding of traffic rules and technical capabilities of motor vehicles as standard in the curriculum provided before transition to practical training for driving necessarily learned the first 7 themes for safety of the traffic and drive the vehicle. Seemed to underestimated the awareness and consideration of some technical aspects of active safety systems in modern vehicles, such as ABS, ESP, etc. knowledge of which and skilful use by drivers increases safety of the movement.

We assume that all eleven components that we included and their arrangement in order of importance reflect the mind-set and attitudes of learners to proactive driving and correct actions which ensure personal and safety of other participants are manifestations of tolerance. In basic training of drivers, the instructors must motivate the candidate-drivers to reflect on their own actions and behaviour during the practical training, and to be able to develop a higher degree of autonomy and self-criticism to his own model of behaviour. The individual form of practical training is requirement to comply with individual characteristics, placing the accent on defensive and proactive model of driving.
4. CONCLUSIONS

From the analysis of various literature sources, best practices developed through various projects and from our research we can summarize:

1. The concept of proactive driving is associated with multiphasic models for training of drivers. In a proactive driving the focus is on initiative, a higher degree of autonomy and responsibility of drivers while driving.

2. The proactive behaviour while driving includes components from all levels of the global goal (GDE) for training drivers and pedagogical taxonomy of Bloom, highlighting the leading role of higher levels.

3. The respondents evaluate the importance of procedural knowledge, and connect it with the ability for maximum control over the car in movement, forming of specific skills, algorithms and techniques by following relevant procedures.

4. We must point out that instructors doesn't evaluated and ranked in order of importance the ability to control the vehicle in situations of loss of control and especially knowledge, skills and specific techniques for restoring stability of the car.

5. We can conclude that at the forefront of arranging of the components of proactive driving, the respondents emphasize on those, that increase the traffic safety (manoeuvre planning, forecasting), but underestimate the knowledge of prior knowledge of the risk factors that increases the probability of road accidents.

6. The respondents have not ranking at the forefront place of the ability to take correct action to the personal security and the safety of other road users, although in the purpose of three-stage model of training of "responsible" drivers, this skill is a separate self. It is necessary in developing courses for proactive driving to pay particular attention to the influence of the cultural and values of the individual, internal motives and their influence on the choice of behaviour model in driving.

5. REFERENCES


