



## **DETERMINATION OF VARIABLE FACTORS AND THEIR LEVELS IN THE PRODUCTION OF TWO-LAYER KNITTED FABRIC**

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### **Annotatsiya:**

Ushbu ilmiy tadqiqot ishida ikki qatlamli trikotaj to'qima matolari va ularning turlari, tanlangan trikotaj matolarining fizik-mexanik xususiyatlari: havo o'tkazuvchanlik, yuza zichlik, nam shimuvchanlik, ishqalanishga chidamlilik, qaytar qaytmas deformatsiya va uzilish kuchi kabi ko'rsatgichlari olinib, olingan natijalar bo'yicha matematik model tayyorlanib, o'n beshta ko'rsatgichi bo'yicha taxlil qilindi.

Annotation: In this scientific research work, two-layer knitted fabrics and their types, physical and mechanical properties of selected knitted fabrics; indicators such as air permeability, surface density, moisture elasticity, abrasion resistance, irreversible deformation and breaking strength were obtained, a mathematical model was prepared based on the obtained results, and fifteen indicators were analyzed.

Аннотация: В данной научно-исследовательской работе получены такие показатели, как двухслойные трикотажные полотна и их виды, физико-механические свойства выбранных трикотажных полотен: воздухопроницаемость, поверхностная плотность, влагуупругость, сопротивление трению, необратимая деформация и прочность на разрыв, на основе полученных результатов составлена математическая модель и проведена проверка по пятнадцати показателям.

Kalit so'zlar: ikki qatlamli trikotaj, matematik model, fizik-mexanik ko'rsatgichlar, chiquvchi parametrlar, kiruvchi parametrlar, poliestr, laykra

Key words: two-layer knitting, mathematical model, physico-mechanical parameters, output parameters, input parameters, polyester, lycra



**Ключевые слова:** двухслойное вязание, математическая модель, физико-механические показатели, выходные параметры, входные параметры, полиэстер, лайкра.

It is desirable to effectively use multi-factor mathematical planning methods in researching parameters of factors determining the structure of two-layer knitted fabric. In the production of double-layer knitted fabric, it is observed that the performance of the work is simultaneously influenced by different independent factors. In previous studies, linear density and complex weaving were used as factors affecting the properties of knitted fabric in order to increase the quality indicators of the fabric. In the production of two-layer fabric, it was shown that the linear density of jute yarn, the type of weaving and the raw material, i.e., the fiber content of the yarn, have a greater effect.

Two-layer knitted fabrics used in enterprises are mainly composed of some fiber content (polyester, lycra). It is being imported from abroad, and since it consists of 100% polyester and lycra fibers as raw materials, it leads to an increase in the price. In order to reduce the price and increase the quality indicators, the research work aimed at improving the quality indicators of knitted fabric using local raw materials cotton fiber (partially polyester and lycra) was carried out. Factors affecting the quality indicators of two-layer fabric, i.e. air permeability, moisture elasticity, thickness, tensile strength, friction resistance, deformation and bulk density of the fabric were studied in the researches, and researches were conducted to find the optimal values of these factors. One of these factors is the amount of polyester and lycra in the knitted fabric.

Changes in the surface density of two-layer fabrics: linear density of yarns, type of warp, coefficient, warp and weft depending on the density. When the surface density is in the warp and weft system yarn direction and the filling coefficient is at the desired level, the penetration of double layer knitted fabrics after washing will be different. Therefore, the surface density property of double-layer knitted fabric is the most important indicator.

Tadqiqotlar rejalash matritsasi va natijalarni qayta ishlash.

Trikotaj to‘qimasini halqa ipi old uzunligi.

$$X_1 = 1,5 \div 3,5 \text{ mm}$$

Trikotaj to‘qimasini halqa qadami.

$$X_2 = 0,4 \div 0,6 \text{ mm}$$

Mato iplarini tolalali tarkibini o‘zgarishi.

$$X_3 = 5 \div 25 \%$$





CHiquvchi parametr:

Y1- Xajmiy zichlik, mg/cm<sup>3</sup>

Research planning matrix and results processing.

Table 1

Name and designation of factors	Change levels			Change range
	-1	0	+1	
The front length of the loop yarn of the knitted fabric.	1,5	2,5	3,5	1
Loop step of knitting fabric.	0,4	0,5	0,6	0,1
Changing the fiber composition of fabric threads.	95 % cotton, 5 % lycra	75 % cotton, 23% poly, 2 % lycra	75 % cotton, 25% poly	-

In general terms, we pass from the natural values of the factors to their coded values.

It became clear from the results of TOT that the organized process is represented by a higher order equation. Therefore, for the second-order regression mathematical model, the central failure experiment (MNKT), which is somewhat simpler and more convenient than other methods, and widely used in the research of technological processes of the textile industry, was selected and implemented.

The working matrix of MNKT and the results of the experiments are presented in the following table: Central non-composite experimental matrix



Table-2

№	Factors			$x_1x_2$	$x_1x_3$	$x_2x_3$	$x_1^2$	$x_2^2$	$x_3^2$	$Y_1$	$S_u^2(Y_1)$
	$x_1$	$x_2$	$x_3$								
1	+	+	0	+	0	0	+	+	0	202	11,0
2	+	-	0	-	0	0	+	+	0	180	9,0
3	-	+	0	-	0	0	+	+	0	175	9,0
4	-	-	0	+	0	0	+	+	0	160	12,0
5	+	0	+	0	+	0	+	0	+	245	8,0
6	+	0	-	0	-	0	+	0	+	211	12,0
7	-	0	+	0	-	0	+	0	+	189	11,0
8	-	0	-	0	+	0	+	0	+	176	8,0
9	0	+	+	0	0	+	0	+	+	209	9,0
10	0	+	-	0	0	-	0	+	+	211	11,0
11	0	-	+	0	0	-	0	+	+	196	8,0
12	0	-	-	0	0	+	0	+	+	169	9,0
13	0	0	0	0	0	0	0	0	0	206	7,0
14	0	0	0	0	0	0	0	0	0	214	5,0
15	0	0	0	0	0	0	0	0	0	211	15,0

(+), (-) and 0 values should be used in the matrix

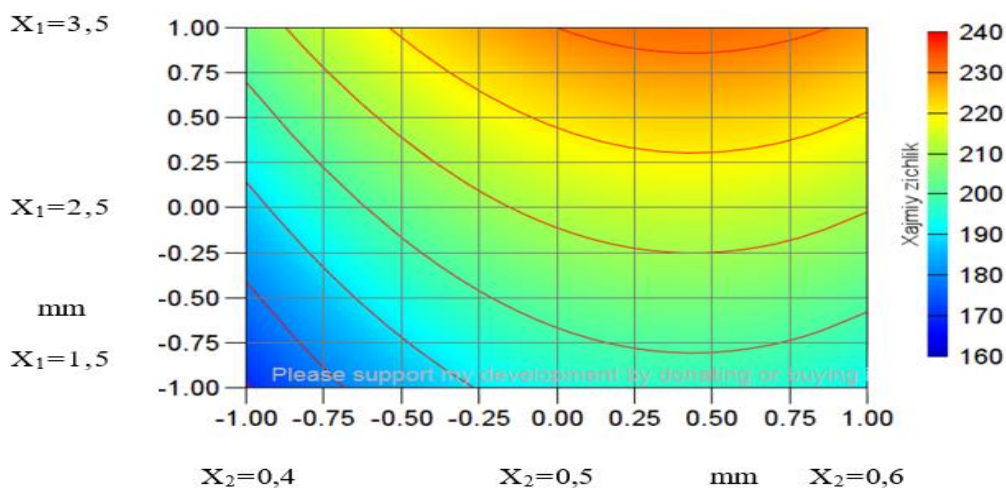


Figure-1. Values of volume density indicators when  $x_3=0$  using mathematical model

As can be seen from the graph above, the input (Y) values of the bulk density are depicted using the average value of the first () and second () factors from the accepted





minimum (-1) value to the maximum (1) value and the third factor (75% cotton, 23% poly, 2% lycra). Using the diagram, (X) knitting fabric ring thread front length in the range of 0.25 0.5 0.75, i.e. 0.525+0.575 mm and (X) factor Knitting fabric ring pitch in the range of 0.25-0.5 (Y) Volumetric density is reaching the highest values.

1. The appearance of our mathematical model is as follows, taking the case of average (0.5 mm) surface density of the knitted fabric as the second factor.

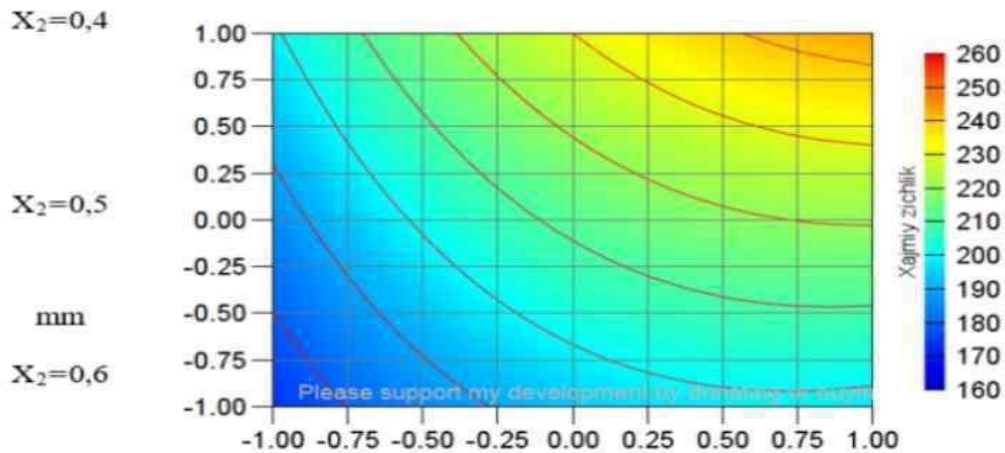


Figure-2 An indicators of volume density when  $x_2=0$  using a mathematical model.

As can be seen from the diagram, the length of the loop thread of the knitted fabric (X) is in the range of 0.25 0.5 0.75, i.e. 0.525 + 0.575 mm, and the factor (X) changes the fiber composition of the threads in the fabric -1, i.e. 75% cotton, 25% poly fiber, and the value (Y) reaches the highest volume density.

2. The appearance of our mathematical model is as follows, taking the average position (2.5 mm) of the length of the loop thread of the first factor knitted fabric.

$$Y_R = 212 + 11,5x_2 + 18x_3 - 13,07x_2^2$$

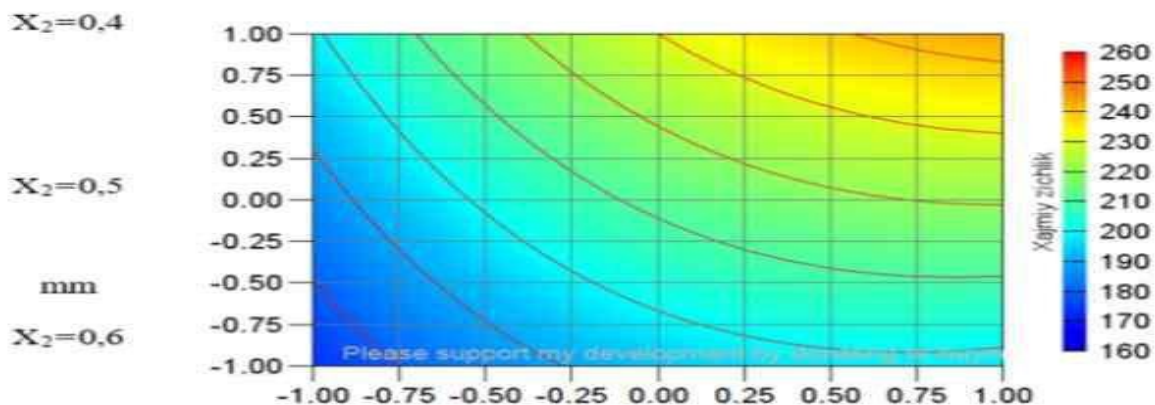


Figure-3. The value of the volume density index by  $x_1=0$  using a mathematical models.



It can be seen from the diagram that (X) the length of the loop yarn of the knitted fabric is in the range of 1.0 i.e. 0.6 mm and (X) the fiber composition of the knitted fabric is in the range of -1-1 i.e. 75% cotton, 25% poly fiber in the value of (Y) reaching the highest values of volume density.

By triangulating the results of the research in 3 cases, (X) the length of the loop thread of knitted fabric in the range of 0.25 0.5 0.75, i.e. the value of  $0.525 \div 0.575$  mm, (X) the length of the loop thread of knitted fabric in the range of 1.0, i.e. the value of 0.6 mm, and (X) the change in the fiber content of the knitted fabric threads in the range of -1 75% cotton, 25% poly fibers achieve the highest values of bulk density (Yi).

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