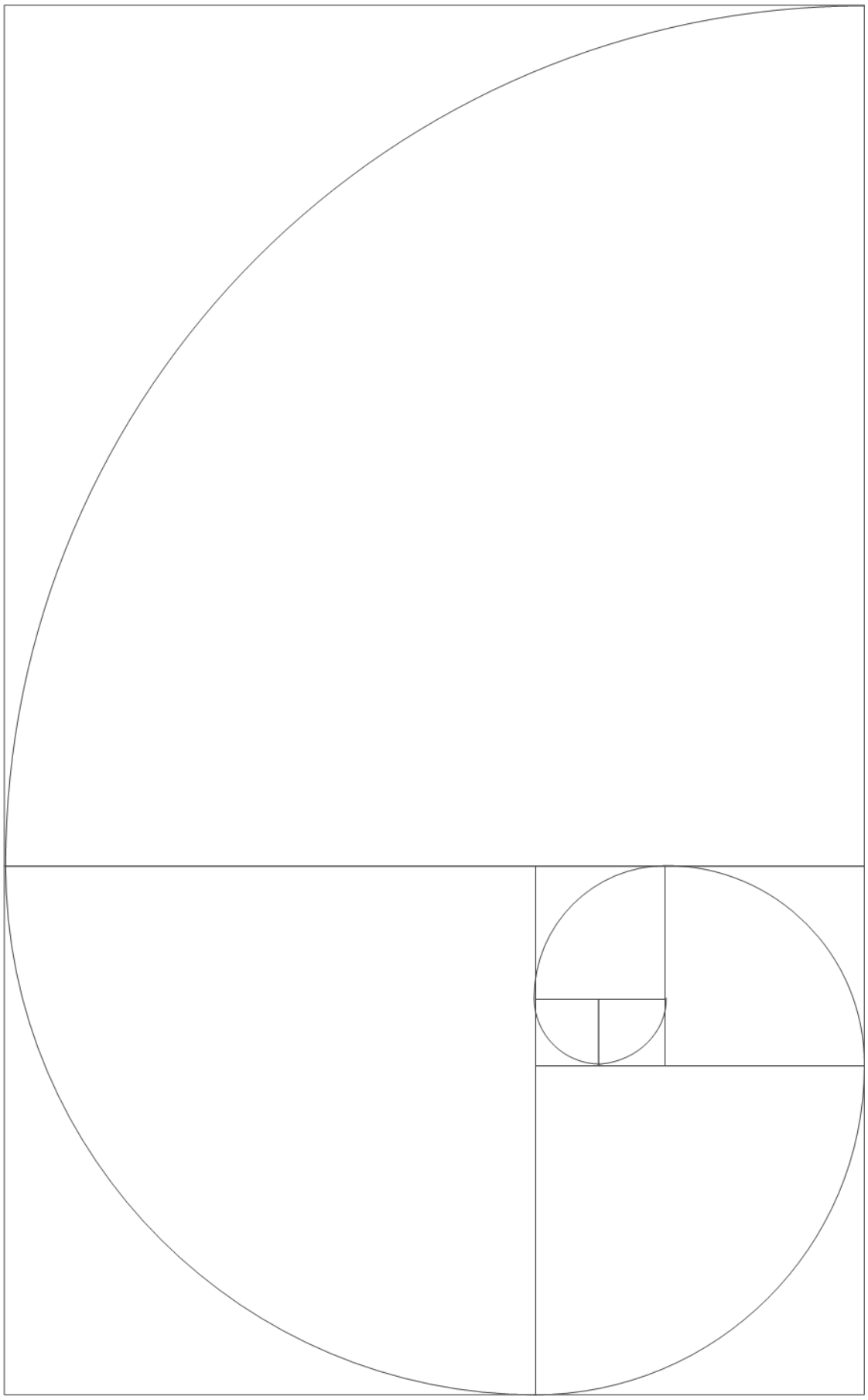

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CONTENTS

REVIEW ARTICLES

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ENVIRONMENTAL CHARACTERISTICS OF DIESEL ENGINE WITH UTILIZING EXHAUST GASES RECIRCULATION

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Abstract: *From the various methods for reducing harmful exhaust emissions as combustion control, improved fuel injection form of the combustion chamber, recirculation of the combustion products, impact of smoke particles, the addition of water, synthetic fuel. Is established that the system for recirculation of exhaust gas is one of the most effective methods for obtaining of lower values of NO_x, because the reduced temperature of the combustion process and excess oxygen.*
Keywords*: emission system for exhaust gas recirculation (EGR), nitrogen oxides, circuit indicators, economic indicators.*

1. INTRODUCTION

The increased popularity of diesel engine due to low fuel consumption at a higher power, coupled with lower operating costs. The diesel engines are installed in vehicles designed to carry heavy loads, cars, stationary devices, allowing production of electricity, which is much more economical compared to other similar, with the same dimensions.
Recently also seen rises in sales of passenger cars equipped with diesel engines [12]. In relation to expectations for improving the quality of diesel fuel (DF) and an increase in sales of cars with diesel engines, manufacturers must work in terms of improving power, fuel efficiency and reduce harmful exhaust emissions (EE). These emissions are identified as carcinogenic and the requirements of the laws are insurmountable in this respect [8].
Another way to reduce emissions is the use of vegetable oils as fuel for diesel engines under the common name biodiesel. It is produced from oils and fats by transesterification and is a liquid similar in composition to a conventional diesel fuel. The use of vegetable oils for operation of the internal combustion engine is an alternative for the coming years. Their production is associated with certain environmental effect. For now there are test results of rapeseed and soybean oils. Vegetable oils are in themselves complex of organic compounds. The main part of all oils is complex ether of tri-atomic alcohol-glycerine and a fatty acid, which is also called glyceride [1]. In its chemical composition are contained primarily fatty acids or ethyl ester.
To qualify for the ecology and, along with it to maintain and low fuel consumption needed to optimize combustion in the diesel engine. Along with this is not solved yet and the concept concerning the production of diesel engines and their economic feasibility. They are very comfortable for power plants in sparsely populated and rural areas where agricultural production due to the ease of maintenance, economy and durability, also produce less harmful emissions than petrol engines [10]. On the other hand higher emissions of nitrogen oxides NO_x and smoke particles (SP) is one of the main problems with the combustion gases. The latter contain carbon dioxide, CO_2, H_2O vapor, nitrogen N_2 and oxygen. Carbon monoxide CO, hydrocarbons CH, nitrogen oxides NO_x and smoke particles are present in smaller in terms of ecology particles. NO_x is composed of nitric oxide NO and nitrogen

dioxide NO_2, and both are considered to be harmful to human health and the environment more harmful is believed NO_2 from NO. From the diesel engine is mainly formed NO, therefore, is paid special attention to reducing its formation [4].

2. EXPOSURE

The formation of NO takes place inside the combustion chamber of the engine, where there is zone with a high temperature and the presence of excess oxygen. This process can be described by the formula of Zeldovich. The main reactions for the formation of NO can be described as follows:

$$O + N_2 = NO + N \quad (1)$$

$$N + O_2 = NO + O \quad (2)$$

$$N + OH = NO + H \quad (3)$$

In order to reduce the NO_x formation in the combustion chamber, to reduce the concentration of oxygen therein. Although there are additives to improve cetane number, which are very expensive, and capable of reducing NO_x, this is insufficient to achieve the required result.
In some engines is used water injection to control NO_x, but this increases corrosion processes in the engine, moreover, increases its weight, due to the presence of the auxiliary tank, as well as to maintain a constant water temperature in cold weather [5].
One of the effective methods for controlling NOx formation is the use of exhaust gas recirculation EGR - Exhaust Gas Recirculation.
Since exhaust gases consist mainly carbon dioxide, nitrogen and others. They have a higher specific heat ratio compared with the ambient air.
Using EGR, is replaced part of the fresh air charge entering the combustion chamber of the engine with carbon dioxide and nitrogen found in the combustion gases. As a result, is reduced the amount of oxygen and is disrupted the condition of the formation of NO_x. Air to fuel ratio is decreased. This essentially influences the emission of combustion gases.
It can be noted that the mixing of inlet air with combustion gases increases the specific heat ratio of the fresh charge, which leads to reduction of the combustion temperature in the chamber of the engine.
As a whole the reaction rate of the formation of NO_x is decreased. EGR is determined in% by the following formula:

$$EGR = \frac{A_{EGR} - B_{EGR}}{A_{EGR}} \cdot 100\ \% \quad (4)$$

where: A_{EGR} - mass of the incoming air without the valve of the combustion gases recirculation system; B_{EGR} - mass of the incoming air with the valve of the combustion gases recirculation system.
Engines using EGR have a small amount of harmful emissions into the combustion gases from these engines not using EGR, as part of combustion gases is recirculated, ie they are reused. Thus even if the concentration of harmful emissions into the combustion gases remains unchanged, the total amount of emissions reduced in the same volume. Diesel engines operating at lower loads can operate with a high degree of EGR.
At high loads, the presence of oxygen in the combustion gases becomes very small and emissions began to dominate with increasing temperature of the combustion gases, which is a prerequisite for the formation of more smoke due to oxygen depletion [11].

In some studies have achieved lower levels of NO_x, as used highly diluted air charge and values of the EGR about 44%, which reduces the content of smoke particles.
On the other hand, this high rate of EGR increases fuel consumption [9]. It has been found that when an appropriate value of the EGR is improved economy and emissions of CH. This is due probably due to the increase in the temperature of the intake air supplied from the EGR system, which improves the flame propagation in a relatively small area of the total volume of the fuel-air mixture that is not evenly distributed [6,7].
In another study is found that when operating a diesel engine with dual fuel – diesel fuel and natural gas, at lower loads is lower the level of harmful emissions, because yielding poorer mixtures, making ignition them more difficult. Using the EGR are improved the environmental performance of the engine. The use of EGR leads to an increase of the effective specific fuel consumption and the values of the smoke particles. Reducing the combustion temperature, results in low values of formation of the smoke particles due to the re-burning. The formation of the smoke particles is a process that obtains degradation of CH under the influence of high pressure and temperature in the combustion chamber, in the presence of a large amount of oxygen. Here, α is in the range of 0,33 to 0,7 and can be expressed with the equation:

$$C_nH_m \rightarrow nC + 0{,}5mH_2 \quad (5)$$

With the increase of the temperature (from 1000^o to 2800^o K) and pressure (up to 5-10 MPa) in the combustion chamber is increased and the quantity of smoke particles. Not least on their formation, have an impact and the type of fuel used.
Increased values of the smoke particles cause premature wear of engine parts - cylinder liners, piston rings, valves and bearings. The wear of the materials is increased and hence the chemical reactions occurring on the surface – adsorption, corrosion, or due to the abrasive action of the smoke particles.
The use of EGR affects the life of the lubricating oil and hence the lifetime of the engine. It is experimentally proved that the smoke particles interact with additives in lubricating oil, such as deteriorated anti abrasive action and increased engine wear [2,3].
The increased levels of smoke particles in lubricating oil causing its thickening and adverse effect on the piston rings by impairing their pumping action with respect to return the oil back into the oil sump of the engine. To improve system efficiency EGR apply intermediate cooling of the recirculating combustion gases. This increases the density of the working medium, which improves engine performance parameters of the engine and reduces the emissions of NO_x. At the same time the presence of moisture in combustion gases, induces and increase the corrosion process in the combustion chamber.
Table 1 shows the standards that must meet emission engines complying with the new requirements.

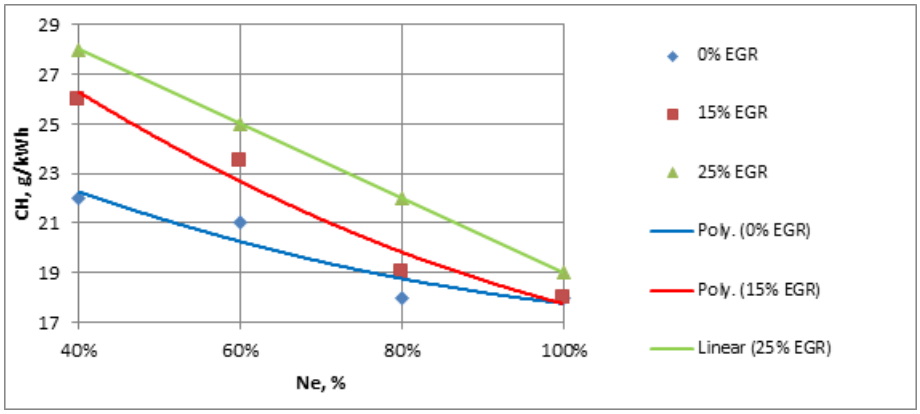
Table 1. Requirements for the content of harmful exhaust gas emissions

Year	Standard	CO	HC	NOx	Smoke particles
1996	Euro 2	4,0	1,1	7,0	0,15
2000	Euro 3	2,1	0,6	5,0	0,1
2005	Euro 4	1,5	0,46	3,5	0,02
2008	Euro 5	1,5	0,46	2,0	0,02
2013	Euro 6	1,5	0,13	0,4	0,01

In the studies was used a diesel engine with the following technical details: type of engine - diesel; Number of cycles - 4; Number of cylinders - 3; Injection - direct; Engine capacity - 2826 cm^3; Compression Ratio - 17; Maximum power - 38 kW / 2500 min^{-1}; Maximum torque - 16,25 Nm / 1500 min^{-1}; Gas distribution mechanism – SOHC
The engine was tested under different loads (40-100% Ne) and at a constant speed of the crankshaft – 1500 min^{-1}. Different is the degree of the EGR (0, 15 and 25%). The aim of the experiment is to analyze and graphically present the data obtained for CH, CO and NOx.
For data processing were used 4 types of mathematical models – exponential, linear, logarithmic and polynomials.
It was found that polynomial model of second order, best fits for establishing the equations of the form:

$$y = a_2x^2 + a_1x + a_0 \quad (6)$$

This model describes with sufficient accuracy experimentally obtained data, which is confirmed by the regression coefficients, which are between of 0,9 -1.
Figure 1 shows the change of the CH in the engine operation in the regime described above.



For EGR = 0%	$y=-15x+34$	with $R^2 = 1$
For EGR = 15%	$y = 9{,}375x^2 – 27{,}375x + 35{,}725$	with $R^2 = 0{,}9646$
For EGR = 25%	$y = 6{,}25x^2 – 16{,}25x + 27{,}75$	with $R^2 = 0{,}902$

Figure 1. Change in CH depending on the engine load

Figure 2 shows the change of CO in the engine operation in the regime described above.
The obtained characteristics expressing the change of the emission of CO and CH have shown that with an increase in the load is increased and their values. It is in direct relation to increasing the rate of EGR. At various places in the combustion chamber arises the area of zones with a lower concentration of oxygen, which is characteristic of the rich fuel-air mixture.

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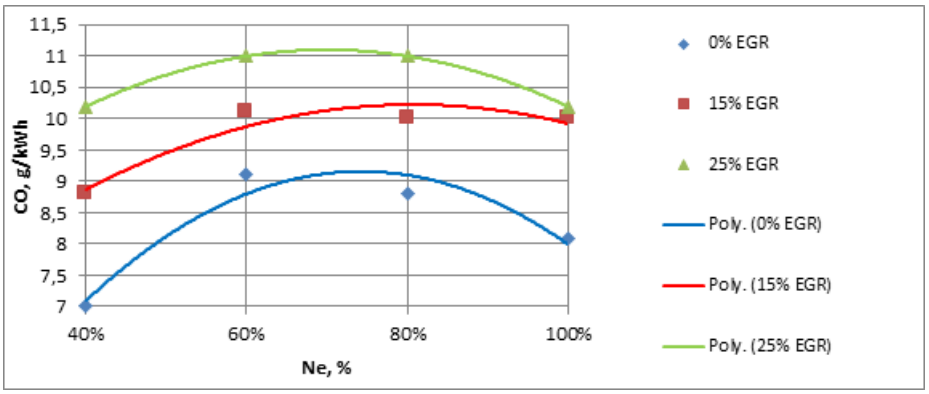
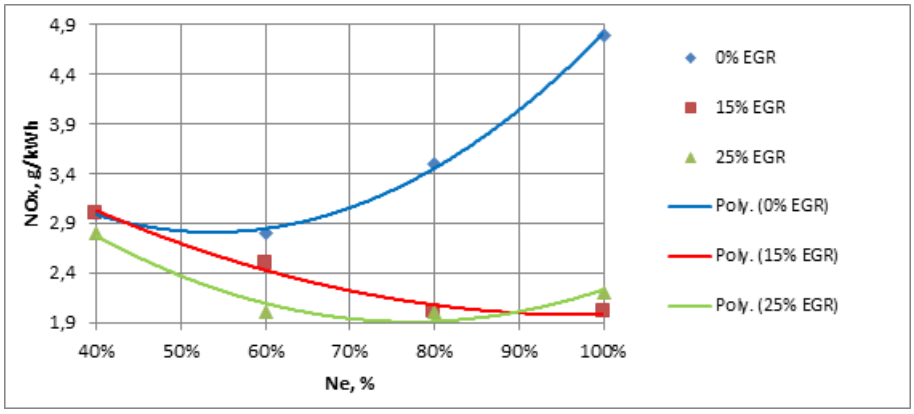


For EGR = 0% $y = -17,5x^2 + 26x - 0,5$ with $R^2 = 0,9234$
For EGR = 15% $y = -8,125x^2 + 13,125x + 4,925$ with $R^2 = 0,902$
For EGR = 25% $y = -10x^2 + 14x + 6,2$ with $R^2 = 1$

Figure 2. Change in CO depending on the engine load

This heterogeneous mixture does not burn completely and leads to higher levels of CO. At partial load, poor mixtures are more difficult to ignite due to their heterogeneity, leading to higher values of HC and CO.
Figure 3 shows the main advantage of the use of EGR to reduce NO_x emissions of a diesel engine.



For EGR = 0% $y = 9,375x^2 - 10,075x + 5,515$ with $R^2 = 0,9981$
For EGR = 15% $y = 3,125x^2 - 6,125x + 4,975$ with $R^2 = 0,9818$
For EGR = 25% $y = 6,25x^2 - 9,65x + 5,63$ with $R^2 = 0,9581$

Figure 3. Change in NO_x depending on the engine load

In the zone of partial load O_2 is in a sufficient amount, but with increase of the load, O_2 decreases sharply, resulting in a reduction of NO_x.
This in turn reduces the values of NO_x at higher loads as compared to incremental loading.

3. CONCLUSION

This study was conducted to analyze the effect of using the system for EGR for engine with direct single injection and measurement of the harmful emissions.. In applying this system showed a reduction of the harmful emissions and specific heat ratio slightly increases at lower loads with EGR than without it:

- By increasing the load specific heat ratio is almost identical with the engine with recirculation and without it;
- The temperature of the combustion gases is reduced with the use of EGR, but CH, CO increased, and NOx emissions are reduced significantly;
- It should be noted that in the 15% usage rate of the EGR is more effective the reduction of NO_x, without deteriorating the operation of the engine;
- At lower loads at engine with EGR, is decreased NO_x, without deteriorating engine performance and the harmful emissions do not reach higher levels.

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INVESTIGATION OF THE FUNCTIONAL DEPENDENCIES BETWEEN MILKING UNIT PULSATION PARAMETERS AND PRESSURE ON AN ARTIFICIAL TEAT

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Abstract: *The milking units with a triangular shape in cross-section were investigated. The data obtained are related to the structure (time-frequency components) of pulsogramme describing the mode of operation of the respective samples. The pressure is measured performed by milking liner on artificial teat at different parameters of pulsation system. The relationship between pulsation parameters of the milking units and the pressure exerted by them on an artificial teat were studied.*
Keywords: *milking unit, artificial teat, pressure.*

1. INTRODUCTION

One of the main focuses of applied research in the field of milking technique focuses on changes in pressure pulsation chambers of the milking cups in the frequency range of 1Hz to 2,5 Hz [2, 3] and the reaction of the walls of the elastic element - milking liners [4, 5].
Differences in the design of milking liners influence the operating parameters of the milking units [8, 11]. It affects the strength of rendered to teat [1]. That depends on the differential pressure between the milking and pulsation chamber and the amplitude of the milking liners [6].
The pressure at massage and irritation performed by milking liner on papilla not only increases milk production but also affects the secretory activity triggering a chain of reflex reactions of the animal. This is crucial for the normal functioning of organs for breathing, stomach, cardiovascular system, sexual organs and others [12].
According to some authors [9, 10] design of milking liner and vacuum optimization is a real opportunity to improve the efficiency of the milking units.
Despite progress in improving milking equipment and applied technology udder health problems continue to focus the attention of scientists and specialists in the field of dairy farming. We must be sought more effective (in terms of the health of the udder) combinations of the pulsation system parameters and the types of milking units. The only normative regulation is an ISO 5707 [7] which allude to minimum values of the individual phases of the pulse as a percentage (%) of its period, without commenting specific frequency range and pulse fill factor respectively pulsation ratio.
The aim of this study is to establish the relationship between pulsation parameters and exerted pressure from milking membranes (liners) on different length artificial teats.

2. METHODS

The research was conducted in the laboratory of "Milking machine" of the department Agricultural Engineering at Trakia University of Stara Zagora with milking installation Impulsa M624. The milking membranes with a triangular cross-sectional shape of the company Milk Rite model Ultraliner with a nozzle (integral type) are used. Changes in pulsation rate and ratio is carried out with electronic pulsator. When examining the size of the pressure artificial teats with a diameter of 27mm and two lengths: 85mm and 110mm ware used. They are closed at the upper part where is a discrete opening with a spigot for attachment of the flexible connection (hose). The same is connected to four-channel pulsotester VaDia. The remaining three milking cups are plugged in order to complete pressurization the milking unit. General appearance of the experimental system is shown in Figure 1. Via flexible tube to the device are connected: artificial teat, milking liner head, the short pulsation tube and the short milking tube.

Figure 1. General appearance of the experimental system

Processing and interpretation of experimental data is consistent with the common graphic profile of pulsogramme at ISO 5707 [7], shown in Figure 2.

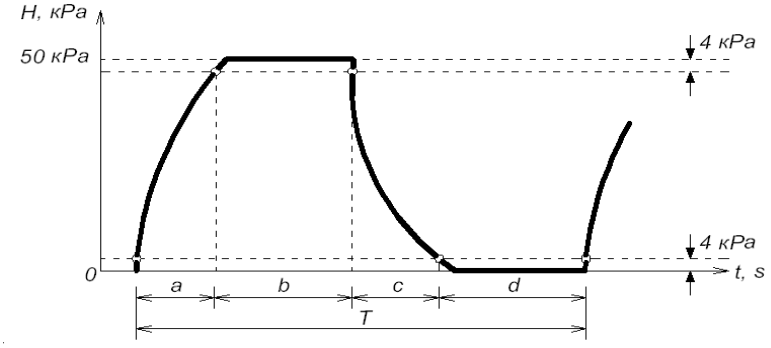

Figure 2. Common graphic profile of pulsograme at ISO standard 5707:
a - the duration of the transition process from atmospheric pressure to a nominal vacuum (front edge of the pulse);
b – the duration of the phase "a real milking" (vacuum highlands);
c - the duration of the transition process from the nominal vacuum to atmospheric pressure (rear edge of the pulse);
d - the duration of the phase "real massage" (atmospheric highlands).

The period of the pulse (T) is determined by the following expression:

$$T = t1 + t2, \text{ ms} \quad (1)$$

where t1 - duration of tact "milking", ms
t2 - duration of tact "massage", ms.

The duration of tact "milking" (t1) is described by the amount of:

$$t1 = a + b, \text{ ms} \quad (2)$$

Within the time pressure into pulsation and milking chamber is aligned and milking liner is in equilibrium - performed tact "milking".

Time massaging effect (t2) on the teat tissue is defined by the amount:

$$t2 = c + d, \text{ ms} \quad (3)$$

In the period t2 pressure into pulsation and milking chamber is different (ΔH = 50 kPa), a consequence of which the milking liner collapses and makes tact "massage".

3. RESULTS

The time pulsation system components are one of the main opportunities to increase productivity and safety of milking equipment. Udder health problems most often associated with inadequate pulsation settings and type of milking liners (membranes).
The vacuum in the milking chamber (measured in head of milking liner and short milk tube) is one of the most important factors associated with the increase of new mastitis infections. At the end of milking tact in the milking chamber exists a negative pressure (vacuum) which may cause backflow milk (fluctuation of milk). In mastitis quarter the backflow milk cause infection and the other udder quarters (cross-infection).
The values of the transition processes are kept almost constant with increasing pulsation rate and ratio (Figure 3). Slight fluctuations occur in phase "a" and they are in the range of 10-12 ms. With increasing ratio can observe an abrupt increase in phase "b". The reason for this asymmetry is created in favor of milking tact.
Increasing the frequency mode of the pulsation system is associated with a reduction in the duration of the phase of the actual milking "b". The rate of reduction is different gradations of the studied frequencies. The largest increase in the frequency of 60 min^{-1} to 90 min^{-1}.
Experimental data for the duration of the phase "d" are similar but reversed. With increasing pulsation rate the duration of the phase "d" decreases. There was a significant reduction of the phase "d" with an increase in the ratio. This is the result of the established temporary asymmetry, as already noted. It is noteworthy that occur slight fluctuations in phase "b" and "d" in pulse rate 120 min^{-1}. The reason probably is due to the fact that with increasing frequency load establishes contraction in pulsation amplitude. Practically this is reflected in incomplete contraction and dissolution of milking liner and hinder normal course of the two working tacts.
The results in Table 1 show that the pressure measured in the artificial teat almost unaffected by pulsation parameters. Its values are in the range of 5,4 to 6 kPa.

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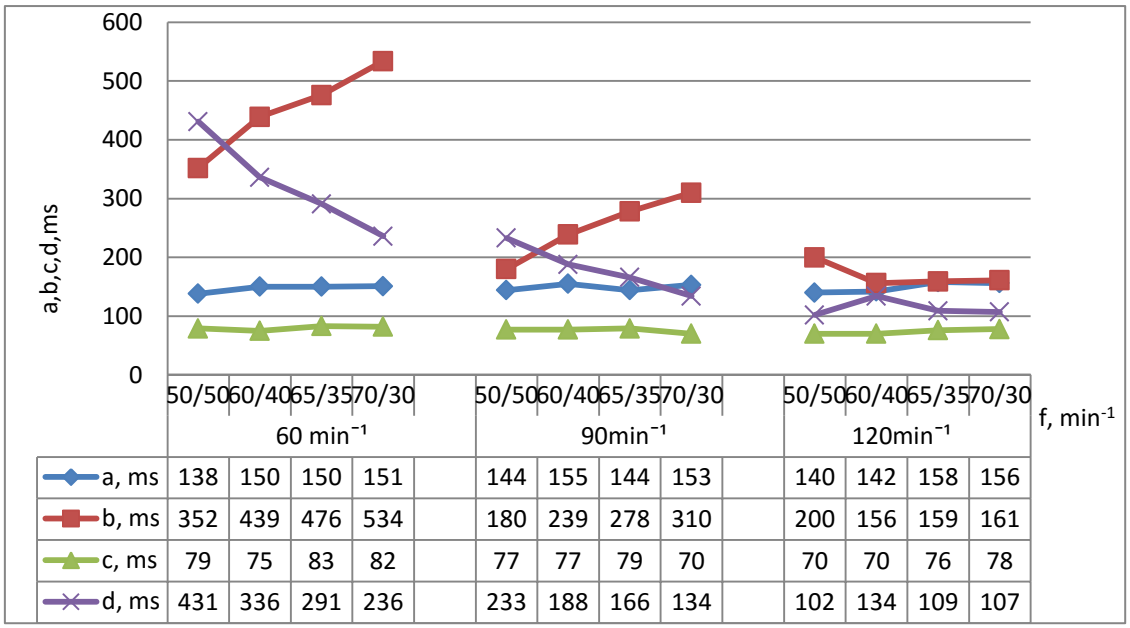
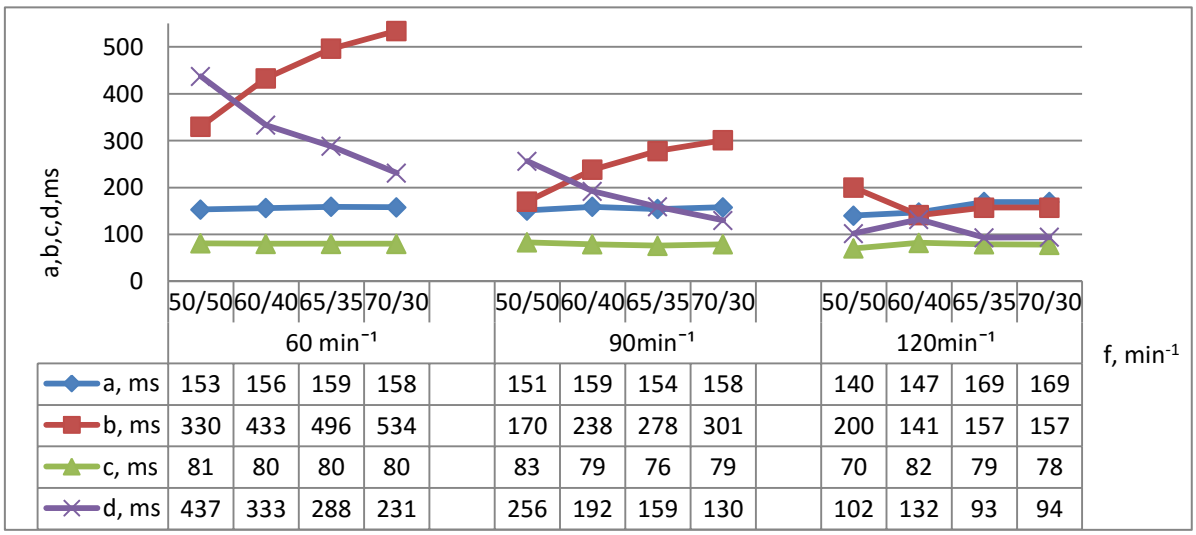


Figure 3. Duration of pulsation phases measured when using artificial teat length 110mm

Table 1. Vacuum pulsation parameters values of milking unit at an artificial teat with a length of 110 mm

Pulsation rate	Pulsation ratio	Artificial teat length 110 mm			
		Pressure in artificial teat	Vacuum value of milking liner head, kPa		Average vacuum value in short milk tube
min⁻¹	%	кPa	min	max	кPa
60	50/50	5,4	12,1	41,2	46,75
	60/40	5,6	12,5	42	47,65
	65/35	5,5	12,5	41,5	47,15
	70/30	5,7	12,7	42,1	47,6
90	50/50	5,8	12,4	41,6	47,45
	60/40	5,6	12,5	41,6	47,3
	65/35	5,8	12,8	41,7	47,25
	70/30	5,8	12,9	41,4	46,9
120	50/50	5,8	12,7	40,9	46,5
	60/40	6	13	41,8	47,35
	65/35	5,9	13,3	41,4	46,6
	70/30	5,9	13,8	41,7	47

The minimum and maximum vacuum values in the milking liner head remain almost constant at change the frequency range and ratio. The average vacuum value measured in the short milk tube varies in the range 46-47 kPa and is the result of the operation of the vacuum pump and the reliability of vacuum regulator.
There is a difference in the maximum reported pressure of the milking liner head and short milk tube. This uneven pressure gradient is a prerequisite for the occurrence of backflow milk. It is related to the transfer of microorganisms from common collector milk back to each teat. It is an objective reason for the spread of inflammatory processes between the individual mammary quarters.
The analysis of the pulsation phases is similar to that of an artificial teat length is 85mm (Figure 4). The duration of the transitional process is almost the same at change of pulsation settings. By increasing the ratio was observed a sudden increase in the phase "b" and decreasing the phase "d".



	60 min⁻¹				90min⁻¹				120min⁻¹			
	50/50	60/40	65/35	70/30	50/50	60/40	65/35	70/30	50/50	60/40	65/35	70/30
a, ms	153	156	159	158	151	159	154	158	140	147	169	169
b, ms	330	433	496	534	170	238	278	301	200	141	157	157
c, ms	81	80	80	80	83	79	76	79	70	82	79	78
d, ms	437	333	288	231	256	192	159	130	102	132	93	94

Figure 4.
Duration of pulsation phases measured when using artificial teat length 85mm

The results (Table 2) show that the pressure obtained in the artificial teat is almost constant and independent of pulsation settings. This value is slightly lower with the use of a shorter teat and is in the range of 5,0 to 5,3 kPa.
The minimum and maximum values of the obtained vacuum in the head of milking liner almost not affected by the change of pulsation rate and ratio.
When using shorter teat showed an increase in the minimum values of the vacuum in the milking liner head (Table 2). They are about 6 kPa in comparison with the data obtained for the longest teat (Table 1). On the one hand this would reflect positively on the teat tissue during the massaging phase. On the other hand the rise in pressure is a prerequisite for the occurrence of hyperkeratotic formations.

Table 2. Vacuum pulsation parameters values of milking unit at an artificial teat with a length of 85 mm

Pulsation rate	Pulsation ratio	Artificial teat length 110 mm			
		Pressure in artificial teat	Vacuum value of milking liner head, kPa		Average vacuum value in short milk tube
min^{-1}	%	kPa	min	max	κPa
60	50/50	5,3	17,2	47,2	47,3
	60/40	5,2	16,2	46,9	46,9
	65/35	5,2	17	47,2	47,4
	70/30	5,2	17,1	47,2	47,4
90	50/50	5,2	17,6	47	47,1
	60/40	5	17,4	46,9	47
	65/35	5,2	16,4	47,2	47,4
	70/30	5	16,1	46,7	47,15
120	50/50	5,1	17	46,7	47,1
	60/40	5,1	17,3	47,2	47,3
	65/35	5,2	17,5	47,2	47,4
	70/30	5,2	17,7	47,1	47,5

4. CONCLUSIONS

1. The parameters of pulsation system does not affect the pressure in the experimental artificial teat.
2. The length of the teat influences caused pressure inside.
3. The pressure on the tissue of the teat measured indirectly by establishing internal pressure is more pronounced at papilla with greater length.

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STUDIES ON VEGETATIVE DEVELOPMENT OF NAKED OAT (*AVENA SATIVA GREX VAR. NUDAE MORDV*) VARIETY "MINA" GROWN IN THE CONDITIONS OF ORGANIC FARMING IN SARKAR AGRO REGION

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Abstract: *Naked oats is varietal variation of oats, whose potential is necessary to examine for the various agricultural regions in Bulgaria.*
The objective of this experiment is to track down and to determine opportunities for growing Bulgarian naked oat variety "Mina", in ecological conditions of Sakar agricultural region.
The surveys were carried out during the period 2009-2011 in experimental base for the Sakar mountain of ISSAPP "N. Pushkarov" Sofia.
Under the too specific conditions of Sakar agricultural region and grown in organic farming the naked oats variety "Mina" shows good adaptability for growth and development. The vegetation period lasts 93-115 days. In the initial phases of its development the naked oats grew by 1.9 – 7.6 cm, in the phases of the active growing season grew by 8.3-12.3 cm. For the vegetation period the naked oats variety "Mina" grew by 64.9-74.2 cm.
Keywords: *naked oat, ecological conditions, vegetative development, dynamics of growth, Sakar agro region.*

1. INTRODUCTION

The focus of modern farming is the cultivation of crops in the conditions of organic farming. According to statistics, every year the demand for organically produced agricultural products is growing on average by 10-15% [10].
The organic farming seriously underlies in the projects of the EU regulations for the application of the common agricultural policy for the period 2014-2020. Conclusions of the European plan for organic food and farming are that Bulgaria has favorable opportunities for the production of organic products. In this context, in many parts of the country farmers turned to organic production of agricultural products [11].
After the accession of Bulgaria in the EU, requirements were placed for the production of agricultural produce, including for the most part of the cereal cultivation to be on the principles of organic farming. So part of the Bulgarian grain production was reoriented and took the new path.
The oats as a cereal falling within this group occupies a rightful place. To 2010 in Bulgaria on the principles of organic farming is produced about 4400 tons oat annually [4], [8].
The review on the studies of the naked oat shown that it is a preferred varietal variation of oats for growing [1], [2], [5], [9]. In Bulgaria are carried out researches on the possibilities of his growing in various regions of the country [2], [3], [6]. Oats “Mina” was recognized in 2005 by the Executive Agency for Variety Testing, Field Inspection and Seed Control (Bulgaria).
The objective of the present study was to explore the possibility of growing the naked oat variety "Mina" in conditions of organic farming in Sakar agroregion. The vegetative development of oats is traced - phases of growth and development, duration of periods

between phases, duration of the growing season, dynamics of growth during the growing season (measured in every ten days), the height of the crop in the various phases of its development and growth for the growing season.

2. MATERIAL AND METHODS

The experiment was carried out at the research base of the *ISSAPP "N. Pushkarov"* Sofia for the Sakar Mountain (the area of the town of Topolovgrad, Reg. Haskovo). The surveys were carried out in the period 2009-2011 under natural field conditions of Sakar agroregion.
Sakar agroregion has very specific natural-climatic conditions. The climate is continental with expressed Mediterranean influence. The soil is leached cinnamon forest with an acidic reaction (pH 4.5) and the content of humus is less than 2%.
In the previous year, the area provided for the experiment was ploughing to a depth of 26-28 cm. The predecessor of oats is peas grown for grain. In the last week of February the area is cultivating and disking. Sowing is carried out at the earliest opportunity at the beginning of March (2-3. III). The seeds of naked oat variety "Mina" are supplied by The Institute for Plant Genetic Resources "K. Malkov", town of Sadovo. The experience was factored in three repetitions with experimental area 20 m2 (2 x 10 m). Sowing of oats is made with sowing norm 18 kg/da. Mineral fertilization and plant protection with chemicals have not been carried out.

3. RESULTS AND DISCUSSION

The oats is a cereal grain, which has certain requirements to the weather conditions. It is a culture of cool and humid climate and often the climate indicators who are unfavorable to the growth and development may affect negatively on its development and productivity.
Sakar agro-ecological region is ranking as one of the warmest and with pronounced periods of drought in Bulgaria [7]. The norm of rainfall in the region is lower than the average rate for the country, and the average annual air temperature is one of the highest in Bulgaria.
In terms of climate the period in which the experiment was carried out is characterized by significant deviations from the established norms for the region. The quantities of rainfall during the first and second year are higher with 65.5 -120.8 mm, and in the third year has 34.1 mm rainfall less than the norm for the area (fig. 1).
The average annual temperature of the air during the three years of the research was higher than the norm for the region with 0.5 – 2.3 °C. The first year of the research (2009) is the warmest and with significantly higher annual average compared to the norm for the region.
The vegetative development of oats from germination to the ripening is conditioned by the manifestation of climate indicators in the period from February to July. Apparent from Figure 2 is that in both climatic indexes (monthly amount of precipitation and average monthly air temperature) over the three years of the study there is significant departures from established norms for the region.
February and March in the first and second years of research are well provided with moisture. This creates problems for soil cultivation and sowing. April and May have less rainfall amounts in 2009 and 2010 years and they are well provided with moisture in the third year. June and July are again with high moisture during the first two years and insufficient rainfall in the third year.
Data from the monthly average temperatures show that during the first year only in April it she comes close to the norm for the region and in all other months is significantly higher. In the second year with normal temperatures are the months of March and April. The third year is the closest to normal values of average monthly temperatures for the period III - VII, as an exception makes only the month of July.

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The alternation of periods of over-moisture and dry periods with high temperatures affect the vegetative development of oats. Due to the high humidity and frequent rains during the first year of the research, sowing was carried out later, and in subsequent years it was carried out at the beginning of March (Table. 1). Germination of oat in a normal weather conditions is 13 days after sowing. In critical weather situations, as is the case in the third year (low moisture in February and March 2011) is 16 days after sowing.

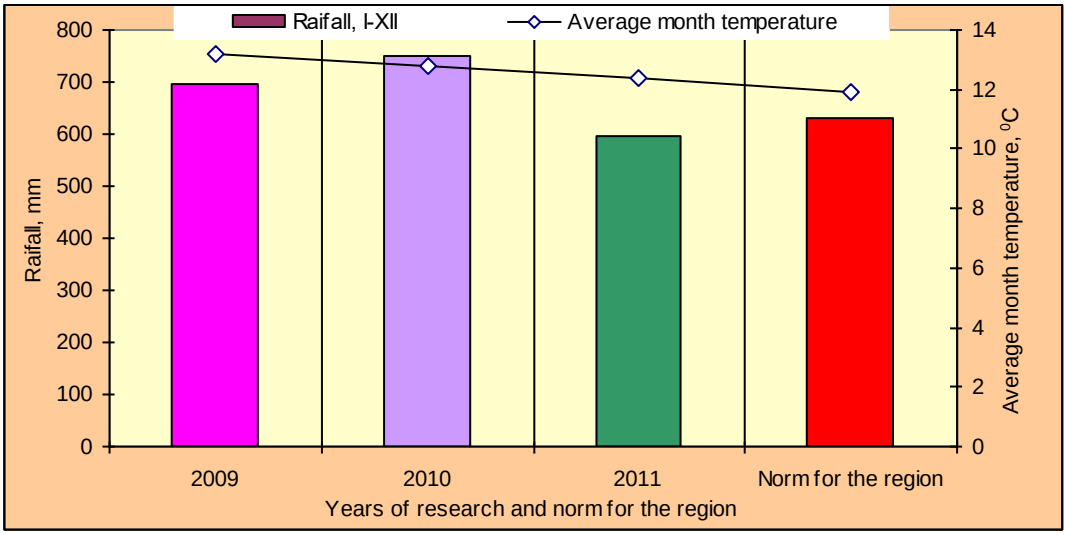

Figure 1.
The annual amount of precipitation and the average annual air temperature in the years of the research and norm for the region

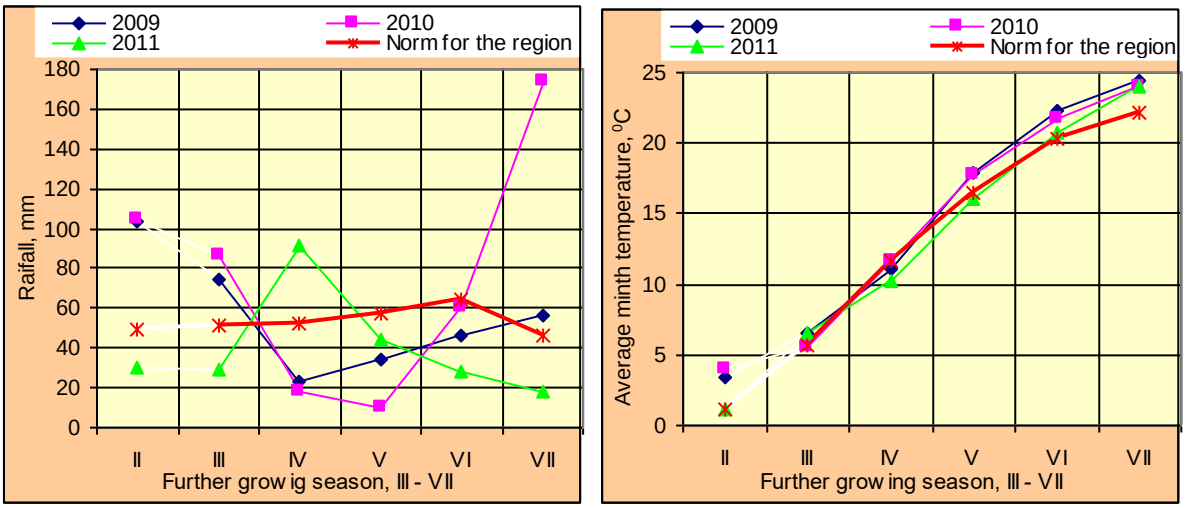

Figure 2.
Monthly amount of rainfall (mm) and monthly average air temperature (^{0}C) during II - VII month by the years of research and norm for the region

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Table 1. Dates of sowing, emergence application, harvesting, length of growing season and growth for the growing season (cm)

Year	Sowing	Date of emergence application	Emergence application of...	Date of harvest	Number of days in the growing season	Growth for the growing season, cm
2009	22.III	4.IV	13 day	3.VII	93	69.9
2010	3.III	16.III	13 day	5.VII	108	74.2
2011	1.III	17.III	16 day	10.VII	115	64.9

Under the terms of the Sakar agroregion the duration of the growing season of the spring oat variety "Mina" ranged from 93 to 115 days. Conventionally this duration is also subordinated to the manifestation of the climate indicators.
Phenological observations taking into account the phases of development on the naked oats variety "Mina" show that the longest are periods between phases tillering / first node and first node / inflorescence emergence last spikelet visible (18-19 days) (Table 2).
The period between phases Inflorescence emergence last spikelet visible / milk ripening 15-17 days. The shortest is the third period third leaf / tillering – 6 days. From Table 2 can be seen that in the first and second years there is almost no difference in the duration of the periods between phases. A certain difference is observed in the third year of research, which is actually with the longest growing season.

Table 2. Duration of the periods between phases in the years of research

	Period between phases, days							
Year	Sowing / emergence application	Emergence application / third leaf	Third leaf / tillering	Tillering / first node	First node / inflorescence emergence last spikelet visible	Inflorescence emergence last spikelet visible / milk ripening	Milk ripening / dough ripening	Dough ripening / Seed ride
2009	13	10	6	18	18	15	10	13
2010	13	12	6	19	18	17	10	13
2011	16	13	8	19	19	17	12	14

In botanical description the naked oats variety "Mina", visually is overlapping with other cereals - fibrous root system, hollow stem composed of nodes and internodes reaching in the years of the research 56,4 - 66,7 cm, inflorescence panicle, grain with sharp and elongated form (Figure 3).
In this variety is noticed the difference from the other varieties of oats. The stem is more gentle and deep green colored. Panicle is upright and piled up to the central axis, and almost no dissipation and lodging. The length of the Panicle ranges from 18,5 to 21,7 cm, and the number of grains per panicle is in the range of 28 – 33 the number. These indicators are directly related to the yield of grain. The husk does not cover well the grain and part of it remains uncovered. Ripening of the grains of panicle is quite uneven process, and is a mistake to wait for full ripening of oats.

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Figure 3. Naked oat variety "Mina" grown under conditions of Sakar agro-ecological region - phase of “Milk ripening”

The dynamics of growth of oats in the period of research under the conditions of organic farming is a direct reflection of the manifestation of climate indicators during this period. Because of the three years of research the climatic conditions have a significant deviations from the norm for the region, in the vegetative development of the investigational variety have outliers in terms of germination, the duration of the periods between phases, the height in “harvesting" phase, etc.

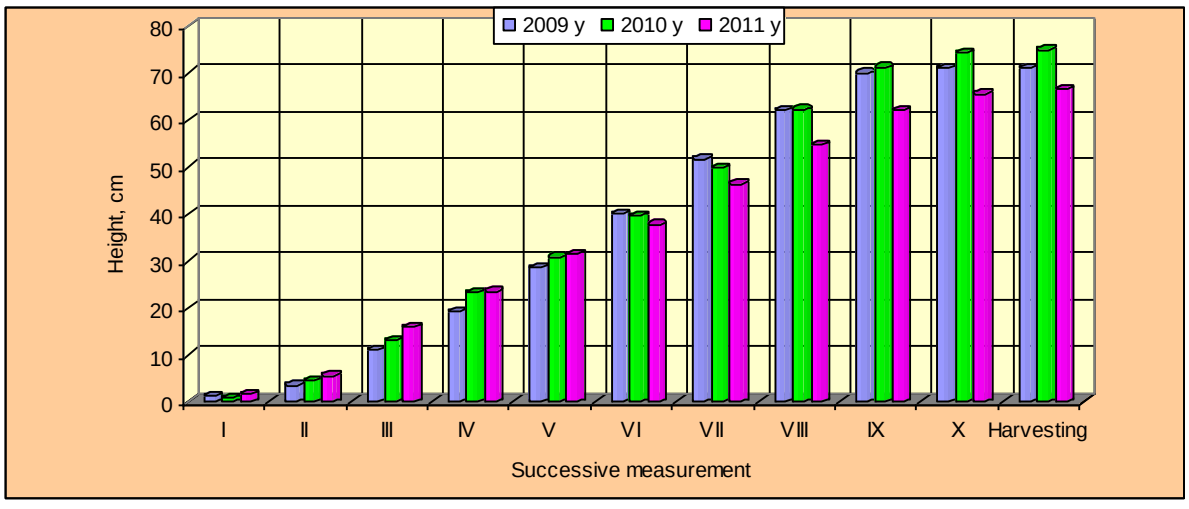

Figure 4. Dynamics of growth of naked oat variety “Mina” during the growing season from month III to harvesting in month VII by years of research, cm

At the start of vegetative growth, after the moment of sprouting, the plants are with a height of 0.8-1.6 cm (fig. 4). In the first week after the start of the growing season oats grow slowly. About one month after germination it reaches a height of 9-11 cm, then began a more dynamic growth and in phase third leaf / tillering has a height of 20,7 - 28,6 cm. In phase Inflorescence emergence last spikelet visible / milk ripening has a height of 44.6 to 50 cm. Technological maturity occurs in early July and at this point naked oats has a height of 66.5 - 75 cm.
As well as Figure 4 shows, the dynamics of growth is at a slower pace at the beginning of the growing season, as it ranges from 1,9 to 7,6 cm. More intense growth rate is observed during the active growing season, which is in the second ten days of May and the first ten days of June. The increase in this period of 10 days is 8,3-12,3 cm.

4. CONCLUSIONS

The researches on opportunities for growing the naked oat variety "Mina", in the condition of organic farming in Sakar agro region can be summarized in the following:
1. Due to the significant deviation of the climatic parameters from the established norms for Sakar agro-ecological region in the period of the research, is difficult to meet the sowing deadlines. For this reason, in one of the years the sowing was delayed and was made on 22.III.
2. The deviation of the climatic parameters from established norms effects on the dynamics of growth and vegetative development of oats.
3. In those weather conditions and in an environment of organic farming, naked oat variety "Mina" grow for growing season with 64,9 - 74,2 cm.
4. The length of the growing season is between 93-115 days, in phase “harvesting” the oats has a height of 66.5 to 75 cm.
5. At the beginning of the growing season naked oats is growing more slowly, with 1,9 – 7,6 cm, and during the period of active vegetation the growth rate is accelerating.
6. In phase ready for harvesting oats is in the first ten days of July.
7. Although observed departures from established norms and sowing deadline, can be recommended cultivation of naked oat variety “Mina” under the conditions of organic farming in Sakar agro region.

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ENERGY EFFICIENCY OF ELECTRIC DRIVE SYSTEMS AND ITS APPLICATION IN EDUCATION

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Abstract: *Motors are the most important driving components of industrial and consumer products. Therefore improving the energy efficiency of their work is an important environmental and economic problem. Systematic review of laboratory equipment for training in energy efficiency is made for the integrated influence between curricular practical training and current requirements of the industry. The application of various training tools opens up new possibilities for adapting the teaching methods in universities to the learning style of today's students. The presented system is improved with application of additional software and hardware components from other manufacturers.*
Keywords: *Electric motor, Energy efficiency, Lucas Nuelle, Training system, Education.*

1. INTRODUCTION

The electromechanical systems are widespread. They are used in many areas of everyday life. Therefore improving the energy efficiency of their work is an important environmental and economic issue. To ensure higher efficiency of these systems requires a good knowledge of the interaction between all elements thereof, which is important in their design and operation [3, 8].
Academics are encouraged to continually develop engines with high energy efficiency. Scientists and researchers are principally engaged in theoretical research, and manufacturers – to create new products and components in response to the global trend of energy efficient electric motors and electric drives, which are regarded as a common energy system and improving the related standards [6, 9].
In terms of the training is important to have a relationship and integration between curriculum based on scientific postulates, as well as industry-oriented obtaining added value [1]. The practical training must adapt to the introduction of new technologies, the level of technical innovation and prepares students for interdisciplinary realization and lifelong learning [7, 14, 15, 16].
The aim of this report is to summarize the methodology for training in the field of energy efficiency of electric drives and to propose an option for further improvement of the existing laboratory system for training and research in this area.

2. LABORATORY EQUIPMENT FOR TRAINING IN ENERGY EFFICIENCY OF ELECTRICAL MACHINES

Crucial to ensure effective learning is used laboratory facilities. In this aspect specializing Department of Electrical Engineering, Electronics and Automation [11] is trying to implement in the learning process advanced technologies, devices and systems of leading companies in the field.

Education in the Faculty of Technics and Technologies of Yambol is aimed at learning competencies for applying the existing methodologies and regulations [4, 5, 10, 18], related to the specific area energy efficiency of electric drives. To meet the requirements for preparation of competitive specialists for the labor market was established laboratory equipped with operating units and models in which students conduct experiments and research with given by the lecturer terms and conditions.
The exercises are related to solving real problems for the design and testing of energy efficient electromechanical systems, including awareness-raising and seeking appropriate solutions through research, calculations, simulations, optimization and testing results on real experimental arrangement.
Used equipment are customary for each lab-related training in automated electric drives. The use of such equipment has the advantage that the exercises which are implemented are practical and implemented by simulating real production situations [13, 17]. Thus, students develop skills in decision-making and behavior model in terms of shortage of time taking into account the parameters and requirements of production.

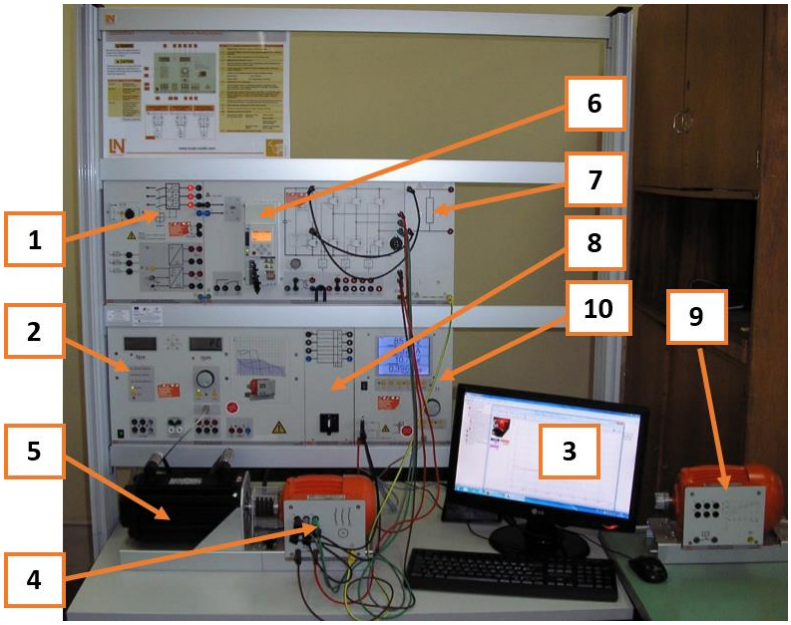
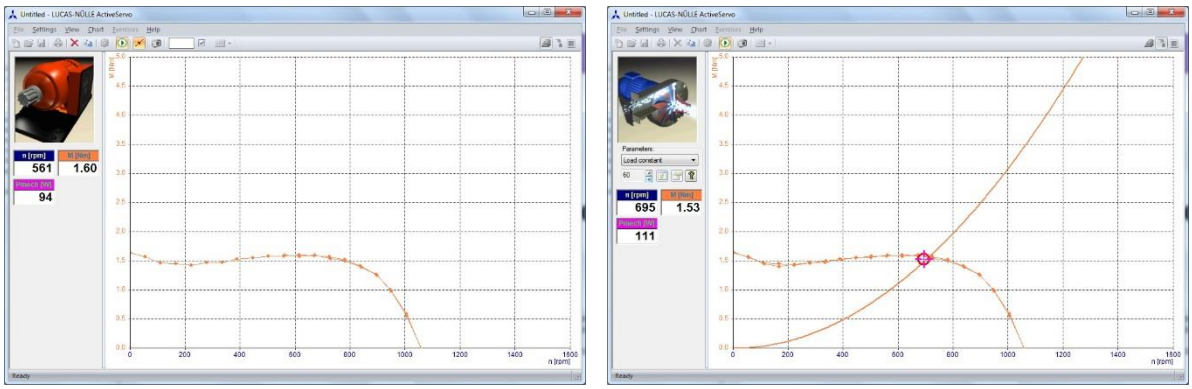


Figure.1. Laboratory stand for study of the energy efficiency of electric drives
1-Power supply unit; 2-Control and testing of servomotors; 3-PC with software; 4-Standard motor; 5-Servo motor; 6-Frequency Inverter; 7-Protective resistor; 8-Galvanic circuit breaker; 9-energy efficient motor class IE3; 10-USB multimeter

In Figure 1 it is represented common type of laboratory setup for Study of the energy efficiency of electric drives. The staging is based on a modular principle. Every element of power and control of the electromechanical system is packaged in a separate module.
The power supply module provides three-phase and single-phase AC and DC power supply for different types of electrical machines, as well as synchronous ones.
The module for control and testing of servomotors is used for testing of electrical machines and drives. It consists of a device for digital control, brake, automatic and manual synchronization. Thermal protection is provided for the controlled machine. The connection of this module to a PC is via USB interface. The control software is “Active Servo“ in which is possible to obtain characteristics of the test motor: speed; mechanical, complete, active,

reactive power; voltage and current per phase; power factor (cos φ); efficiency. Figure 2 is an example for determining the mechanical characteristics and operating point of electromechanical system with three-phase induction motor.
Through the software product can be simulated electromechanical systems such as pump, fan, compressor, lifting machine, winding machine, inertial wheel. Can be determined the regime parameters of electromechanical system with various types and value of motor loads.



a) obtaining of mechanical characteristic b) determination of optimal operating point

Figure.2. Working screens of the software „Active Servo“

Through the мultimeter with a USB connection to a PC can be measured: voltage; electricity; active, full, reactive power; power factor.
The block with frequency inverter is based on the device Lenze 8400 [20]. This module is designed specifically for training and research. The inverter operates with a linear or quadratic V/f characteristic and vector control. Management and assignment of the inverter is done with potentiometer, by the operator display or via the digital inputs. The frequency inverter can be controlled through an industrial network of field level CANopen. Can be added extensions for EtherCAT, EtherNet/IP, POWERLINK, PROFIBUS, PROFINET.

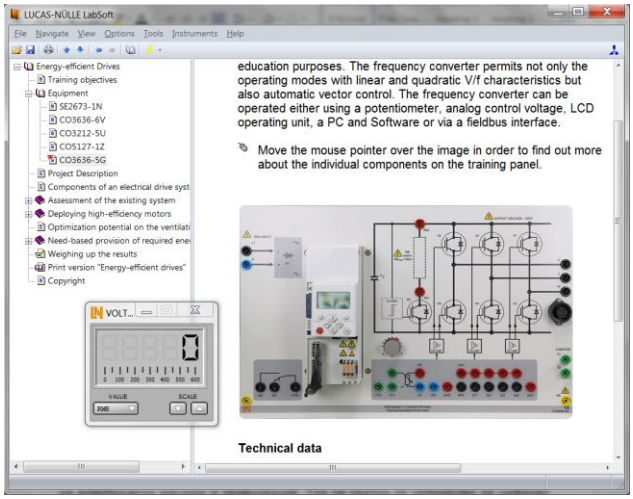


Figure 3. Screen of the interactive environment “LabSoft” with virtual instrument „Multimeter“

The training course is managed with multimedia interactive environment “LabSoft” [21]. In this software (Figure 3) are provided virtual instruments for measurements in real time and generate output signals. The work area is divided into two main window. The left side is the course content in the form of hyperlinks to the exercises, which are displayed in the right pane.

3. SUMMARY OF THE CONTENT OF THE COURSE ON ENERGY EFFICIENCY OF ELECTRIC MOTORS

Training provided by the manufacturer methodology is implemented in the usual deductive approach – „From the general to the particular“.

Table 1. Summary of the training course on the energy efficiency in electric drives

Stage		Description
Basic questions. Topicality		Justification of the topicality of the problem of application of energy-efficient electromechanical systems
Description of the equipment		Presentation of the equipment as described in Figure 1
Description of the project		Characteristics of the electric drives system of a particular object, such as a fan, pump, compressor, etc.
Block diagram of the system		Description of the system as a whole and its individual elements
Assessment of the existing system	Determination of losses	Review and description of the losses in the individual elements and of the system as a whole
	Determine the required power	Determining the necessary capacities, negative impact of oversized motor, opportunities for energy savings
	Determination of the operating point of the motor	Determination of the operating point, required power and efficiency of the system
	Determination of losses in induction motor by equivalent circuit	Calculating the parameters of the replacement scheme catalog data on motor nameplate
	Determining the optimum operating point of stable collaborative work	Studying and analyzing the important characteristics of asynchronous motors as setpoint and power required
	Direct and indirect determining the maximum usable capacity of the motor	Theoretical justification for experimental and numerical determination of nominal and critical motor parameters
Implementation of energy efficient motors	Specifics in the design of energy efficient motors	Use of energy efficient materials, reducing losses, comparative analysis of standard and energy efficient motor
	Classification of motors	Comparative analysis of the energy efficiency standards of electric motors
	Attempted preparation of the characteristics of energy-efficient motors	Practical task of testing of nominal parameters of the motor
	Identification of potential savings at partial and full load motor	Comparing the costs of operation of standard and efficient electric motor. Determination of the period for return on investments
	Opportunities for optimization of electromechanical system	Theoretical justification of energy efficient design
Efficient use of energy	Determining the optimal variant for actuation and control of the system	Choosing a method of control of the motor with adjustable speed
	Operation of the system with frequency inverter	Determining and setting the parameters of a frequency inverter. Comparative analysis of direct on-line start of the motor and under control with frequency inverter
	Determining the optimal parameters of the frequency inverter	
Analysis of results and conclusions		Analysis of results and assessment of the possibilities for energy savings in the use of standard and energy efficient motors. Possibility of upgrading of existing electromechanical system with energy efficient solutions

In Table 1 it is made summarized contents of developed by a team of the company “Lucas-Nuelle” [12] training course on the energy efficiency of electric drives. The course consists of research into energy efficiency of ventilation system with three fans powered by three-phase asynchronous motors.
The training is organized in groups of tasks, preceded by theoretical reasoning and presentation of the problem to be solved in general form. Followed by numerical and/or experimentally determination the parameters of the motor, and finally a summary of the results. After each exercise is designed test to consolidation and examination.
The presented course has the advantage of using modern multimedia and interactive tools for training the students. In software product is embedded content with hyperlinks to the exercises and the ability to use virtual instruments for measuring parameters of electrical machines. There is simulation used in the practice of electromechanical systems.
One disadvantage of this computer integrated system is that the data was plotted as a raster graphics, which hampers their direct use for processing and analysis. In the software is a possibility resulting graphics can be copied as an image file and stored on the PC or inserted into word processing applications such as MS Word or Open Office Writer and others. Connectors are provided to connect external measuring devices, such as multimeters, oscilloscopes etc.

4. IMPLEMENTATION OF OF SOFTWARE AND MEASURING EQUIPMENT FROM OTHER DEVELOPERS FOR OBTAINING AND PROCESSING OF DATA

Improvement of the system is in obtaining graphic data of measurements with application of software from other developers with tools for extracting points from raster graphics and converting them into vector. These are published on the website of Mathworks and can easily be run in software product Matlab [22]. Suitable programming tool is Grabit (Figure 4). The program offers a form defining the minimum and maximum value by x and y axes, review of the received graphic recording in a file. The coordinates are obtained by clicking on the image points, which are part of the processed chart [23].

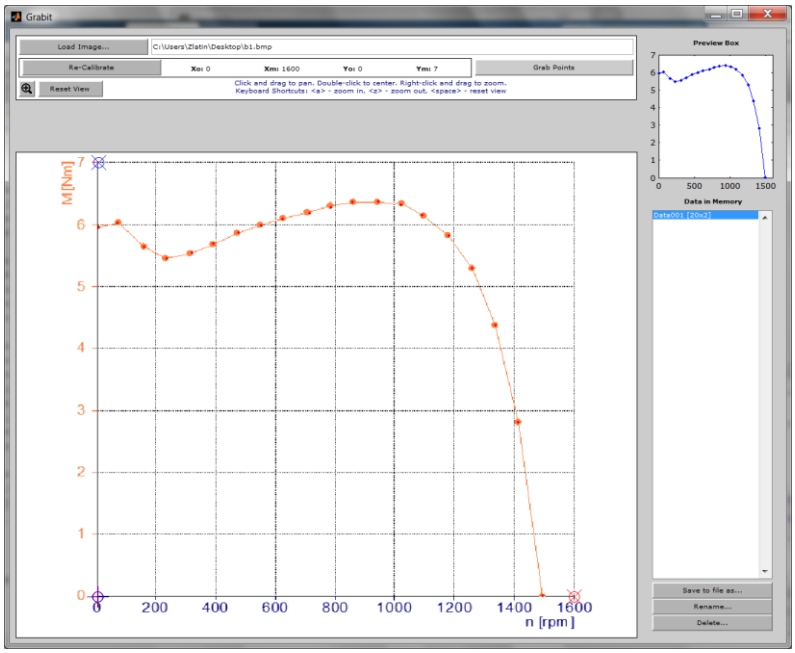


Figure 4. Form for obtaining the values from chart “Grabit”

The resulting characteristics of the motor can be presented as the Principal components, Wavelet coefficients or a combination thereof, to use methods for classification with Support vectors machines, Neural networks, Kalman filter, Decision tree and others. For example, in determining the losses in electric motors, which are related to energy-efficient use as described in [2, 19].
On the panel of the module for control and testing of servo motors are displayed connectors for measuring speed and torque. These parameters of the motor are displayed in the form of voltage proportional to them and under the connectors are specified conversion coefficients to convert measured voltage to speed and torque.

Figure 5. Measurement of speed and torque with USB multimeter
1-Multimeter with USB interface; 2-PC with PC-Link software; 3-Connectors for measuring speed and torque

Figure 5 is an example of recording of torque through multimeter with USB interface VA18B. This multimer is connected to a personal computer. The system for external obtaining of motor characteristics consists PC installed with the following software: PC-Link – Direct reading and recording the readings of multimer; MS Excel – data import from software of the meter and export to Matlab; Matlab – Importing data from MS Excel for the purpose of processing by the methods presented above.

5. CONCLUSIONS

Technology development in the field of energy-efficient electric drives require adaptation of educational content to them.
An analysis and systematic review is made of hardware and software content of training courses of laboratory setup for testing the energy efficiency of electric motors. The results of this analysis indicate that additional software and measuring equipment is necessary for application of this equipment for research purposes.
By summarizing the methodology for conducting exercises in the field of energy efficiency of electric drives are systematized different options allowing students to find appropriate solutions in case of problems in this area.
Software and measuring instrument are adapted for obtaining data of motor characteristics in vector format. From these characteristics can easily be retrieved features that can be used as input to the classifiers.

6. ACKNOWLEDGEMENTS

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CONTACTLESS METHODS FOR QUALITY EVALUATION OF DAIRY PRODUCTS

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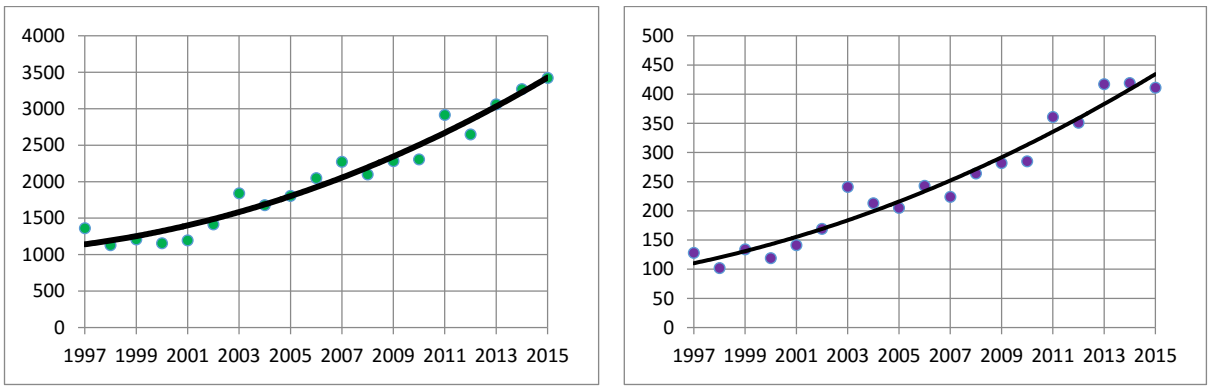
Abstract: *The aim of the report is to present a comparative analysis of the methods and technical means for assessment of the quality and safety of dairy products, particularly yellow cheese by spectral characteristics. As a result of the analysis are established appropriate methods for representation of the spectral characteristics and classification of the researched product. In the development are shown and evaluated the accuracy and performance of the results of studies conducted in the laboratory of the Trakia University, faculty of Technics and technologies with the discussed methods for evaluation the quality of the food product.*
Keywords*: Dairy products, Noncontact methods, Yellow cheese, Spectral analysis, Classification.*

1. INTRODUCTION

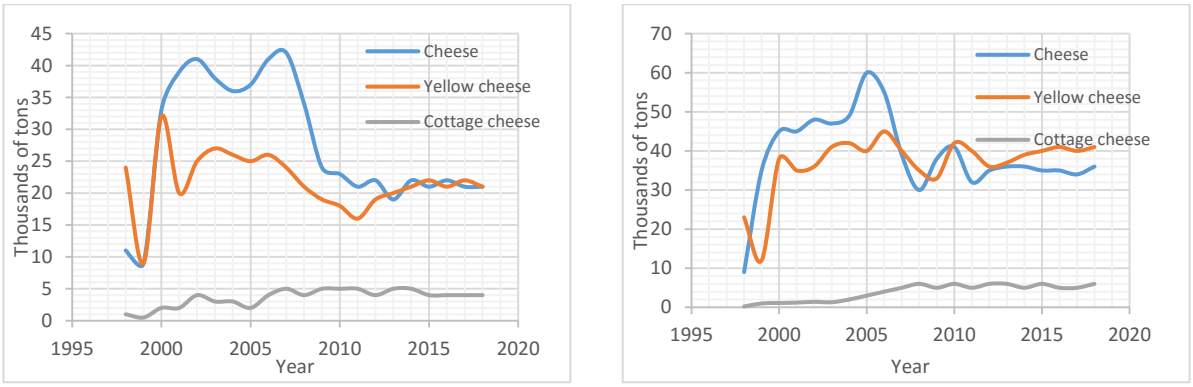
Milk and dairy products are one of the main foods that presents on our table. Due to their structure and chemical composition they are favorable environment for microorganisms. Secondary contamination can occur in the extraction of raw materials and at different stages of production of dairy products. Today, most consumers monitor a wider range of criteria in choosing of dairy products. They consider dairy products not only in terms of their taste and their direct nutritional value, but also in terms of their potential beneficial and health effects. This makes the traditional and well-established dairy products in an appropriate basis for the search and development of new functional foods and directs its efforts towards characterization of lactic acid microflora [27,32].



a) Keyword „Cheese“ b) Keyword „Yellow cheese“

Figure 1. Number of publications for dairy products in Google Scholar and ScienceDirect

Therefore, before, now and in the future dairy products have been, are and will be a constant subject of research by many scientists. This is evidenced the recent upward trend in the number of scientific papers published in refereed databases [9,24] „ScienceDirect“ and “Google Scholar“ (Figure 1) on the innovations in assessing the quality of dairy products.
With the country's accession to the European Union (EU) dairy industry has become an integrated part of the European Common Market, as well as to policy and regulations existing in the market and on market competition. The milk sector in Bulgaria, unlike that of other member states, has its specificity – it is based mainly on cattle, although Bulgaria has traditionally been a manufacturer and sheep, goat and buffalo milk – in the limited quantities. While in other EU countries the share of cow's milk is over 98%, in Bulgaria it is between 85-90% with an expected upward trend due to the continued contraction of the sheep and goat farming in the new marginalization [4].



a) Production of dairy products

b) Consumption of dairy products

Figure 2. Production and consumption of dairy products by year

The results of in-depth analysis testify to a distinct tendency to maintain high levels of production and consumption (Figure 2) dairy products from cow's milk in Bulgaria and the European Union, White and Yellow Cheese remains one of the most consumed products [8]. The production and control of this product should be harmonized with European requirements and tailored to the nature and specifics of consumer needs. Safety, quality and wholesomeness of dairy products can only be guaranteed through the integration of law and control the entire food chain. The achieving of these indicators on food also is a goal that requires joint efforts and competence of experts from various professional fields - technologists, engineers. Standards related to the quality and safety of dairy products are subject to improvement by amendments – adopted procedures for standardization in practice, if some of their clauses and details do not withstand the test of time.
International Standard BDS EN ISO 22000 integrates the principles of the system of hazard analysis and critical control points (HACCP - Hazard Analysis and Critical Control Points) with: ISO 22004 for steps for its implementation, developed by the Commission of Codex Alimentarius; BDS EN ISO 22005 - Traceability in the food and food chain ISO/TS 22003 management systems of food safety. The national standard for Bulgarian yellow cheese BDS 14: 2010 is valid from 16.11.2010 and applies to Bulgarian yellow cheese made from cow, sheep or mixed milk, whole or in standardized ratio casein / fat using starter culture produced in Bulgaria selected strains of lactic acid bacteria isolated in Bulgaria by coagulation with rennet, given the necessary treatment, undergo a process of ripening and intended for consumption.

2. NONDESTRUCTIVE METHODS FOR OBJECTIVE ASSESSMENT OF THE QUALITY OF DAIRY PRODUCTS

In recent years are carried research for dairy products to determine the brand (manufacturer) of white and yellow cheese, identification of the content of hydrogen peroxide, the geographical origin of the product. In modern stage are seek methods for coadministration of multi-sensor systems with or without fusing the data from them for quality evaluation of dairy products [14]. In Table 1 are presented from the literature known types of sensors and measurement methods used in assessing the quality of dairy products. Some of the methods are contact, while others are used without a direct physical impact on the product.

Table 1. Sensors used for analysis and evaluation of the quality of dairy products

Type of the sensor	Method of measurement	Description	Reference
Conductive electrode	Conductance	The method is contact	[15,20]
Gas	Resistance, frequency	Electronic nose - contactless method used are polymer or resistive sensing elements	[21,31]
Biosensors	Resistance, frequency	Electronic tongue - contact method used are selective sensors	
pH	Acidity	pH meter – contact method	[27,30,31]
Viscosity	Current of the motor, time to expiration	Viscometer – contact method	[27]
Penetration	Penetrometer	Contact method - measuring the force required for penetrating of the sensitive element in the product	[22]
Optical	NIR, VIS, UV, IR, laser	Spectrometers, colorimeters with transition and reflection, video camera	[7,12,21]
Ultrasound	Impedance, amplitude, frequency	Non-contact method – reflection or transition	[1]

Table 2. Comparative analysis of optical methods for non-destructive evaluation of the quality of dairy products

Method	Advantages	Disadvantages	Reference
Computed tomography	Non-destructive	High cost of the equipment	[16]
	Detailed images are obtained	Long time for data processing	
		Limitation of application areas	
Computer vision	Can be obtained spatial information about the object	Restriction for objects with varied composition	[33]
	Higher precision than the human judgment	Not suitable for detection of the internal defects	
	The ability to detect external defects		
Spectral analysis	Easy to use	Limited sensitivity to small changes in the properties of the object	[6]
	Obtaining of spectral information		
	Suitable for internal defects		
Hyperspectral analysis	Obtaining of spectral and spatial information	Висока цена на оборудването	[11]
	High sensitivity to small changes in object	Problems processing the data	
	Construction of images on the chemical composition of the object		

Contact methods have significant disadvantage that measured on immersion of the measuring probe in the product, in which can be inserted micro-organisms from the environment. For example, some types of electronic tongues use sensors that measure the extent of the chemical reaction between the chemical substance and product to detect the presence of harmful toxic element for humans [13]. These disadvantages of the contact methods of measurement are prerequisites for seeking suitable contactless methods for assessing key quality indicators of dairy products. Such techniques are optical, gas, ultrasound. Gas sensors are suitable for assessment of raw milk as a feedstock for the production of dairy products. For example, in lactic acid fermentation of Bulgarian yoghurt does not emit odoriferous substances and this type of sensors are not appropriate. They could be applied in the preparation of functional foods from milk as yogurt, cheese, cottage cheese, because it is possible products used as additives to emit aromatic substances in fermenting. Video sensors are suitable mainly for assessment of milk and again in the preparation of functional foods and microbiological analysis in microscopic research and evaluation of surface characteristics of dairy products.

Table 3. Examples of application of spectral analysis for quality assessment of dairy products

Spectral range, nm	Parameters of the product	Number of the samples	Method of representing of the data	Method for processing	Reported results	Ref.
270÷550, 310÷590	Riboflavin	42	Parallel factor analysis (PARAFAC)	Partial least squares regression (PLSR)	R^2=0,94÷0,97	[36]
400÷1000, 325÷1075	Determination the type of product	160	Principal component analysis (PCA)	Back propagation Neural network (BPN)	100% recognition	[37]
No data	Determination of arsenic, plumbum, mercury and selenium	No data	Comparative analysis of five measuring apparatus	Relationship with reference parameters	Common error of the devices 0÷23%	[19]
325÷1075	Sugar and pH	35	Combination of PCA and artificial neuron network (ANN)	PLSR	R^2=0,91÷0,92	[26]
200÷1000	Amendment during storage of the humidity, protein, fat, ash content	No data	Conversion of spectrum to L, S, H color components	Analysis of variance (ANOVA)	Non-parametric comparative analysis	[28]
500÷2500	Determination the type of product	No data	Possibilities for predicting parameters by spectral characteristics		Non-parametric comparative analysis	[18]
1100÷2300	Fat content	141	Coefficients of PLSR	PLSR	R^2=0,93÷0,98	[10]
200÷1000	Changes during storage: pH, viscosity	75	Coefficients of PLSR and relationship with reference parameters	PLSR	R^2=0,02÷0,85 depending on the observed parameters	[2]
400÷1200	Protein	257	Coefficients of PLSR	OC-PLS (one class)	10% outliers	[35]
1000÷4000	Melamine	No data	No data	Correlation analysis	2% precision of determination	[23]
900÷1700	Fat content	No data	Coefficients of PLSR	PLSR	R^2=0,97	[25]
420, 520, 700	Changing of the pigments during storage	No data	Conversion of spectrum to color components	No data	Non-parametric comparative analysis	[34]

More universal application than other methods are found optical and ultrasonic sensors that are applied to assess the quality of dairy products at all stages of production and that acceptance of raw milk pasteurization, starter culture, tracking of the fermentation process, control of final product and storage. Known from the literature for non-destructive analysis of dairy products occupy considerable space the optical methods. Such methods are computer vision, spectral and hyperspectral analysis. Table 2 presents comparative analysis of the presented methods for non-destructive evaluation of the quality of meat and meat products and are listed their advantages and disadvantages.
The spectral analysis is a set of physical methods for quantitatively and qualitatively determining the composition of substances by studying their spectra. It is widely used in the research of the quality of various food products, including milk and dairy products. Compared with computer vision, spectral analysis has found wider application in assessing the quality of dairy products. The possibilities for application of spectral analysis in the near infrared and mid-infrared range are well studied in the evaluation of dairy products. This includes monitoring the production process, determining the geographical origin, quality assessment, monitoring the ripening process of some dairy products. The relationship between the composition of a substance is the electromagnetic spectrum emitted or absorbed by it, allows spectral analysis be used as sensitive, relatively simple and quick method in research and industry. One of its advantages is that it can be applied to a large number of samples without this having a significant impact on the price and timing of the study [13,32].

3. METHODS OF EXTRACTING THE INTRINSIC PROPERTIES OF SPECTRAL CHARACTERISTICS

Principal component analysis (PCA) [26]. Extracting characteristic features is a transformation of the original data with all their variables in a sample of reduced benefits. Use all measurements or variables that are designed in small size area. The reasons for the extraction of characteristic properties are as follows:

- Reducing the bandwidth of the input data;
- Providing a smaller number of features to speed up the classification;
- To reduce the surplus of information;
- To obtain a smaller dimension of the data in the ideal case - two dimensions with a minimum loss of information and in this way data are displayed better.

Discrete parametric models [3]. Discrete parametric models reflect discrete behavior of the object only in moments of time that are multiples of the so-called “time sampling” – time measurement clock cycle T_0. For processing of the spectral characteristics of the surface areas of dairy products are selected discrete parametric models as they are discreet in nature.

4. METHODS FOR PROCESSING OF SPECTRAL DATA AND CLASSIFICATION

In the study are used methods for classification: discriminant analysis DA; K-nearest neighbors KNN; Method of support vector machines SVM (Figure 3). Referred are the main characteristics of these methods.

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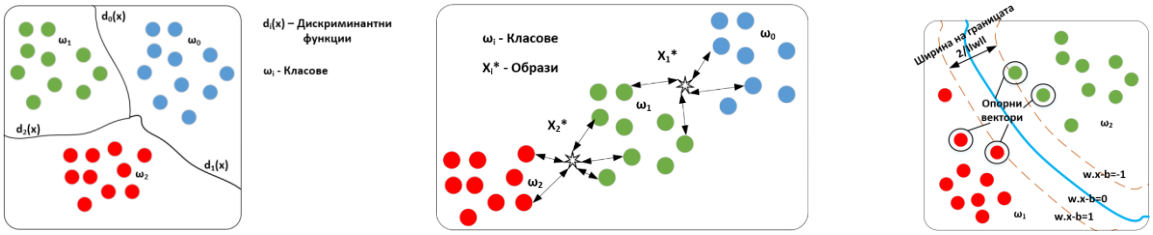


a) DA b) KNN c) SVM

Figure 3. Methods for classification used in the investigation

Discriminant analysis [5,13]. The discriminant analysis is multidimensional data analysis, which is used when there is need for "predicting" the values of the grouping variable. This is also called classification or pattern recognition. In non-linear discriminant analysis to build non-linear discriminant functions of the predictors. The aim is to obtain a rule for assignment of a new observation of the given class. Assignment or „distribution“ to a certain class of features is necessary on this development.

K-Nearest Neighbors (KNN) [13]. The method of k-nearest neighbor (k-nearest neighbors method- KNN) is a method of classification of images, which is based on the closest training examples in the space of features. Unknown image refers to a class to which they belong at least S from k nearest neighbors by providing a sample of images. S is the threshold for credibility.

Support vector machines (SVM) [17,29]. In this method is performed non-linear transformation of the original data in another space with a higher dimension where the objects are linearly separable (Figure 6c). In SVM – the method on the support points that represent breakpoints for a class data in multidimensional space of the features can be calculated hyper planes separating classes for which the distance limits between the two classes is maximum.

The original algorithm of the SVM method is linear, but are developed and nonlinear ones. In nonlinear algorithm data are separated by a non-linear kernel function. This allows the algorithm to match the hyper plane with the greatest separation between the two classes in the transformed feature space. The kernel non-linear function can be homogeneous polynomial, non-homogeneous polynomial, Gaussian radial basic and hyperbolic. The significance of the parameter Capacity - C, which is common to all types of SVM, account during the phase of training of the classifier and is expressed in prioritizing one of the two factors - minimizing the number of wrongly classified objects of the training sample or complexity factors of the synthesized hyper plane.

Erross in determining the parameters of the models are calculated by equations, described in table 4.

Two-factor analysis of variance [28]. The main objective of the analysis of variance is as in regression analysis - to investigate the significance of a particular group of factors (independent variables) on a dependent variable, but here factors are nominal variables. Two-way analysis of variance allows simultaneously to study the influence of two factors on the outcome of the research object.

Partial least squares regression and principal component regression [25,26]. Quantitative analysis of the data was realized by partial least squares regression (PLSR) and principal component regression (PCR). The effectiveness of certain methods in the processing of predictive values with high dimension, such as the spectral characteristics of meat and sausages. Both methods generate new predictive variables known as components as a linear combination of the original predictive values. Methods used to analyze data

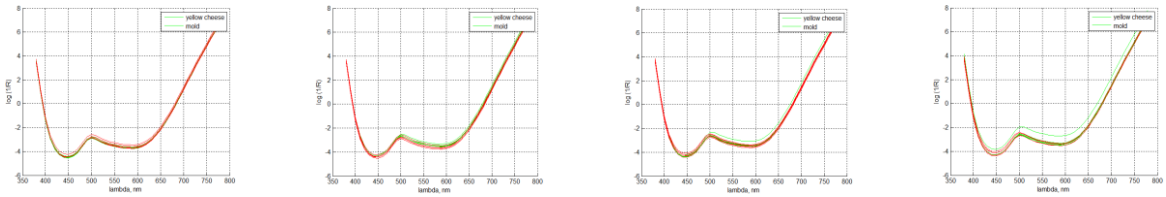
create these components differently. PCR creates components describing the variation in the prediction variables without considering basic components. In the partial least squares regression these output variables are taken into consideration and results obtained with lower accuracy at a small number of components. The choice of method of analysis of the data depends upon the particular application in which they are used.

Table 4. Errors in determining the parameters of the models

R^2	$R^2 = \frac{r_{ss}}{t_{ss}}$	$t_{ss} = \sum_{i=1}^{n}(y_i - y_{mean})^2$ $r_{ss} = \sum_{i=1}^{n}(y_i - y_{i\,fit})^2$	R^2 – Regression coefficient y_i – Measured values y_{mean} – Mean of measured values y_{fit} – Values of the model n – Number of measurements
MSE	$MSE = \frac{1}{n}\sum_{i=1}^{n}(y_{i\,pred} - y_i)^2$		MSE – Mean squared error $y_{i\,pred}$ – Predicted values y_i – Measured values n – Number of measurements
RMSE	$RMSE = \sqrt{\frac{1}{n}\sum_{i=1}^{n}(y_{i\,pred} - y_i)^2}$		RMSE – Root mean squared error $y_{i\,pred}$ – Predicted values y_i – Measured values n – Number of measurements
Common error	$\varepsilon_0 = \frac{\sum_{i=1}^{n}(\sum_{k=1}^{n} y_{ik} - y_{ii})}{\sum_{i=1}^{n}\sum_{k=1}^{n} y_{ik}}.100, \%$		y_{ik} is number of samples from class i, classified in class k y_{ii} – Number of correctly recognized samples k = 1...n – number of incorrectly classified as a class i in the total number of samples n – Number of classes

5. ANALYSIS AND ASSESSMENT OF THE CHANGE OF SURFACE CHARACTERISTICS OF DAIRY PRODUCTS BY SPECTRAL DATA

Objects of the study is yellow cheese purchased from a licensed manufacturer and manufactured of BDS and the adjacent regulations. Characteristics to be assessed are surface changes of the product in storage in conditions not complying with the requirements specified by the manufacturer. The spectral characteristics were obtained with laboratory staging for measuring spectral characteristics of reflection in the visible spectral region, developed at the Department of „Electronics, Electrical Engineering and Automation" of the faculty „Technics and Technology" – Yambol. Laboratory measurements of titratable acidity were made at the Department of „Food Technologies" at the same faculty. Figure 4 shows the spectral characteristics of object areas with yellow cheese and mold during every day of measurement. There is overlap of these characteristics in different spectral ranges are also visible differences in these characteristics, for example in the range 550÷600nm.

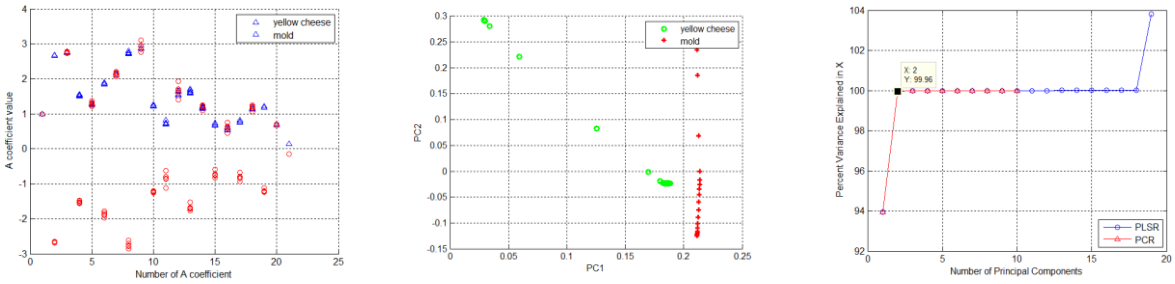


a) day 1 b) day 3 c) day 4 d) day 6

Figure 4. Spectral characteristics of object areas with yellow cheese and mold in different days of measurement

➢ **Presentation of the spectral characteristics as features**

Figure 5 shows auto regression coefficients and major components of the measured spectral characteristics of the yellow cheese and mold on day 3. There is a partial overlap of the autoregression coefficients, while the principal components is available clearly distinguish of the surface characteristics of product under study, divided into two classes „yellow cheese" and „mold".



a) AR b) PC c) Number of PCs

Figure 5. Representation of the spectral characteristics as features for day 3

➢ **Designation of the necessary number of principal components for a description of spectral characteristics**

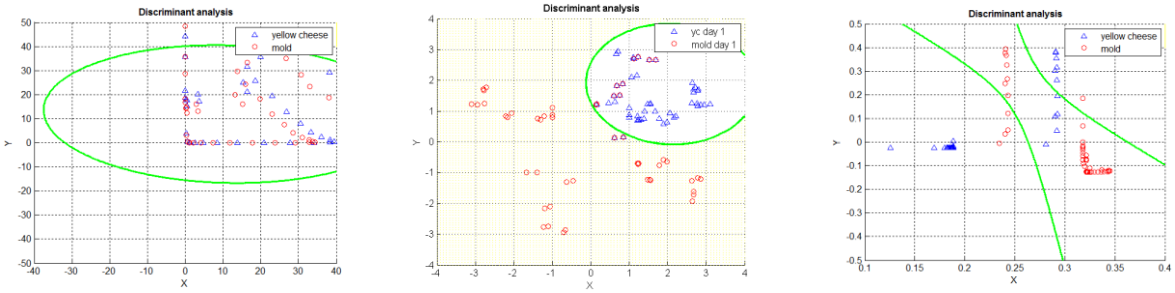
Figure 5c presents the results in determining the required number of major components for a description of spectral characteristics of the object areas with yellow cheese and mold. It can be seen that the two main components describing 99,9% of the variance in the data.

➢ **Evaluation of the separability of object areas of spectral characteristics in different days of storage by classifiers**

The evaluation of the separability of object areas was realized with three classifiers that are most commonly used for analysis of dairy products. These are discriminant analysis (DA), method of support vector machines (SVM) method and K-Nearest Neighbors (KNN). DA and SVM are used with nonlinear separating functions.

Discriminant analysis. Figure 7 shows the results when using a non-linear discriminant analysis of separability of the object areas with yellow cheese and mold on day 3.

For all days of storage were used spectral characteristics (raw), Autoregression coefficients (AR) and principal components (PC). For all methods of data representation is observed overlapping of classes.



Raw AR PC

Figure 7. Classification with DA for day 3

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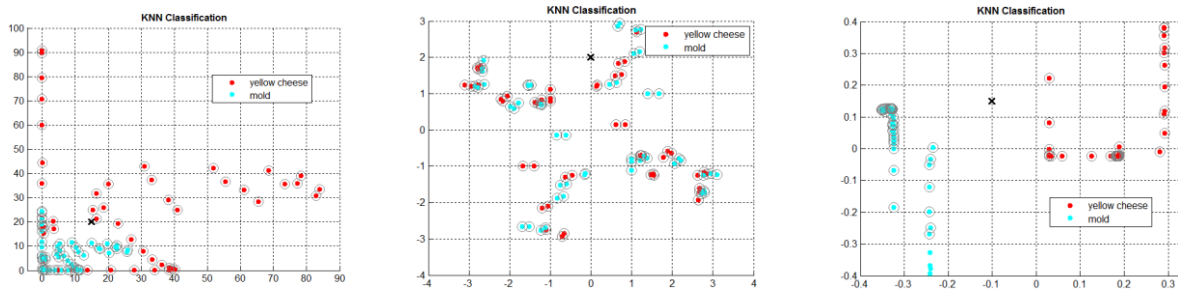
Table 5. Separability of object areas on a particular day of the storage with discriminant analysis

Day of the storage	Raw	AR	PC
	ε_0, %	ε_0, %	ε_0, %
day 1	49	11	1
day 3	47	11	9
day 4	46	12	5
day 6	46	12	4
Raw - spectral characteristics; AR - auto regression coefficients; PC - principal components			

This overlap is also reflected by the common error of the classification. The values of this error for all days of storage are presented in Table 5. Small amounts of the common error is obtained using major components ε_0=1÷9%. Using a nonlinear discriminant analysis and two other classifiers for the presentation of object areas – spectral characteristics and autoregression coefficients the common error greatly exceeding 10%.

KNN analysis. The results of Severability of object areas for day 3 are shown in Figure 8. Overlap between the two classes is observed using direct spectral characteristics and Autoregression coefficients while using the principal components will overlap of classes on this day.



Raw AR PC

Figure 8. Classification with KNN for day 3

Table 6. Separability of object areas on a particular day of the storage with KNN analysis

Day of the storage	Raw	AR	PC
	ε_0, %	ε_0, %	ε_0, %
day 1	30	25	5
day 3	26	31	13
day 4	28	32	12
day 6	34	19	3
Raw - spectral characteristics; AR - auto regression coefficients; PC - principal components			

This trend is observed for the remaining days of storage. Table 6 indicates the values of the common error in classification by three methods for presenting data of object areas with yellow cheese and mold. Using principal components was observed common error within 3÷13% depending on the day of measurement. In other methods of representing the spectral characteristics the common error is over 10%.

SVM analysis. Figure 9 shows the results in the classification of yellow cheese for day 3 of storage. The processing of data by the three methods for their submission with the method of the support vectors indicates that the direct use of spectral characteristicsoverlapping was observed of the two classes while using the autoregressive coefficients, and the main components that overlap is with minimal error.

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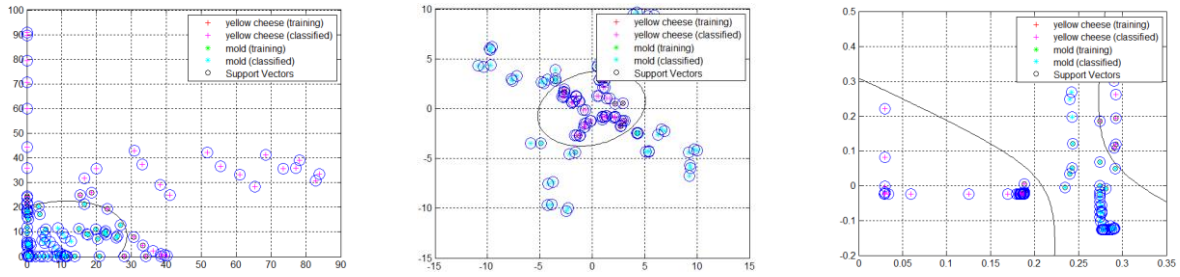


Raw AR PC

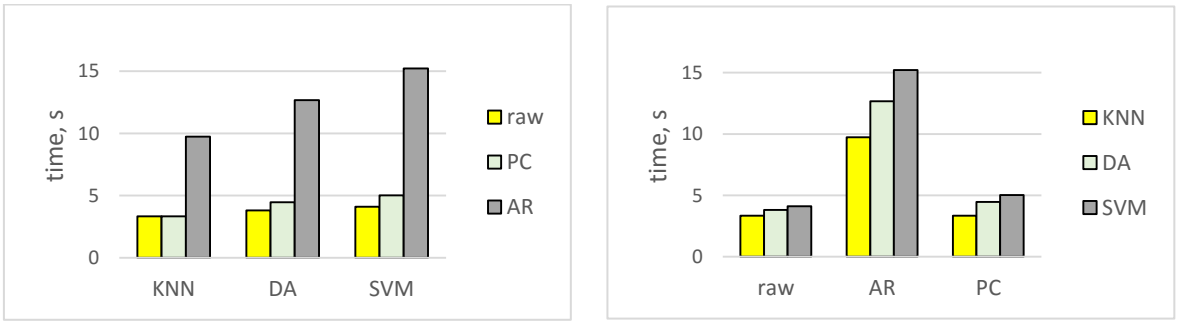
Figure 9. Classification with SVM for day 3

Table 7. Separability of object areas on a particular day of the storage with SVM analysis

Day of the storage	Raw	AR	PC
	ε_0, %	ε_0, %	ε_0, %
day 1	35	2	2
day 3	31	2	4
day 4	36	2	4
day 6	31	2	2
Raw - spectral characteristics; AR - auto regression coefficients; PC - principal components			

Evidence of this is the common error of the overlap of classes for individual days of measurements, which values are presented in Table 7. Using auto regression coefficients and principal components error values are between 2÷4%, while in the direct use of spectral characteristics the common error is over 10%.

Results from analysis of the processing time. The values for the time of data processing in classification are coefficient of variation 3 ÷ 12% << 30%, so it can be presented as mean values (Figure 10). Data on time for the processing at classification are analyzed with two-way analysis of variance by the means of Data Analysis Toolpack of MS Excel. At accuracy level α=0,05 the results obtained are presented in Table 8. The table shows that it is derived significance level p <0,05, which indicates that there are differences in the results using the various classifiers and other methods of representing data. The results of the analysis indicate that at least processing time is obtained with direct using of the spectral characteristics and classification method of K-Nearest Neighbors (KNN).



a) depending on the classifier b) depending on the features

Figure 10. Time for processing the results of classification

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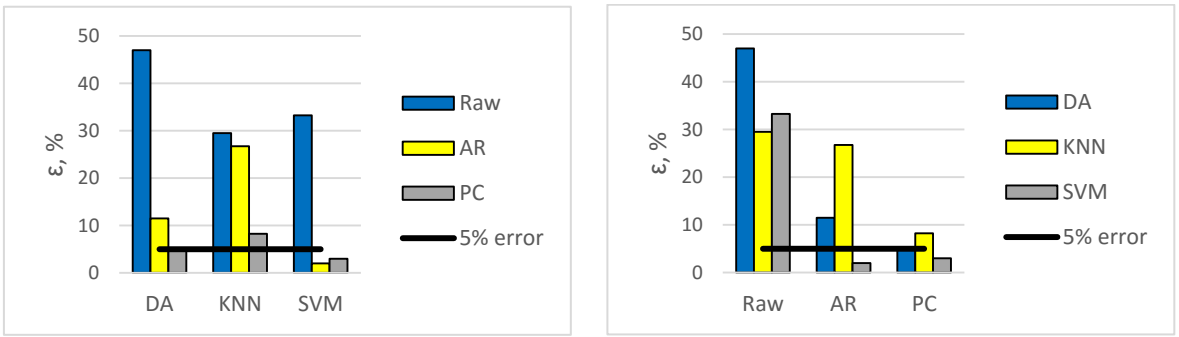
Table 8. Analysis of the results of time for data classification

Anova: Two-Factor Without Replication				
SUMMARY	*Count*	*Sum*	*Average*	*Variance*
KNN	3	16,42	5,47	13,65
DA	3	20,95	6,98	24,36
SVM	3	24,34	8,11	37,98
raw	3	11,26	3,75	0,15
AR	3	37,62	12,54	7,49
PC	3	12,83	4,28	0,73

ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Rows	10,53	2,00	5,26	3,38	0,14	6,94
Columns	145,76	2,00	72,88	46,81	0,00	6,94
Error	6,23	4,00	1,56			
Total	162,52	8,00				

Errors in the classification. Errors in the classification are coefficient of variation 3 ÷ 12% << 30%so it can be presented as mean values (Figure 11). Data on time for the processing at classification are analyzed with two-way analysis of variance by the means of Data Analysis Toolpack of MS Excel. At accuracy level α=0,05 the results obtained are presented in Table 9. The table shows that it is derived significance level p <0,05, which indicates that there are differences in the results using the various classifiers and other methods of representing data. The results of the analysis indicate that the smallest value of common error is obtained with using of principal components and classification method of support vector machines (SVM).



a) depending on the classifier b) depending on the features

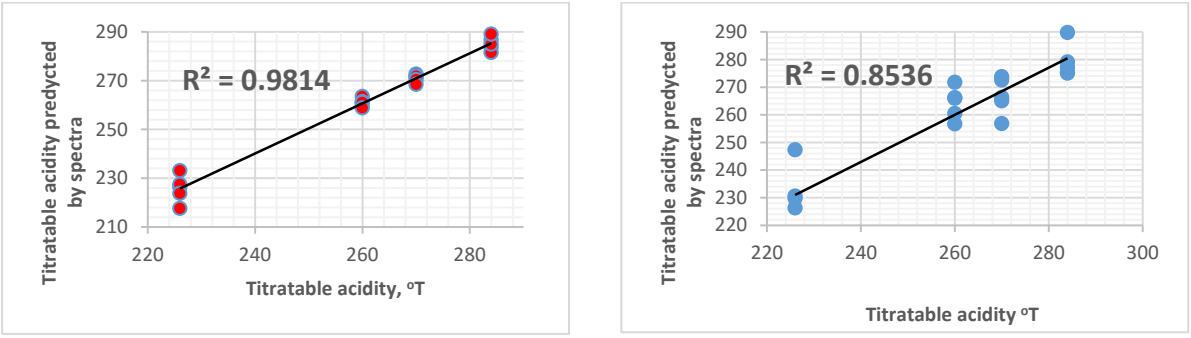
Figure 11. Common error of classification

Predicting the titratable acidity by partial least squares regression. Figure 12a presents the results of prediction of titratable acidity by spectral characteristics. The regression coefficient R2 is 0,98; the sum of squared errors is 183,6; root mean square error is 3,194. Can be concluded that the titratable acidity can be predicted by spectral characteristics at 98% accuracy, but high levels of errors.

Table 9. Analysis of the results for a common error in data classification

Anova: Two-Factor Without Replication				
SUMMARY	*Count*	*Sum*	*Average*	*Variance*
DA	3	63,25	21,08	515,15
KNN	3	64,50	21,50	133,56
SVM	3	38,25	12,75	315,44
Raw	3	109,75	36,58	84,90
AR	3	40,25	13,42	155,90
PC	3	16,00	5,33	7,15

ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Rows	146,18	2,00	73,09	0,84	0,50	6,94
Columns	1578,60	2,00	789,30	9,03	0,03	6,94
Error	349,69	4,00	87,42			
Total	2074,47	8,00				



a) by PLSR b) by PCR

Figure 12. Predicting the titratable acidity by spectral characteristics

Predicting the titratable acidity by principal components regression. Figure 12b presents the results of prediction of titratable acidity from spectral characteristics by principal components regression. The regression coefficient R^2 is 0,85; the sum of squared errors is 1145; root mean square error is 7,974. Can be concluded that the titratable acidity can be predicted by spectral characteristics at 85% accuracy, but high levels of errors.

6. CONCLUSION

This report provides an overview of current research related to the quality and safety of dairy products. From the analysis of publishing activity in this field is found that the yellow cheese is the main subject of study because it is one of the commonly consumed dairy product along with cheese curd and yogurt. Moreover, this product is a favorable environment for the development of hostile microorganisms.
A review was made of the methods and technical equipment for assessing the quality and safety of yellow cheese in which it is established that are suitable for the purpose contactless methods because the measurement with contactless sensors does not affect the composition and structure of the product.

From contactless methods with small error values up to 2%, in determining the content of substances harmful to health in dairy products and the ability to predict the physicochemical parameters with accuracy more than 97% have proven optical methods.
In recent years, optical methods of research have proved the spectral and hyperspectral analysis. From these methods is selected spectral analysis because it is easy to use method and does not require special preparation of measuring equipment.
An assessment is made of the possibilities for separating objects areas on the surface of yellow cheese during storage in conditions not regulated from specified by the manufacturer using the three most commonly used in the analysis of food products classifiers – SVM, KNN and DA. The work of these classifiers was evaluated by the common error of classification. From this analysis it is found that the direct use of spectral characteristics the classification common error is over 10%. Suitable to use are principal components for the representation of spectral characteristics and classification because the common error of classification is up to 5%.
For classification are suitable the discriminant analysis (DA) using nonlinear discriminant function and support vector machines (SVM) with the use of principal components, because the processing time is up to 5s.
The use of KNN classification method is impractical because the total error of the classification in it, irrespective of the method for representing the spectral data is greater than 10%, while in comparison with the other two classifier processing time in this classifier is shortest.

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THREE-DIMENSIONAL OF CRINKLES EFFECTS USING MULTILAYER WOVEN FABRICS CONTAINING SPANDEX

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Abstract: *Development of the wrinkled fabrics depends on geometry and relaxation behavior of the multilayer woven fabrics. After bleaching and relaxation, the new shapes and sizes of crinkles were recorded. The results prove that the manner of fabric deformation during relaxation depends upon the multilayer fabrics structure. The quantities of the crinkles on the fabric are related to the float length type. Multilayer woven fabrics with longer float length show higher crinkled, and its deformation behavior is non-linear. Thus, connected deformations are closely related to the stretch potential and influence multilayer woven fabrics draping and fitting of the garment. For this purpose, we have postulated new model for the relationship between fabric geometry and stretch potential. The suggested hypotheses make it possible to predict mathematically the crinkle of multilayer woven fabrics and prediction of suitable-sett of warp and weft. The area covering value was chosen as suitable model for description of multilayer woven fabrics structure. The study was divided into two parts, the first presents the relationship between fabric geometry of the relaxation behavior whereas the second investigated the influence of multilayer woven fabrics stretch potential on the relaxation ability of bleached fabric. Three variants of cumulative parameter of a crinkle woven fabrics structure were introduced. The realistic models based on a better approach of geometry and material properties will be created in order to investigate the numerical analysis performance of the mechanical properties of crinkle woven fabrics. A correlation between calculated values of structural parameters crinkle multilayer woven fabrics values was evaluated.*
Keywords: *Multilayer Fabrics, Stretch, Crinkles, Relaxation, Distortion.*

1. INTRODUCTION

Fabrics are designed to fit different project demands in order to be suitable for their end use. [17]. for a fabric constructor it is essential that the relationships between the constructional parameters of fabrics and their individual property, that should fit the desired quality, are well defined. The mechanical properties are considerable important for the fabric end use, so a lot of researches deal with them and try to define a different models [Elnashar, Chen, Jong, Reallf, Shananah, Sinoimeri, Fangning]. [18, 10, 21, 24, 25, 26, 20], crinkles in woven fabric as wrinkled from being a part of potential aesthetic interest to the fashion or mass-market garment industry can be used as a detection and response mechanism in high performance garments [19, 11].
The crinkle double layer woven fabrics problem can occur in warping, weaving, and finishing processes. Tension variation across the width of the warp beam could cause bow and crinkles multilayer woven fabrics at warping and weaving stage [12]. In case of sectional warping, improper slope or tension applied to each band of the warp can create the same distortion. In addition, two sides of the weaving cloth are not equally tensioned causing crinkles multilayer woven fabrics. The main cause at any step of the finishing process is the variation in running speed across the width of the fabric, which causes shear deformation. The crinkle of double fabrics have more complex construction which is not altered only by

type of weave, yarn fineness and thread density, in comparison with single fabrics, but also the method of stitching [13]. The crinkle Double fabric is composed of upper and lower layers, which are woven one above the other and stitched together. Stitching these two layers of fabric together forms one of the principal features of double fabric construction. The main goal of our research was to find out if the type of weave and method of stitching have a statistically important effect on some mechanical properties of woven double fabrics in order to extend the knowledge of double woven fabric construction. The results of this research could help the constructor by developing a new fabric construction with adequate properties.[15,16],the crinkle multilayer woven fabrics by using spandex, is a generic name for rubber-like synthetic fibers comprised of at least 85% of segmented polyurethane. To improve the recovery of woven fabrics, it is now common to co-weave a small amount of spandex yarn with the companion hard yarn according the methods of stitches.

1.1. Stitching methods of Double-layer woven fabrics [16]

Multi-layer woven fabric consists of at least two layers, which are woven one above the other and stitched together. Double woven fabric contains two systems of warp, face and back, and two systems of weft. The fabric can be called either two-ply fabric or double fabric. Interlacing the face warp threads with the face weft threads forms upper fabric (layer), and the interlacing the back warp threads with the back weft threads forms the lower fabric (layer) of the double fabric. by stitching of the back and face fabric, double fabric can be constructed according to the following methods of stitching:

- Stitching from back to face or warp stitching, where the back warp is stitched to the face fabric;
- Stitching from face to back or weft stitching, where the face warp is stitched to the back fabric;
- Combination stitching or double stitching, where the stitching from back to face and from face to back is applied simultaneously.
- Stitching with an extra warp: the face and back fabric are stitched together by an extra warp that binds the face and back wefts.
- Stitching with an extra weft: the face and back fabric are stitched together by an extra weft that binds the face and back warps.
- Warp interchange with interlacing; where the face warp interchanges with the back warp when desired to obtain special colour effects.
- Weft interchanges with interlacing; where the back warp interchanges with the face warp when desired to obtain special colour effects.
- Chessboard stitching; where face and back warp interchange their positions in order to obtain special colour effects.

1.2. The object of the work

The main objective of the proposed research is to reveal the influence of the 3D structure parameters (filling yarn, fiber type, weave and type of stitches) of 3D modeling of crinkle Multi-layer woven fabric with spandex constituents on their physical and Mechanical properties (stretch and stretch recovery, thickness,) for crinkle of double-layer Woven fabric.

2. EXPERIMENTAL

Experiments are carried out on two group of Single and Folded core-spun yarn. First: We made core-spun yarns in Misr for spinning and weaving company ElMahala ElKoubra, Egypt according the single and folded yarn specifications – table1.

Table1. Specifications of Single and Folded core-spun yarn

Single core-spun yarn					Folded core-spun yarn				
Yarn type	Blend Ratio %	Spandex denier	Yarn denier	Final denier	Yarn type	Blend Ratio %	Spandex denier	Yarn denier	Final denier
Spandex+ cotton	7+93	Dtex 22	40/1	40/1	2(Spandex+ cotton)	50: 50	Dtex 22	40/2	40/2
Spandex+ polyester	7+93	Dtex 22	40/1	40/1	2(Spandex+ polyester)	50: 50	Dtex 22	40/2	40/2
Spandex+ (cotton+ polyester)	7+93	Dtex 22	40/1	40/1	2(Spandex+ (cotton+ polyester))	50: 50	Dtex 22	40/2	40/2

2.1. Second production of double-layer woven fabrics

Experiments are carried out on two group of fabrics structure. One group contains elastane yarn and the other group not. The weaving trials using Lycra® yarns were conducted on Sulzer Nouva weaving machine with an attachment of Sutble head jacquard, Model: JC, Made in France, with the power 2655 hook. with the following specifications; warp yarn: 30(cotton),warp density:100 ends/inch, weft density: 60 weft/inch , with using 1/1plain, 20x40 spider, in ElMahala Elkoubea companies , Egypt. In additional the fabrics were tested in Misr for spinning and weaving company, ElMahala Elkoubra, Egypt.
A groups of samples made from yarns: Type of spinning Machine: Zinser 319, Model 1986 Pinter, in spinning and weaving company, Mahala Elkoubra , Egypt. Method of spinning: core-spun yarn Spandex (denier): Dtex 22. And the source of spandex : Germany ., Type of materials: combed 100% of cotton, Giza (86), combed 100% of cotton, Giza (86) blended with polyester (50%+50%), blended, cotton and Lycra® fibers as weft, but with different weight per unit area another group made from same weft , Yarn count after spinning: 40/1, 40/2 in table1. ,Twist factor :4 , with 25.2 turn per inch. Type of folded machine: Savio Geminis S, with different weight per unit area for evaluation the thickness of clothing: The measurement of thickness of each of the trials woven fabrics has been carried out according to the A.S.T.M standard [3]. With two groups of woven fabrics structures; first group (upper layer plain weave 1/1, lower layer plain weave 1/1, and Satin weave 5 for stitch), second group (upper layer spider weave, lower layer plain weave 1/1, and Satin weave 5 for stitch). By using the eight Stitching methods of multilayer woven fabrics.
The tests have been carried out for textiles research labs (Chemicals Division) The National Institute, Pyramid Street, Giza, Egypt.
UPF: Resistance radiations of ultraviolet, according ASTM D 6603 - 10 Standard Guide for Labeling of UV- Protective Textiles [5],Ultraviolet Protection Factor (UPF) , by using the Spectrophotometer. And Abrasion Resistance; according the ASTM D 3885 - Standard Test Method for Abrasion Resistance of Textile Fabrics (Flexing and Abrasion Method) [4], by using the RUBTESTER.
- ASTM D737– 04(2008) Standard Test Method for Air Permeability of Textile Fabrics [9]. By using Electronic Air Permeability Tester – Type FX 3300,
- ASTM D5035 – 06(2008) Standard Test Method for Breaking Force and Elongation of Textile Fabrics (Strip Method)[8], H5KT SDL ATLAS.
- The Stiffness, weight, and Thickness tests have been carried out for textiles research labs, in faculty of Specific Education, Kafrelsheikh University, Egypt. ASTM D 1388 – Standard test method for stiffness of fabrics. [2], ASTM D3776 / D3776M – 09a Standard Test Method for Mass per Unit Area (weight) of Fabric [7, 6], by using ElNashar Digital Tests Methods for weight, durability, stuffiness, strength and elongation for fabrics in figure 1.
- ASTM D1777 – 96(2007) Standard Test Method for Thickness of Textile Materials [6], by using ElNashar Digital Thickness Test Methods in figure 2.

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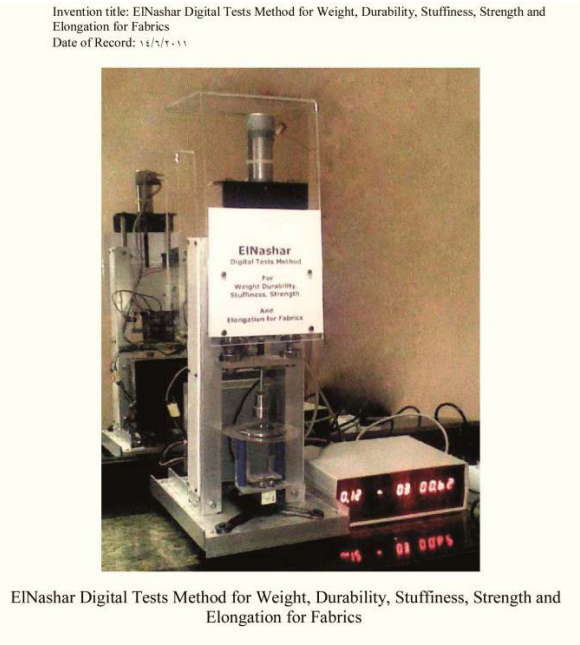

ElNashar Digital Tests Method for Weight, Durability, Stuffiness, Strength and Elongation for Fabrics

Figure 1. ElNashar Digital weight, Durability, Stuffiness, Strength and Elongation for tests methods for fabrics

ElNashar Digital Thickness Test Method

Figure 2. ElNashar Digital thickness test methods

3. RESULTS AND DISCUSSIONS

Bulky crinkles factors: In multi-layer woven fabrics bulky crinkles in the fabrics occur as a result of change in the levels of the surface cloth in places to become three-dimensional differ in appearance from the rest of the surface of the fabric, which contributes to the type and format of the interlacing threads "woven structures" as well as the quality of the coherence and the exchange of threads among cloth layers. It has been exploring the possibility of using threads weft have spandex to produce three-dimensional effects. Three-dimensional effects have been developed through designs woven fabrics with different degrees of intensity. Different degrees of intensity caused shrinkage of various on removing the cloth of the" loom, washing in relax. Constructivist free installation fabric such as cooled contraction caused the highest compared with the arbitrator fabric such as masters of 1/1. Different deflation cause of parts of the design rises in vertical direction on the surface of cloth.

The use of threads that contain spandex integrated with different fabrics and using different combinations of woven fabric structures to the production of three-dimensional effects "bulky crinkle ", Note that washed under tension light or non-existent - without the need to heat or chemical treatment or mechanical methods such as that used to produce effects of wrinkles.

Development of the fabrics curls depends on the construction of engineering and behavior of relax woven fabrics. After Whitening and relaxation were registered wrinkles new forms and sizes. The results prove that the way in which distorted the cloth during constructivist relax depends on the installation. Quantities of crumple fabrics linked to type the floated length, fabrics with floated longer appear higher crimp, distorted by non-linear behavior. Thus, the distortions are closely linked to rate durability rubber cloth robes and appropriate. For this purpose, we assume that a new model of the relationship between the installation engineering rubber rate. Realistic models are based on the best replace the geometrical

characteristics of raw material which can be implemented in order to achieve Numerical analysis mechanical specificity fabrics woven discoloration. Processing plays an important role in the final characteristics elastane fabrics containing spandex ,termination cause slack fabric of tension, which happen to him during the curling cloth .If the installation fabric constructivist allows deflation, mostly cloth is shrinking as a result of reaction spandex component, if required, the high rubber cloth must be designed low level to the average of the tension. The relations between the rates of rubber cloth, installation, constructivist learning to give crimp spandex type, allowing design requirements specialized rubber products to suit the performance of final use. As the following factors:

1. Types of woven fabric structures;
2. Stitching methods of multilayer woven fabrics
3. Fabric structures.
4. Types of multi-layer woven fabrics.
5. Type of materials
6. Processor thermal on fabrics (wet, dray).
7. Chemical processors on Fabrics:

The dimensions of the woven sample before and after wet relaxation were used to calculate the stretch potential using equations 1 and 2. Maximum stretch potential % in length (warp) direction [22],

$$SP_{L,\max} = \frac{L_{on-loom} - L_{relaxed}}{L_{on-loom}} x100 \quad (1)$$

Maximum stretch potential % in width (weft) direction,

$$SP_{W,\max} = \frac{W_{on-loom} - W_{relaxed}}{W_{on-loom}} x100 \quad (2)$$

Here $L_{on\text{-}loom}$ and $W_{on\text{-}loom}$ are the length and width of the on-loom fabric. $L_{relaxed}$ and $W_{relaxed}$ are length and width of the woven samples after wet relaxation. The target stretch dimensions at which the woven samples would be heat-set were calculated using equation 3. [22] Fabric dimensions at target stretch of *y*%

$$W_{y\%} = W_{on-loom} - \frac{(y * W_{on-loom})}{100} \quad (3)$$

We can calculate the bulking potential according the following Equation:

$$\mathrm{FTB} = 1/\frac{WR_{relaxed} * SP_{W,\max}}{WR_{on-loom} * T} \quad (4)$$

BP = bulking potential

$WR_{relaxed}$ = width repeat of clothe after relaxation

$WR_{on-loom}$ = width repeat of woven fabric on loom

$SP_{W,\max}$ = stretch potential

T = clothe thickness

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Table 2. Specifications of potential of)Bulking & crinkles)

Woven Fabric Structures	Potential of (Bulking& Crinkles)															
	Specimen 1		Specimen 2		Specimen 3		Specimen 4		Specimen 5		Specimen 6		Specimen 7		Specimen 8	
	BP	CP	BP	CP	BP	CP	BP	CP	BP	CP	BP	CP	BP	CP	BP	CP
First group of fabric Structures																
Upper cloth: Weave 1/1, Lower cloth : Weave 1/1, Weave of Stitch : satin weave5 [Methods of Stitches(4,5)]	1,07	15,6	1,14	5,8	1,19	6,3	1,6	8,02	1,6	108,6	1,60	106,9	1,6	106,8	1,4	94,2
Width of clothe / Cm	242		199		201		197		256		256		256		256	
Width of repeated on loom	260		260		260		260		260		260		260		260	
Stretch Potential	0,069		0,234		0,226		0,242		0,015		0,015		0,015		0,015	
Second group of fabric Structures																
Upper cloth: spider weave, Lower cloth : Weave 1/1, Weave of Stitch : satin weave5 [Methods of Stitches(4,5)]	1,28	19,79	1,6	6,2	1,61	6,4	1,50	6,09	1,94	74,7	1,87	71,9	1,91	63,7	1,84	70,8
Width of clothe / Cm	243		179		181		183		253		253		252		253	
Width of repeated on loom	260		260		260		260		260		260		260		260	
Stretch Potential	0,065		0,311		0,303		0,296		0,026		0,026		0,030		0,026	

BP: Bulking Potential, CP: Crinkles Potential
The weft of cotton for the two layers of control specimen (2 single: 1 folded).

Table 3. Properties of Bulking & Crinkles of double-layer woven fabrics

Woven Fabric Structures	Properties of Bulking& Crinkles of double-layer woven fabrics															
	Specimen 1		Specimen 2		Specimen 3		Specimen 4		Specimen 5		Specimen 6		Specimen 7		Specimen 8	
	BP	CP	BP	CP	BP	CP	BP	CP	BP	CP	BP	CP	BP	CP	BP	CP
First group of fabric Structures																
	1,07	15,6	1,14	5,8	1,19	6,3	1,6	8,02	1,6	108,6	1,6	106,9	1,6	106,8	1,4	94,2
Strength (newton)	242		199		201		197		256		256		256		256	
Elongation(mm)	260		260		260		260		260		260		260		260	
Air permeability ($Cm^3/Cm^2.S$)	68,66		46,66		54,33		45		23		26		27,66		28,33	
Thickness (mm)	1,077		1,141		1,194		1,618		1,63		1,605		1,603		1,414	
Wight (grams $/m^2$)	261,6		274,6		277,3		285,6		489		464,3		455,6		464,6	
Stiffness (mg.cm)	115,8		115,3		93,1		87,9		794,6		831,5		766,7		770,3	
Aborigine resistance (cycle)	263,3		150		165,6		154,6		968,3		960		985,6		1060	
UPF	87,4		72,2		64,4		75		95,3		84,6		67		87,9	
Second group of fabric Structures																
	1,28	19,79	1,6	6,2	1,61	6,4	1,5	6,09	1,9	74,7	1,8	71,9	1,91	63,7	1,8	70,8
Strength (newton)	243		179		181		183		253		253		252		253	
Elongation(mm)	0,065		260		260		260		260		260		260		260	
Air permeability ($Cm^3/Cm^2.S$)	94,33		50,33		58,33		53,66		32		37		35,66		35	
Thickness (mm)	1,28		1,6		1,6		1,5		1,94		1,87		1,91		1,84	
Wight (grams $/m^2$)	278,3		326,3		313		309		506,6		473,3		477		457,3	
Stiffness (mg.cm)	163		78,3		68,2		69,8		823,2		650,7		596,2		605,9	
aborigine resistance (cycle)	261,6		114,3		162,3		175,3		671,3		547		559		730	
UPF	16,4		65		76		66,3		23,9		39,2		28,5		34,3	

The following are the results of quality using radar maps of the samples control in combination histological first and every form represents properties that have been measured practical experiments which evaluate (tensile strength and elongation, air permeability and abrasion resistance, Stiffness and resistance to ultraviolet radiation) and shows every form in the shaded properties scale space and determines that order of preference in specimen (1, 2, 3). Then the sample number (1) using a fourth method of stitch.

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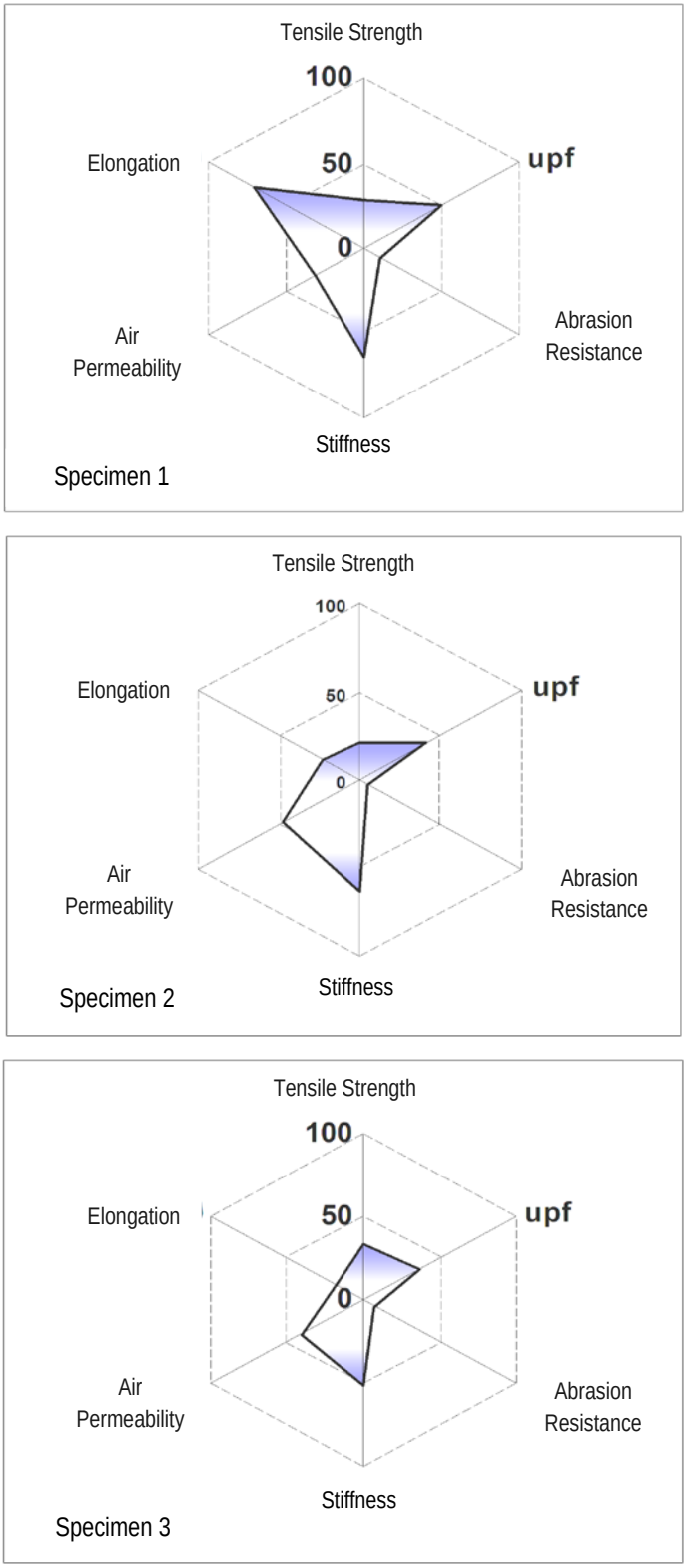

Figure 3. Specimen (1, 2, 3): shows the results of using quality radar maps of the first group of fabric structures

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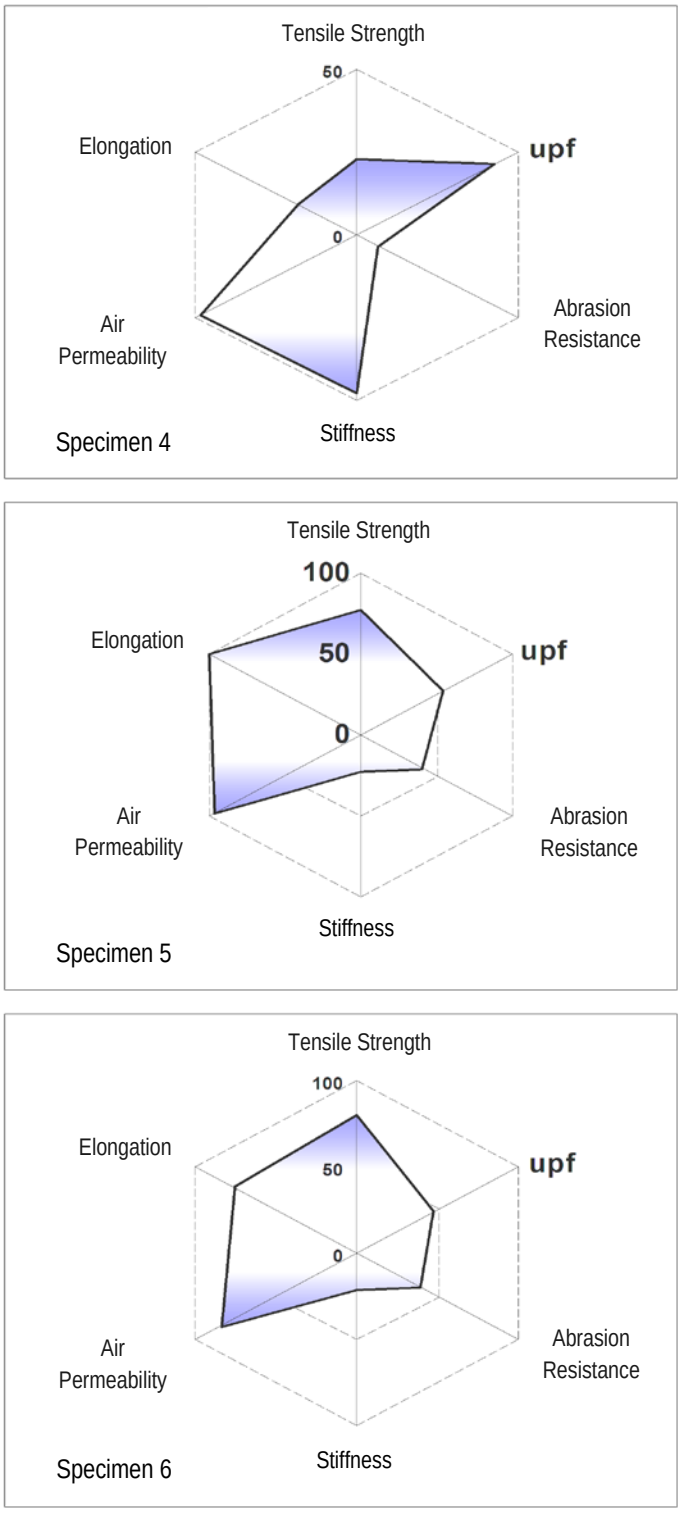

Figure 4.
Specimen (4, 5, 6): shows the results of using quality radar maps of the first group of fabric structures

From previous results, we find that the best samples containing spandex in the composition of textile first, a plain 1/1 of the two layers and texture of satin weave 5 is the Specimen (8) using a weft of spandex encased by a thread mixture (cotton + polyester) using fifth type of cohesion, a cohesion added weft redundant, followed by the sample number (6) using a weft of Spandex covered with cotton using fifth type of cohesion, a cohesion by adding extra weft, then the sample number (7) using a weft of spandex encased polyester using a fifth type of cohesion, a cohesion by adding extra weft, any that there is a clear preference for the fifth type of cohesion in this Textile installation.

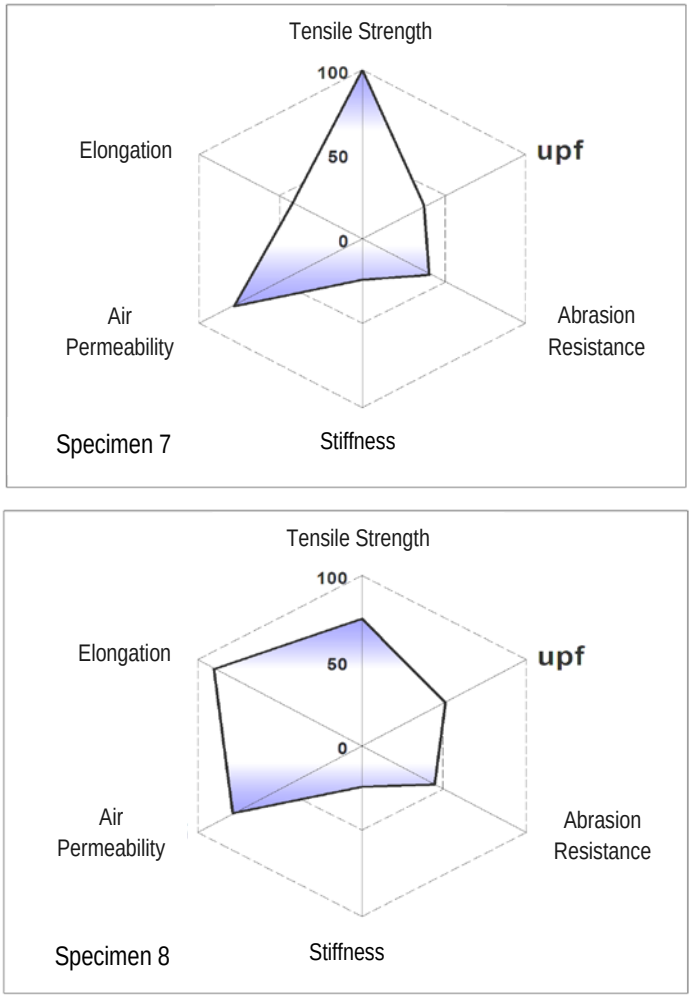

Figure 5. Specimen (7, 8): shows the results of using quality radar maps of the first group of fabric structures

The following are the results of quality using radar maps of the samples officer in the composition of textile second and every form represents properties that have been measured practical experiments which evaluate (tensile strength and elongation, air permeability and abrasion resistance, stiffness and resistance to ultraviolet radiation) and shows every form in the shaded properties scale space and determines that order of preference in specimen (1, 2, 3). Followed by the specimen (5) using a fifth method of stitch, a cohesion by adding extra weft.

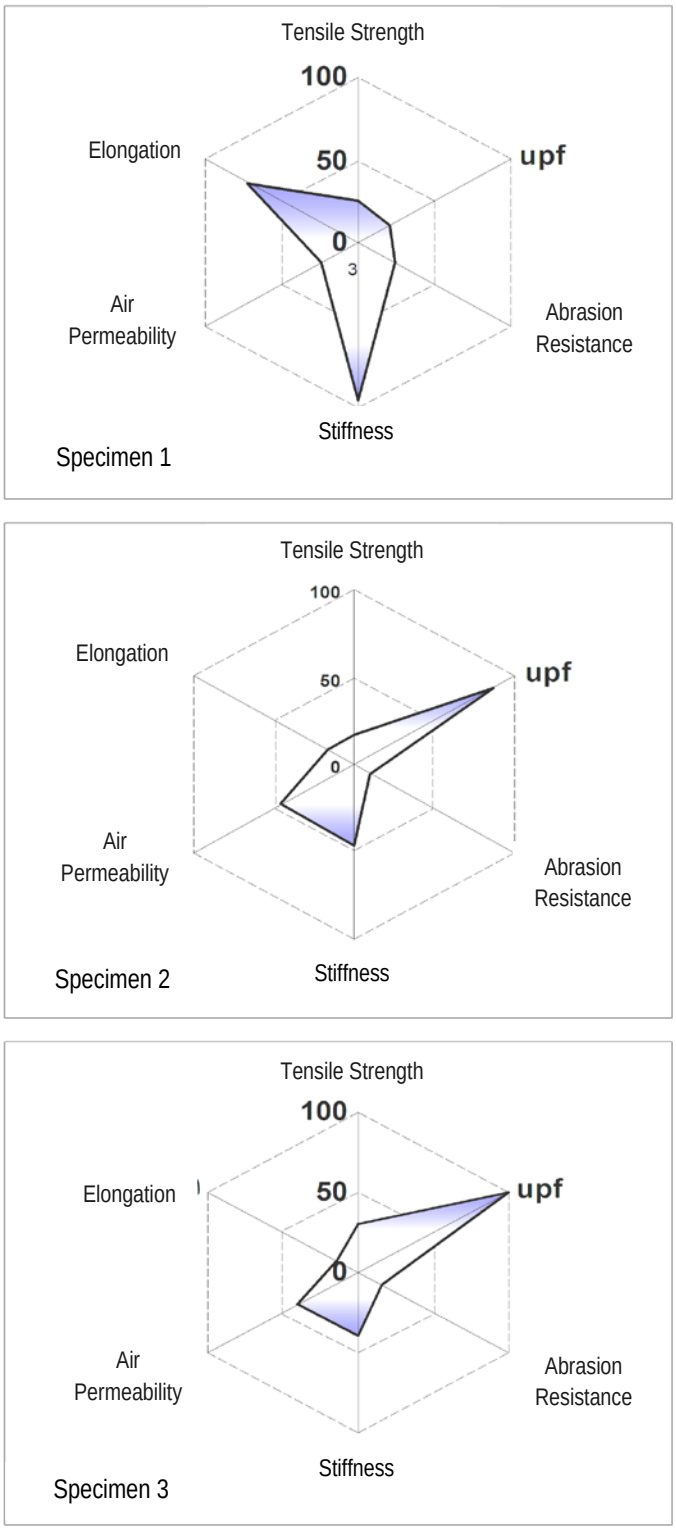

Figure 6. Specimen (1, 2, 3): shows the results of using quality radar maps of the second of fabric structures

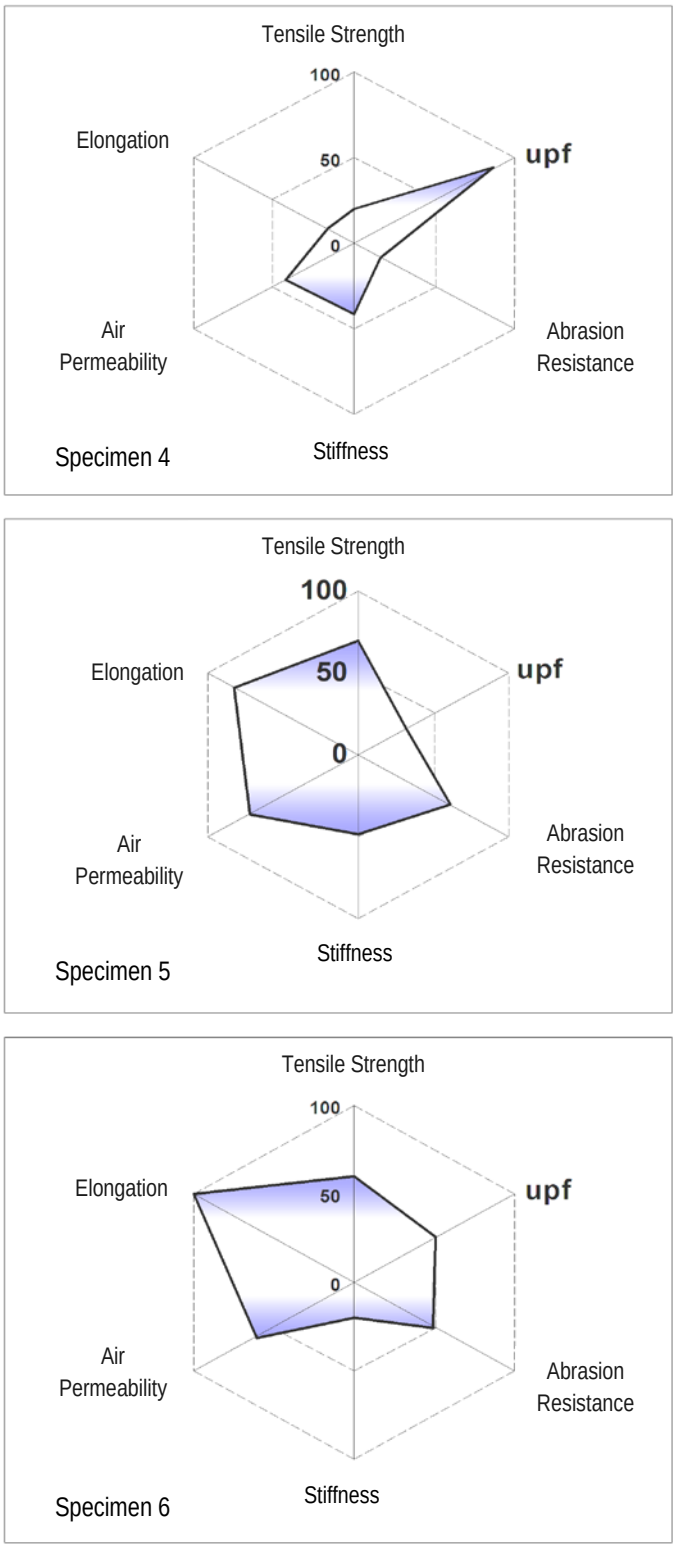

Figure 7. Specimen (4, 5, 6): shows the results of using quality radar maps of the second of fabric structures

From previous results, we find that the best samples containing spandex in the composition of textile second which is the top layer spider web and lower plain weave 1/1 and the fabric of cohesion Atlas 5 is the specimen (6) using a weft of spandex covered with cotton using fifth type of cohesion , a cohesion by adding extra weft , followed by the specimen(8) using a weft thread of Spandex encased mixture (cotton + polyester) using fifth type of cohesion, a cohesion by adding extra weft, Then the specimen(1)using a weft of spandex covered with cotton using a third method of stitch, a common (warp and weft), then the specimen (7) using a weft of spandex encased polyester using a fifth type of cohesion, a cohesion by adding extra weft, that is, there is a clear preference for the fifth type of method stitch.

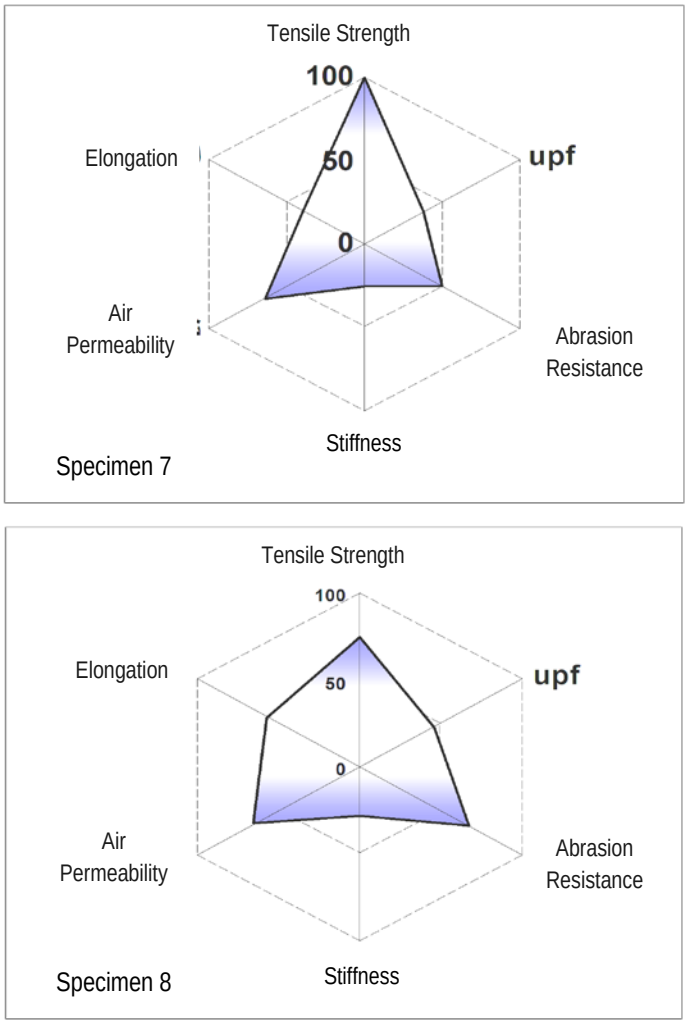

Figure 8. Specimen (7, 8): shows the results of using quality radar maps of the second of fabric structures

Crinkles Potential of weave pattern development of element structures 3D woven structures can be produced on conventional (2D) weaving machines by flattening and weaving them as multi-surface, woven fabrics. After the removal of the woven semi-finished product from the machine, it is erected or shaped as desired. In general, the transformation Crinkles Potential of 3D semi-finished products into weaves-Technically producible structures can be divided into three main process steps. These are explained in the following.

- Developing the desired structure: This includes the shaping of the original form into a weave-technically (woven) producible planar structure. Several development variants are possible for the same 3D structure.
- For each development variant, a number of yarn arrangement possibilities are designed, which have to be realizable by the loom. This allows the pinpointing of the most readily realizable variant. The selected development variant should be characterized by an optimized yarn orientation and subsequently excellent properties and produce ability.
- Corresponding to the selected variant, the weave patterns of the specific structure are developed, and then used to realize the desired final product on the weaving machine. With this method, numerous complexes Crinkles Potential of 3D structures can be realized using conventional loom technology without any special modules or technologies. Based on above mentioned steps,

The basic theories of design do not change when designing stretch filling fabrics. The fabric in a plain, twill weave cannot stretch until they shrink. A construction must therefore provide for shrinkage, and there must be sufficient space between ends such as spider weave. This section includes a comparison of woven fabrics produced from wefts and the arranging as horizontal stripes of weft with spandex, all the woven samples were then wet-relaxed and the relaxed dimensions of the marked squares were measured and recorded. The dimensions of the woven samples before and after wet relaxation were used to calculate crinkles potential. Several goals were established for statistical analysis of the data.

3.1. Compact Colour Values of Crinkles Potential

Yarn mass per length unit, threads density, stretch potential and weave determine the size and the shape of the stretch surfaces on a fabric, which are covered with warp and weft threads, stretch potential geometrical models of plain weave, satin (double cloth), plain weave (double cloth), with the warp interlacing point- w and the weft interlacing point-f. colour surfaces are warp-1, weft–2 and space between threads; the diameters of the warp and weft threads, and 1/gw and 1/gf the spaces between the warp and weft threads, the size of the stretch weft and warp interlacing point surface is calculated from the geometrical model.

3.2. Crinkles Potential in Patterns of Triangular, Rectangular and Circle

Triangular, rectangular and circle pattern are the face of the original elements of artwork into three smaller during this all-quad woven fabrics mesh conversion, of warp and weft yarns that appears on the fabric faces, which is a function of the constructional parameters (warp and filling yarns densities, warp and filling fiber densities, warp density, pick density, weave, warp color arrangement, and weft color arrangement, the changing between two-layers). To predict contribution of each colors/weaves to the fabric surface, we considered idealized fabric geometry with the following assumptions to simplify calculations since real fabric construction parameters are rather complex in their shape:

1. Yarns' diameters are uniform cylinders.
2. Warp spacing at the weave intersection and under the float is constant.
3. Pick spacing at the weave intersection and under the float is constant.
4. The projection (two-dimensional) of the fabric on a plane parallel to fabric plane is considered.
5. Yarns' are uniformly colored/weaves.

The resultant proportions of colors/weaves present on the surface of the woven design are calculated for the repeat that represents an entire region in the Jacquard design.

3.3. Crinkles Potential of Wefts in Shape Square

In differential geometry, deformations from the wefts on a surface are considered as a series of twisted curves which generate into a three-dimensional shape in figure6. This theory is applicable to the surface of the material in fabric buckling, folding and drape. The differential geometry parameters can incorporate the mechanical properties of a material by relating these mechanical properties to the changes in curvature as a surface is transformed into another surface. And compact forces of deformation on square shape:

$$\mathrm{C\,D} = \sqrt{\frac{\mathrm{S\,P\,\%}}{\mathrm{C\,W\,R/mm}}} + \frac{warp + WR}{WR}\% \tag{5}$$

Where: CD: Crinkles Distortion, ST%: stretch potential %, CWR: crinkles width repeat/mm., and WR: Weft Repeat, we believe that the numerical integration method is a better approach because surface area is the double integration of surface for the two layers of fabrics coordinates, which acts as low layer while changing with height layer out deformations. Surface areas between the double-layers and compact force of stretch of weft and wove structures. For better approximation, the following formula which takes layers of woven fabrics, namely:

$$\text{Warp Float Distortion} = \frac{\text{weft contraction for each float}}{\text{the warp float length}} \times 100 \tag{6}$$

$$\mathrm{S_D} = 100\pi \frac{\omega \int}{4} + \frac{WFD}{SP_W}\left[\int \frac{K_C + \Sigma\left(h_y + h_w\right)}{4T_{TK}} + \frac{(\rho \mathrm{y})}{(\rho \mathrm{f})}\right] \tag{7}$$

Where: $\mathrm{S_k}$ = shape Deformation. WFD =Warp Floated Distortion. T_{TK} = fabric thickness. $SP_{W,\max}$ = Stretch potential. ω = width of shape. $\int$ = length of shape. K_C = cloth cover factor. ρy = yarn density. $\rho \mathrm{f}$ = fiber density., $\left(h_y + h_w\right)$

Where: $L(h)$ is the parameter of a cross sectional curve at level h and h_2 are the "height" of the bottom, middle and top cross section, respectively. The perimeter is the sum of point-to-point distance (chord length).

In order to minimize the choices that had to be made, and to streamline the process, a couple of specific conventions have been built into the software: - Of the two stitch lines that make up the edges of a given panel, the stitch line with the lower number is deemed to be the left-hand side of the panel. - Each stitch type is deemed to run in a particular direction: horizontal stitch s run left-to-right, vertical stitch s run top-to-bottom , right diagonal stitch s run from top left to bottom right, left diagonal Stitch s run from bottom left to top right, and geodesic stitch run in the direction in which they were created.

Let us examine what these conventions actually mean, and what affect they have on the actual panel-creation process. Consider the tent portion below: tent portion with stitch s defined on it, the dark lines represent the Stitch s. When surface calculates the panels defined by this stitch (1) is deemed to be the left-hand side of the panel, and stitch 2 the right-hand side. Next, it is necessary to find the start points of the stitch.

The fundamentals of the geometric assumptions of the computer program are shown in Fig. 10 (a), (b) and (c).

As will be seen in Fig. 9 (b):

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$$L_{n/2} = \left(\frac{\sin\alpha \sqrt{(L_o/2)^2 + D^2}}{D} \right) D \Big/ L_{o/2} \quad (8)$$

It can be detrained. So:

$$\left(\frac{\frac{j}{N/2}}{\frac{l_{oj}}{L_{o/2}}} \right) - \left(\sqrt{\frac{j}{N}} \right) + \frac{2j + l_j}{N} \quad (9)$$

j : The sequence of any warp yarn, l_{oj} : The initial length of any one of the warp yarns

l_j : The length of any one of the warp yarns after deformation, and N/2

Figure 9: geometric assumptions forming the fundamentals of the computer programs (a) Distribution of the pressing force, (b) Position at the perpendicular cross-section after deformation: L0=2: The length until the middle point of the frame side , Ln=2: The length of the yarn until the middle point of the frame side after deformation , (c) Comparison between before and after deformation (Top view) The all results in a panel as below:

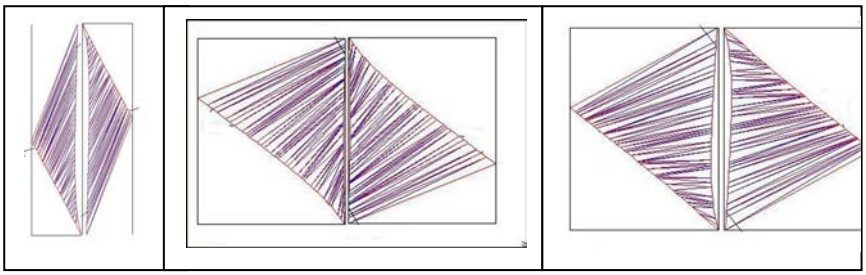

Figure 9. Panel produced from the tent region between stitch 4 and 5

Similarly, the second panel (between stitch s 2 and 3) has stitch 2 on the left-hand side, stitch three on the right-hand side, and has the start points of the Stitch s at the bottom of the panel , and the panel produced from the tent region between stitch 2 and 3.

3.4. Geometry of the relaxation behavior

As the free spaces (voids) increase, the freedom of movement for the yarns goes higher in Figure 3. In other words, the firmness of the fabric reduces. Comparison of the three woven fabrics by using different materials is shown in Table1. The weave factor and shrinkage factor are calculated according to equations 5 and 6.

3.4.1. Calculation Warp Float Distortion

$$\mathrm{WFDe} = \frac{\mathrm{WCEF}}{\mathrm{WFL}} \times 100 \quad (10)$$

WFDe: Warps float Distortion, WCEF: weft construction for each float, WFL; the warp float length.

Warp degree of movement of the 1/1 plain weave, satin and spider weave. The angle in which the weft float will migrate (the weft plane movement) is: warp float migration (mm): The movement of the warp float is related to the amount of weft contraction. In other words, warp float migration is the weft contraction per each warp. The maximum possible movement of the warp float is equal to (5 mm/27). Therefore, there is no migration and movement for the weft float is related to the amount of warp contraction by using the spandex throw crinkles

effects: 1 - Fabric Structures; 2 - Type of materials (Normal, Containing Spandex...); 3 - Types of Multi-Layer Woven Fabrics; 4 - Stitching methods of multilayer woven fabrics; 5 - Length of yarn floated; 6 - Processor Thermal on Fabrics (Wet, Dray); 7 - Chemical processors on Fabrics; 8 - Thickness of fabrics; 9 - Shape of Three-Dimensional.

3.4.2. The Relationship of Crinkles Potential with Using Double-Layer Woven Fabrics

It has been found that there is a clear relationship between of crinkles Potential with using double-layer woven fabrics, where it has been used in different woven fabric structures:
A. First woven fabric structure, is plain woven 1/1, for face and back “the repetition woven fabric structure of warp yarns and weft. It was found that there are some samples achieved a higher crinkles Potential than others, including samples from 1 to 8, which include fourth type stitched , and fifth type of stitched, also sample No. 8 gave higher crinkles potential, resulting from the use of the addition extra warp.
B. Second woven fabric structure, which is the very fabric of facial spider for face fabrics, plain woven 1/1, for back fabrics, and yarn repeat, and wefts were found that samples had achieved a higher inflation and samples produced using methods of stitched fourth and fifth, compare first woven fabric structures (plain woven 1/1 for face and back) with combination second woven fabric structures (spider weave for face , plain weave 1/1 for back) from where crinkles effects was found that the composition of the second woven fabric for given a clearer structure of crinkles effects more than the first woven fabric, due to the use of the very fabric of spider as well as increase the high repetition woven fabric in combination second woven fabric in the composition of the first woven fabric of 1/ 1 for face and back.

3.4.3. Crinkles potential and type of material

In double-layers woven fabrics, There is a clear relationship between the crinkles potential and type of material in double-layers woven fabrics, it was found that when using spandex as wefts in fabrics combinations of research resulted in an crinkles effects did not appear clear that when using a weft of cotton in the samples, also found that spandex as weftscored of blended cotton plus the polyester 50% : 50 % gave clear results of crinkles effects in all types of stitches in combination of first and second examples of these samples in comparison to covered spandex.

3.4.4. The Relationship between type of stitches and Crinkles potential

There is a clear relationship between crinkles effects and the number of layers, using dual fabrics and woven fabrics in different woven structures got as much of crinkles potential cannot be obtained in the single fabrics, this crinkles potential could increase with the use of other variables as a stitches between the two layers or different woven fabrics structures use various of wefts. The relationship between crinkles potential and type of stitches between double layer woven fabrics, there is a clear relationship between the crinkles potential and type of stitches in between double layer woven fabrics it has achieved certain types of stitches, of inflation and other types of stitches, which achieved a clear fourth type of stitches and interlacing threads overlap with and fifth type of stitches and interlacing threads.

3.4.5. Construction Repeats

The fabric repeat angle is the sum of the warp and weft repeat angles. In other words, the fabric repeat is the degree of the warp and weft float distortion, based upon the above theoretical suggested estimation, the maximum possible repeats for each fabric is calculated and the values are compared with the actual measured repeats. This equation gives us more

fitting results especially to calculate the crinkle woven fabrics in garments. This model was constructed to have a geometry complicated enough to see the effect of changing the medium location but simple enough to save computational time by using the equation (11, 12, 13). So we had established new equation for calculation the crinkle distortion:

$$\mathrm{CD} = \sqrt{\frac{\mathrm{SP}\,\%}{\mathrm{CWR/mm}}} + \frac{WDe + WfR}{WfR}\% \tag{11}$$

CD - crinkles distortion, SP – stretch potential, CWR – crinkles width repeat, WDe – warp density of ends.

$$Yarn/cmm = \frac{\text{Warp Threads}}{\text{Width of Crinkel Fabrics}} \tag{12}$$

For calculating yarn per centimeter as: Then must be used new equation for calculation a length (L) of crinkle woven fabrics.

3.5. Calculation a length (L) of crinkle woven fabrics

$$\mathrm{CL} = \frac{\pi(d_2 + d_2)}{\mathrm{CD}\sqrt{{d_2}^2 + 2d_1d_2}} + (\pi\psi - \Omega)\cos^{-1}\frac{d_1}{d_1 + d_2} - 1*10 \tag{13}$$

Where; CD; crinkles distortion, CL; crinkle length, ℓ;crinkle length (mm), Ω is crinkle width (mm), ψ is crinkle height (mm), as example for calculation crinkle length of sample 1 as the following to:

$$\text{Crinkle length} = \frac{3.14(0.0239 + 0.0239)}{180\sqrt{(0.0239)^2 + 2(0.0195)*0.0239}} + (3.14*2.36 - 4)\cos^{-1}\frac{0.0195}{0.0195 + 0.0239} - 1*10$$

$$DW = DW \text{ per cm.} \times Wd \tag{14}$$

DW – Density of Warp, Wd – Width of Warp .

$$\mathrm{RPW} = \frac{\mathrm{DW}}{\mathrm{YR}} \tag{15}$$

RPW - Repeated of plain weave, YR - yarn repeated. Warp threads = 27*162= 4374 yarns; Repeats of Plain weave = 4374/ 2= 2187; Repeats of on Based twill weave= 4374/12= 364.5; Repeats of Spider weave=4374/ 48= 91.125.

3.6. Aesthetics Distortion of the Crinkles potential

We can get the aesthetics crinkle fabrics by distortion structure of woven fabrics, due to the structural symmetry as repeats of a crinkles potential woven fabrics and the unit cell is considered as the one quarter of spider crinkle woven fabric. The yarns are represented as homogenous cylinders of constant diameter, with initially restricted contact area between them. We consider orthotropic structure properties of the spandex yarn with three levels of crinkle woven fabrics modules, one for the yarn axis direction, and one for the yarn radius direction as Figure 9. The levels of crinkle woven fabrics allow the unit cell of deformation as distortion structure considered as being positioned in the center of the specimen. Simulation of the structure test of a of a crinkle woven fabrics as it is executed at the main purpose of this distortion structure for crinkle unit is the creation of a model of the crinkle woven fabrics

structure via Photoshop software programming and use of the 3D visualization of the structure. This method supports the better understanding of the deformation process of the yarns crinkle due to the applied distortion structure in the fabrics, by the superposition of three deformation modes (height, medium, graven) levels, figure 4. With three woven fabric structures, which correspond in the distortion structure, these three regions cannot be distinguished and are accompanied by the yarn slippage and the compression deformation of distortion structure by spandex weft at the link points of the crinkle woven fabrics. Especially at spider weave condition, that is the zone of the main interest, the dominating mechanism of deformation is the change of the crinkles potential woven fabrics shape due to the distortion structure of the yarns in woven fabrics. Under these conditions, the shaped arcs of the crinkle cell have a significant influence in the deformation process of distortion structure. Since the mechanical loading of the yarns imposes increase of the contact area with essential local deformations and distortion structure. The satisfactorily fitting of the theoretical curves to the experimental ones ensures the accuracy of the geometrical characteristics that are used for the modelling; all parameters of distortion for crinkle woven fabrics structure mentioned above were calculated for all crinkle woven fabrics. The specific volume is significantly influenced by behavior of the spandex filling spaces in between structural characteristics values of porosity and rephrases fabrics in figure 4 and their deviations from experimental crinkle woven fabrics values after bleaching. In open structure fabrics the suggested method gives relatively good results.

In-Plain movement: This portion of the spandex yarn, in one hand is shrinkage and causing to bring the crossing yarn closer to each other and the shrinkage forces of the crossing cotton yarns effect clamping itself tighter on the other hand. The shrinkage forces acting on the Interlacing parts of the spandex yarn are opposite to each other and act against the in-plane float movement. However, the distortions resultant quantity of the moment is relatively low due to the short length of the cotton yarn and lower freedom to migrate. The second movement is in the direction perpendicular to the plane of the fabric, in the thickness direction of the fabric and does not have a direct effect on in plane movement of the floats.

In-Satin movement: This portion of the spandex weft, in one hand is shrinkage and causing to bring the crossing warp cotton yarn, more closer to each other and clamping itself tighter in Satin weave and on the other hand is rephrase by the shrinkage forces of the crossing warp cotton yarns. The shrinkage forces acting on the interlacing parts of the warp cotton yarn are opposite to each other and act realizing the in- Satin float movement. However, the distortions resultant quantity of the movement is relatively high due to the longer length of the warp cotton yarn and lower freedom to migrate. The second movement is in the direction perpendicular to the satin of the distortions fabric, in the thickness direction of the fabric, and has direct effects distortions crinkles on in satin movement of the floats while fabrics thickness go up.

In-Spider movement: This portion of the spandex yarn, in one hand is shrinkage causing to bring the crossing warp yarn closer to each other and clamping itself tighter in spider weave and on the other hand is affected distortions by the shrinkage of the crossing warp cotton yarns. The shrinkage forces acting on the interlacing parts of the warp cotton yarn are closer to each other and more act realizing the in-spider float movement. However, the results of distortions quantity by the yarns of warp migration are high relatively due to the short length of spandex. The second movement is in the direction perpendicular to the spider of the fabric in the thickness direction of rephrase on in-spider movement of the floats. Total movements acting on each yarn in one repeat is the sum of the forces acting on floats making the floats to distortions crinkles and movements acting on the interlacing portion of spandex weft, therefore, effective movement is related to the characteristic of spandex to contract and its distortions surface character, the weaving conditions especially the spider weaving tension, and the fabric structures the lower the weave factor, the higher the freedom to migrate.

Location of the Free Spaces: The location of the free spaces assigned the direction of the float movement. Indeed, the location of the free spaces on either side of the float offered a free way of assigning the direction in which the float in plane is distortion crinkles. Twill have free interlacing zone on right side of the top part and left side of the bottom part of the cotton warp floats offering the warp floats to turn crinklewise. So twill weave have free interlacing zones located on left side of the top part and right side of the bottom part of the cotton warp floats to let them crinkles counter crinklewise, so spider weave has free interlacing zones on warp cotton located on left side of the top part and spandex right side of the bottom part of the yarns floats to let them crinkles potential counter crinklewise of horizontal direction. It causes less air permeability while fabrics crinkle go up.

The Float Length: As the float cotton yarns length gets longer the freedom of the float contacts get higher. The comparisons of 1/1 plain weave to satin and spider weave in Table 2 shows a direct relationship between the locations of the free spaces assigned the direction of the float movement. Indeed, the location of the free spaces on either side of the float offered a free way of assigning the direction in which the float an in plane could crinkle. Satin weave has free zone on spandex right side of the top part and left side of the bottom part of the warp floats to turn crinklewise. Left hand stains have free zones located on left side of the top part and right side of the bottom part of the warp floats to let them crinkles potential counter crinklewise.

Shrinkage: comparing fabric tightness (weave), plain weave showed lower shrinkage after wet processing as compared to stain and spider weave at same crinkle distortion, stretch potential. This shows that plain weave is more stable than on based stain and spider weave. This is because plain weave started with lower stretch potential due to tight construction and does not have enough margins for distortion. However, in both weave types, shrinkage reduced with further wet processing. It was obvious from the results that irrespective of spandex type, fabrics containing spandex do retract/expand after treatment. The % retraction needs to be determined and accounted for to get to rephrase.

4. SUMMARY AND CONCLUSIONS

The purpose of this study was to establish crinkles potential the dependences between the constructional parameters of double woven fabrics, namely type of weave and the method of stitching, and following mechanical properties: breaking strength and elongation, tearing strength, wrinkle recovery and fabric stiffness. The results of analysis of variance clearly indicate that the method of stitching doesn't have statistically important effect level on the upper mentioned mechanical properties, except for the tearing strength in warp direction and fabric stiffness. The influence of type of weave is much more evident regarding the mechanical properties. All mentioned mechanical properties are influenced by weave, except wrinkle recovery.

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VARIANTS OF LADIES' JACKETS WITH DROPPED SHOULDERS SLEEVES

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***Abstract**: The paper presents designs of ladies' jackets with dropped shoulders sleeves on the base of variations of a model. In presented designs the geometrical lines, which form the dropped shoulders of the sleeves, are the same for the four jackets. Of course these lines can be with different geometrical form and directions, but main idea in presented models was subjection of the other elements to the lines which form the dropped shoulders. By this reason the jackets' designs are without collars, pockets and other types of small parts and elements, and the other using forming elements are designed in shapes which are simple or connected to leading lines.*
***Keywords**: fashion design, pattern making, jacket, dropped shoulder, sleeve.*

1. INTRODUCTION

Dropped shoulders' sleeves are interesting accent in ladies clothing not only for the fashion design, but for the apparel technology too. According to the fashion design these kinds of sleeves bring casual soft touch in the classic dresses, jackets and coats, or are very suitable for sports and free time garments. According to the apparel technology these kinds of sleeves are very easy for manufacture.
The paper presents designs of ladies' jackets with dropped shoulders sleeves on the base of variations of a model.

2. A BASIC MODEL

Figure 1 presents a model of a lady's jacket with dropped shoulders' sleeves. The design constructional seams, which formed the waist and bust areas, and the dropped shoulders' form of sleeves, are the center of the composition. By this reason the model is designed without collar and every element is in a simple form.
Figure 1.1 presents the pattern making of the jacket, shown in Figure 1. The pattern design is made on the constructional base for pattern making of raglan, semi raglan, kimono, and dropped shoulders' sleeves, which is presented in [1].
In the front: The bust and waist darts are transformed in a curved design constructional seam which passes through the pick point of the underarm area and continues in a straight line in the sleeve. This straight line designs the dropped shoulder's sleeve and it is perpendicular to the upper arm seam. The oval neckline is in the shape of the neckline of constructional base after a little sinking.
In the back: The waist dart is transformed in a curved design constructional seam which passes through the pick point of the underarm area and continues in a curved line in the sleeve. The curved line in the sleeve designs the dropped shoulder's form. The distance between the hem line and the line of dropped shoulder on the upper arm seam in the back is

equal to the distance between the hem line and the line of dropped shoulder on the upper arm seam in the front. According to this equality and the requirement of passing of the dropped shoulder seams through the pick points of the underarm areas in the front and back, the form of the dropped shoulder seam of the back is a curved line. It is not straight line like the dropped shoulder seam in the front.
Figure 1.2 shows the details of the jacket. The front and back parts of the sleeve are united in one piece.

3. VARIANTS

Figures 2, 3, and 4 present models of ladies' jackets which are designed on the base of a model of a lady's jacket with dropped shoulders sleeves.
In the model, presented in Figure 2, the hidden buttons from the model in Figure 1 are replaced with a zipper. According to the zippers in the sleeves, the one piece sleeve from the model in Figure 1 is changed in two pieces one.
The pattern making of the model 2 is shown in Figure 2.1 and it is made on the base pattern making, presented in Figure 1.1. In Figure 2.1: The additional width for buttons is removed. The darts in the sleeve are transformed in a design constructional seam.
Figures 3 and 4 present variants with necklines formed with convex curves which pass supply in border lines for buttons. The shapes of the necklines connected to the form of the design constructional seams in the front parts of jackets. In these models the sleeves can be designed like the sleeves from the model in Figure 1 or like the sleeves from the model in Figure 2.
The model, presented in Figure 3, is designed with high neckline formed with intensive convex curved line. The pattern making of the model is shown in Figure 3.1 in which it can be seen that the neckline of the model is drawn over the neckline of the constructional base.
The model, shown in Figure 4, is designed with neckline formed with soft curved line which is similar to a circle arc. The pattern making of the model is presented in Figure 4.1.

4. CONCLUSION

In the models, presented in Figures 1-4, the geometrical lines, which form the dropped shoulders of the sleeves, are the same for the four jackets. Of course these lines can be with different geometrical form and directions, but main idea in presented designs was subjection of the other elements to the lines which form the dropped shoulders. By this reason the jackets' designs are without collars, pockets and other types of small parts and elements, and the other using forming elements are designed in shapes which are simple or connected to leading lines.

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Figure 1. A model of a lady's jacket with dropped shoulders' sleeves

Figure 2. A model of a lady's jacket with dropped shoulders' sleeves and zippers

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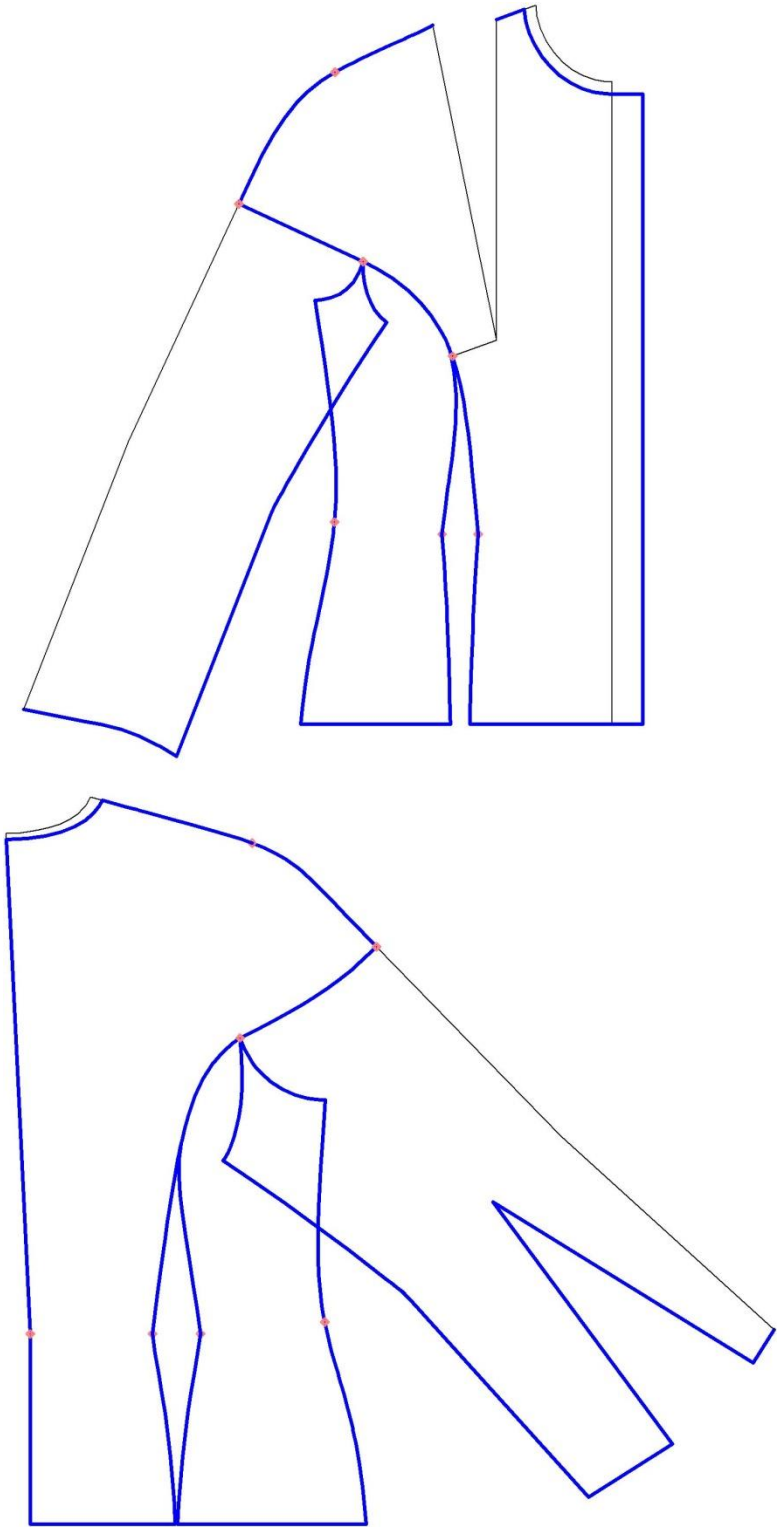

Figure 1.1.
Pattern making of a lady's jacket with dropped shoulders' sleeves

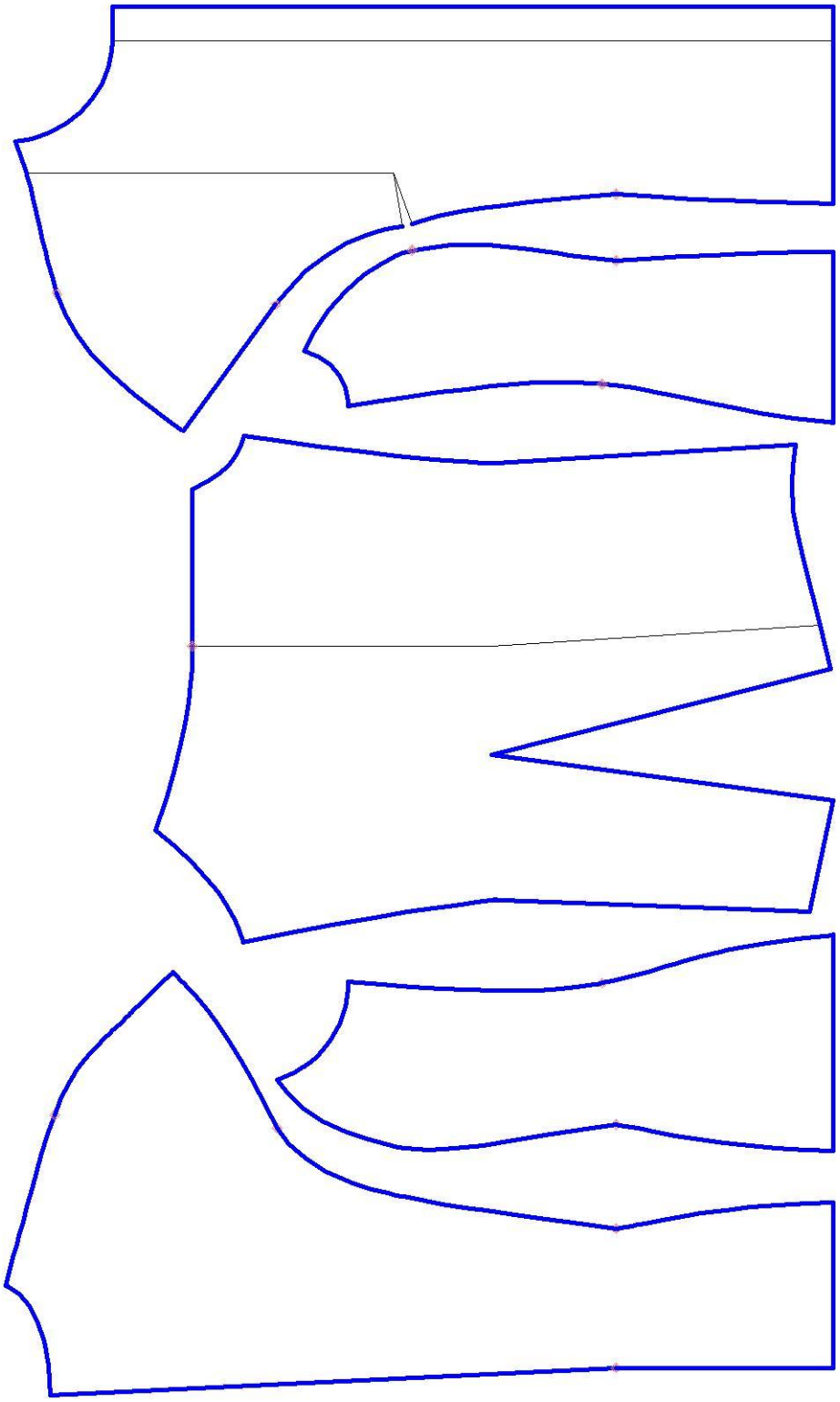

Figure 1.2.
Details of a lady's jacket with dropped shoulders' sleeves

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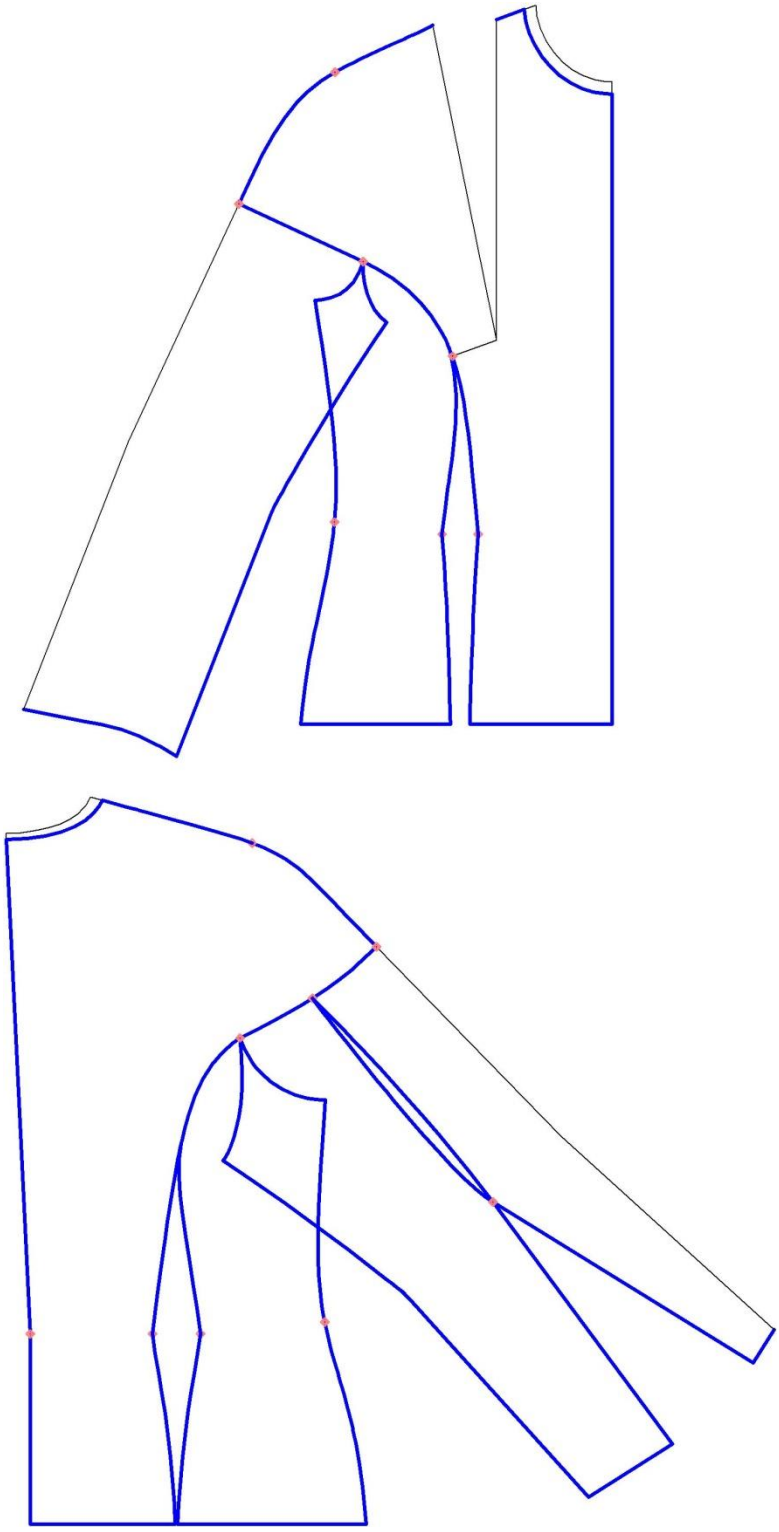

Figure 2.1.
Pattern making of a lady's jacket with dropped shoulders' sleeves and zippers

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Figure 3. A variant with high neckline formed with intensive convex curved lines

Figure 4. A variant with neckline in arc shape formed with supple curved lines

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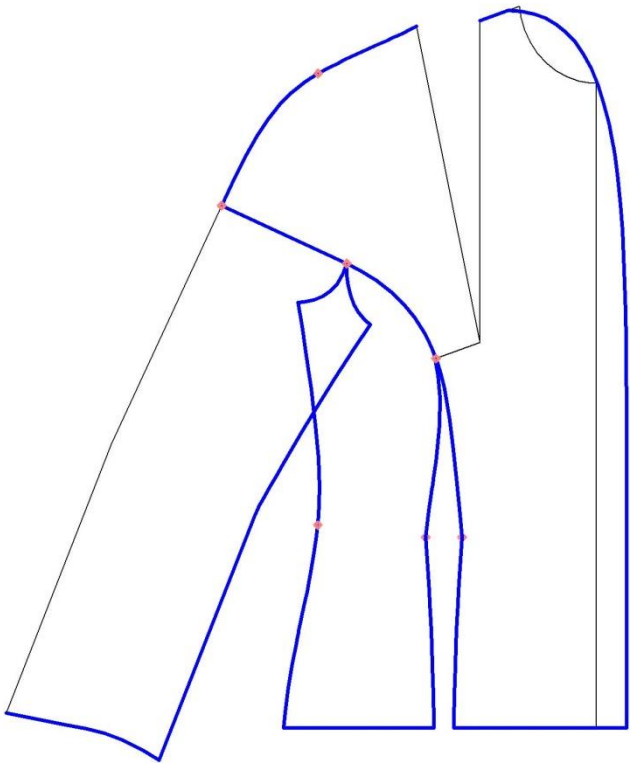

Figure 3.1. Pattern making of a lady's jacket with dropped shoulders' sleeves and high neckline formed with intensive convex curved lines

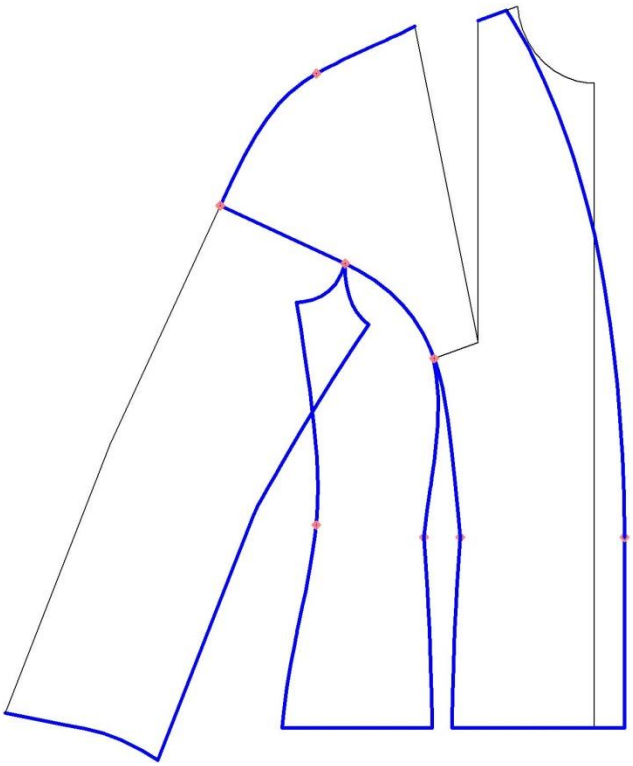

Figure 4.1. Pattern making of a lady's jacket with dropped shoulders' sleeves and neckline in arc shape formed with supple curved lines

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THE MODERN STYLE IN INTERIOR AND EXTERIOR DESIGN

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Abstract: *The style is a way of expression, which is characterized by all the features that distinguish it from the rest. In the art indicates overall characteristics of an artist or art school, direction or time. Modern design is difficult to define. The term "modern" refers to the impact of modern art to the design of interiors and exteriors. Modern design is defined more by its own trends, which is largely unchanged for several decades.*
One of the most important elements in modern design of interiors and exteriors is the form. Modern design uses geometric forms including rigid squares and rectangles, with a smooth, even and curved ends. Perfect circles and oval shapes are also common in modern design. Modern design is also plain and simple.
Keywords: *designer, landscape, art, interior, exterior.*

1. INTRODUCTION

The style can be characterized by art in a certain period of time (Gothic, modern, baroque style or direction), a specific environment (rustic style), particular artist, etc.
The modern style is mainly characterized by simple forms without decorations, while creating beautiful shapes of the structure's elements.
The concept of modern architectural style means more movements and styles, some of which are related, while others are clearly distinguished.

Figure 1. Interior in modern style

Figure 2. Exterior in a modern style

Modern art as a movement followed the trends of modern design. In painting, modernism began with the impressionists and others that use abstraction in their work. Interior and exterior's modern design is derived from decorative art, particularly art deco, in the late 19th and early 20th century. It reached its peak in the 1950s and 60s.

Modern style as a term often used to describe modernist's movements in the late 20th century, with the rapid technological progress and modernization of society, using new materials and incredibly innovative new designs, making buildings and interior received brand new functions and forms.
The rise of this style is characterized by numerous movements and openings of many schools of design.
While modern design has its roots in the 1930s, modern interiors and exteriors become widespread after the Second World War.
The creation of modern style in the design of interiors and exteriors is credited to a group of European designers which began in the Bauhaus school of design in Germany in 1919.
Bauhaus philosophy is that form and function should be combined in all designs. The modern design style is pure, linear and focuses first and foremost on function and avoids excessive accessories and decorative elements seen in many other styles. Some people feel modern design too simple, rough or cold, but when it is well planned can promote a sense of calm and simplicity.
From its inception to the present, the style has new materials and technology.
The modern design evolved over time and covers a wide range of styles from the mid-century modern to contemporary styles of houses.
Minimum textures and bold geometric shapes, neutral colors accented with color filled with polished ends and asymmetrical balance are key features of the modern style of interiors and exteriors.

2. DECORATION

Modern furniture | Modern sculpture | Fireplace | Fountain

The colors should be futuristic, such as silver, bronze and similar "modern" colors.

3. COLORS

Blue | Orange | Grащ | Neon Green

The modern design of the interior uses many different materials. Wood and plastic are common, some designers use natural wood as organic versus artificial forms and materials. Glossy metal such as stainless steel are among materials in modern interior spaces. Designers of modern design interior and exterior also use mixtures of glass and plastic.

4. MATERIALS

Wire Cable | Car Panel | Wooden | Sheath

5. PALLET PLANT

Grass | Juka | Palma | Succulents | Cactus | Palma

The space; commitment to all that is linear; windows as part of the design; open creative plans; focus on materials; strict forms and calm colors. Elimination of the familiar, classic "kalpaks" in the family house and yard simplicity; inspired by space, location and function; Only the necessary work involved in the design; decorations are the elements by themselves: walls, windows, ceilings, metal structures; there is no overcrowding and kitsch; The materials used for construction are shown in their natural form, not hidden; Brave horizontal and vertical lines; The windows and doors are characteristic of this style from floor to ceiling; Almost always the topography is incorporated in the design of the house and so on.

6. SIMPLICITY IN SHAPE AND DESIGN

Too many decorative elements that give a sense of kitsch are eliminated or greatly simplified, giving the image of a clean, aesthetically landscaped space. Modern taste enjoys the simplicity and clarity.
Clutter and unnecessary elements are abandoned in modern architecture. Project objectives are clear from the start and only functionality is necessary in the design.
The space that is made in a modern style was "stripped" so it will show the architectural design of space - the focus will be exclusively on the space, not the decorations or details that are not relevant to the overall design.

7. INSPIRED BY FUNCTIONALITY

Modern architecture aims to create designs that will be above the standard ideas that will primarily be of great benefit.
Louis Sullivan publicly declared that "form follows function". This idea expresses the tendency of the modernists to dictate the ideas of design.
The designers of the modern age have inspiration from the project - if the project aims to show something, for example a house, or to be taken from another person, the architects have to design according to the unique situation and to be inspired by the purpose and functionality of the facility.

8. NOTHING TO BE HIDDEN

Instead of concealing the nature of space, modern style viewer wants to have visibility inside the work and the real nature of the project.
Materials are displayed in their natural form.
Structural elements are disclosed to show the structure and support.
Exposed beams, open floor plans, and structural elements are exposed to the viewer.
The idea of a sense of "truth" is present in the space where all materials and architectural elements are bare and honestly revealed.

9. TRENDS TOWERDS LINES

In many modern designs, you can find strong linear elements and bold horizontal and vertical features.
Beams, shapes, windows, staircases, fireplaces, roof lines and other structural elements assist the designer in creating a linear inspiring space. This focus is much more famous in modern design, and is less important in other, more traditional styles of building.
The lines of modern architecture tend to be straight and angled instead of curved, organic lines can still play a part to his time in modern design in the home.

10. USE OF MODERN MATERIALS

Modern homes often experiment with the latest building materials and techniques.
Many areas built according to modern style use wood as a material.
Steel poles are used in exposed applications, concrete block used as finished material, concrete floors.
Modern exteriors are in most cases stone, plaster, wood, or brick.
A modern design highlights strong and smooth materials, including steel, concrete, chrome and stone.
Exposed beams and opposing wall materials commonly seen inside.
Neutral colors are preferred in modern houses to highlight the materials and design.

11. USE OF ADVANTAGE OF SUN AND IMPROVEMENT OF HUMAN COMFORT

Best modern spaces are efficient with use of the home. They are oriented to take advantage of natural forces.
Homes made in a modern style providing solar heating in winter and in summer provide shade from the sun, so prevent entry of excessive heat in the house, and thus preserving the comfort of the air in summer.

Figure 3. Pool in the modern style, characteristic is infinite pool; There are no curves, circles, ellipses; The rectangular shape dominated; Pure linear forms

Figure 4. Bathroom - Minimum decorations; Metallic elements, natural colors - gray, white, brown; Large windows, plenty of light; Simple mirrors and rectangular shapes of the sink, doors and hanging elements

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Figure 5.
Kitchen - Open, large; Horizontal and vertical lines; Sharp corners, clean shapes; Major elements and calm colors; Tall windows, simple bars

Figure 6.
Features Kitchen - Open, large; Horizontal and vertical lines; Sharp corners, clean shapes; Major elements and calm colors; Tall windows, simple bars


12. CONCLUSION

The main features of modern style in interior design and exterior are clean linear design, function over form, avoiding too many embellishments, minimal use of textures, asymmetrical balance, simple shapes and design.
Modern style has a few things in which they contrast from other styles. The focus initially is on simplicity and asymmetry.
Modern style is ideal for small spaces, because it maximizes the functional space and creates the impression that the space is larger than it really is.

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APPLICATION OF INDUSTRIAL DESIGN IN GREEN AREAS

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Abstract: *The existence of green areas is essential for quality of life in every living space. Application of industrial design in parks and gardens has an important role and nowadays is very common. The impact of industrial design in urban green spaces in residential areas provides dedicated aesthetic note that enriches the whole functional and aesthetic forms which are always placed at precise positions that accentuate the landscape, while the cohesion and harmony are combined and contrasts nature in industrial design.*
The design is created as an artwork in a predetermined order. The artwork gets the role of usability and functional aesthetics. The design evolves with the development of industry and mass consumption.
Industrial fragments in green areas make artwork that is unique and are one of a kind.
Keywords: *design, park, city, composition, landscape.*

1. INTRODUCTION

"Dynamic composition" is frequently used expression when speaking of modern parks. The expression is often associated with the ability to move, to change mood and mutual relationship of all elements in the full expression of the park. The composition represents forms within a given expanse.
Setting up forms and elements depends of the desired effect. In the narrow sense, composition can be defined as an image, or better yet image-composition of free or geometric figures that are found in any dependency on each other. The compositions depend on a number of objective factors, among which the aesthetic requirements take an important part.
As a scientific discipline, the theory of composition has its own categories, those are tectonic structure and volume – spaciousness structure.

2. THE COMPOSITION IN THE ART OF PARK IMPLIES COMBINING ELEMENTS AND PRINCIPLES IN BUILDING A PARK.

2.1. Convergent line

If one pays attention to the convergent lines such as roads, railroads, sidewalks or shadows, it is noticeable that these lines will direct one's gaze to distant parts, making the view more dynamic.

2.2. Rhythmic elements

The rhythmically repeated elements, such as trees, benches, people - or any group that repeats, forms a resting feeling for visitors, but small variations in the composition brings out liveliness and makes it more interesting.

2.3. Elements that overlap

Overlapping of elements in the scenery, partially covering objects creates a sense of mystery. It is creating more depth by creation of space in the view.

2.4. Shaping of elements

Elements that give shape to the space such as trees, urban equipment, doorways form a framework that will focus the viewer's attention to the point of interest. This technique provides excellent results with any zoom setting. Proper composition can matter great deal in building a park. The park should not just represents a picture, but a work of art that will offer pleasant feeling and lot of content. Composition is a matter of relations in a park. Every composition has its own specific factors such as:

- Concept or idea;
- Material which achieves the idea;
- Form for composition;
- Elements for composition.

Effective expression of the artist's (photographer's) idea is the main objective of any composition, and it can be expressed only in a composition that is in place and related to make a firm and clear synthesis. Synthesis means unity, and unity is what makes the creation (pictured) giving a strong impression even upon first contact with the viewer.
Given that the first and strongest impression comes from the visual elements that give the momentary and direct effect on viewer's feelings, the artist (photographer) should seek his expression to flow more through them than through thematic content. After all, the viewer does the intellectual reading of the thematic content gradually and much later.

Figure 1. Effects in the park

Park art – Park art is a way through which a person maintains the surrounding natural environment. With the deviation of pagan beliefs before religious beliefs the park art evolved and began to express ideas and other functions. In the advanced stages of society development gardens turn into an object of visual pleasure and a way for the superiority of man over everything else to be shown. The approach of people towards nature gives vigor to think they govern it. This opinion was dominated at the time of the Italian Renaissance.
Art can be divided into three categories:
1. Spatial - arts that exist only in space - art, architecture and applied arts.
2. Temporal - which only exists in time - music, literature.
3. Spatial-temporal - exists in space and in time - dance, theater, and cinema.
Therefore park art is spatial-temporal because the spatial created work, park or garden exists in space and time at the same time.
Park art belongs to the category of spatial – temporal fine art and complex art.
Park art is a creative activity that aims to create a purposeful organic material environment for communication between man and nature which are charged with content of modern and cool new trends of the fast and dynamic life.

Features of the park art

- Emotions – the ability to express specific feelings;
- Cognition – with its help people enrich their knowledge;
- Nationality – it forms the love and empathy towards national tradition;
- Realism – art is aligned with some purpose and characteristics (efficiency).

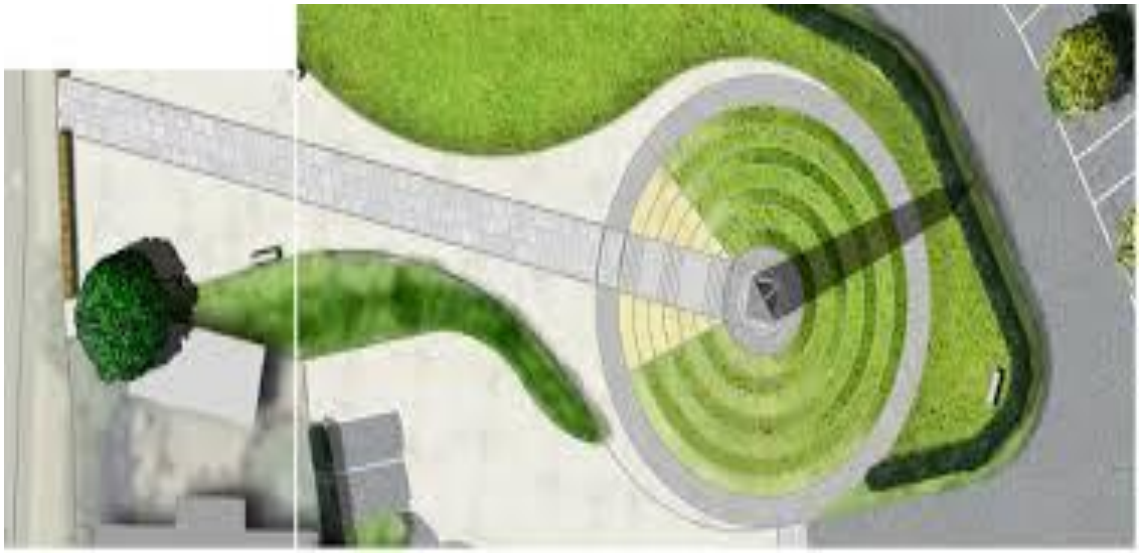

Figure 2. Composition

Industrial design is a creative activity to determine external quality of industrially manufactured items. The term industrial design can be treated as a term that denotes the area or discipline that means a finished product. Industrial design is an area that is directly derived from modern technology, where mass production and distribution of spent goods creates demand that can be satisfied with the quality products to the needs of man.
Therefore interdisciplinary and multidisciplinary treatment of the design is correct and true approach, using multiple scientific disciplines in the development of products or methodology of industrial design.

The design is a creative activity whose aim is to establish multilateral quality of facilities, processes, services and their systems in the whole life cycle. That is why design is the key, a central factor in innovative humanization of technologies and the crucial factor of cultural and economic change.

Industrial design is an industrial property that relates to a specific look or form of body, painting, drawing, contour, composition, color, texture or their combination thereof it meets the requirements of novelty and individual character to those previously known to public. Industrial design gives products a certain visual aesthetic, ergonomic, practical purpose or quality that distinguishes them from other products on the market.

Industrial design services are often provided in the context of cooperation and working relationship with other members of the development group. Typical groups include management, marketing, engineering and manufacturing specialists. The unique contribution of the industrial designer is emphasizing those aspects of a product or system that relate the most to human characteristics, needs and interests. This contribution requires an understanding of visual, tactile, safety and convenience criteria, with concern for the user. Education and experience in anticipating psychological, physiological and sociological factors that affect the user, are considered as essential industrial design resources.

They work to prove that design recommendations use materials and efficient technologies, in accordance with all legal and regulatory requirements.

Industrial design has a dual application. It serves to satisfy the need of a good and useful. By its nature and by its shape, with which it presents to the public, it is located halfway between the invention and the "pure" art.

The legal protection of industrial design consists in protecting the distinctive elements that are responsible for the success on the market. The legal protection of industrial design among other things intensifies the investment in resources that nurture it, pushing design as an element of production. Protection of industrial design is determined in different ways depending on the country. Industrial design is an applied art that enhances aesthetic and use values of the products.

Figure 3. Complete clarity and functionality

The link between the park and the industrial design - the reason for setting up industrial objects is primarily adding functional segments in a park which is complemented with decorative content and shows us modern trends.
Specific features of park art and industrial design are as follows: scale, dynamics of development, availability and understandable character.
Scale - artistic principle, which defines the relationship of the dimensions of individual components and elements between them and toward the whole. The scale is also widely used in industrial and manufactured items because they are related to ergonomics.
There are two types of scales in a park:
• Relative - when surface or volumes cause optical performance for different scales in the same size of the entire area.
• Human - distinguishing the volumes and surface areas in such ratios that are associated with generally accepted medium dimensions of the human figure and the reach of his perception.
- Dynamic of development - the basic material that is alive suffers continuous changes.
- Available and understandable character.
The application of the scale in a park and related industrial scale give the complete composition of the future park.

Figure 4. Industrial design in the park

3. CONCLUSION

The composition is very important element in the landscape design and industrial design. It makes exterior spaces much more pleasant while overpassing. Thus we can conclude that various compositions are compatible with one another and in combination fit perfectly into the design of the landscape, but also have to do with the ideal blend of all elements that make up the whole.
Short definition of industrial design would say: the design represents determining and shaping of the quality and the attitude of manufactured items, cleaning, communications, systems, processes and environment satisfying conditions of production, distribution and use of interdisciplinary methodology.
When accurately determined and placed in the composition of the park they have a dual role they have strictly defined functions and their second purpose is sculptural decoration which gives parks a modern and contemporary look, their setting gives industrialized look which is the right concept for large cities. The idea is for the visitors to rest and yet, not to forget the everyday.

4. LITERATURE

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