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DETERMINATION OF ACCEPTABLE VALUES OF THE MAIN FACTORS AFFECTING THE PRODUCTION OF TWISTED THREAD

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Abstract: In this article, the limit parameters of the main factors affecting the performance of the improved working part of the yarn winding machine were determined, and their optimal values were determined by the method of mathematical planning. These values were graphed and analyzed for the effect of the machine on yarn stiffness.

Keywords. Textiles, tenacity, spinning, yarn, yarn cooking, acceptable values, factors, yarn tension, yarn winding speed, puck weight.

Introduction. Increasing competition in the world market of textile products, improving the quality of products due to the development of production technologies in countries producing textile raw materials and increasing the productivity of equipment and technologies, as a result of ensuring resource efficiency in industrial enterprises, is increasing the need for wide use of expensive raw materials. Accordingly, in order to improve the quality of products and reduce their cost in the field of textile production in the world market, it is of great importance to identify and eliminate the factors that have a negative effect on the operation of technological processes in one of the main processes - spinning and thread preparation for weaving, as well as the creation and introduction of automated, resource-efficient modern machines. [1,2].

Creation of the scientific basis of the techniques and technologies of the preparation and cooking of spun yarns, the development of normative technological parameters with a detailed study of the scientific and technical capabilities of modern machines and equipment suitable for the production process are gaining special importance in the world. In this regard, it is of urgent importance to carry out targeted scientific research on changing quality and strength indicators by cooking yarns from the spinning process, producing cooked yarns that meet market requirements, ensuring resource efficiency in the production of cooked yarns, and reducing the cost of manufactured products [3].

The yarn splicing process is graded by splicing the yarn at the same length and tension. As influencing factors of the splicing technological process, the input factors x1 - thread tension, sN, x2 - thread winding speed, m/min, x3 - puck weight, grams, indicators were taken. The choice of levels and intervals of the studied factors is presented in Table 1.

Table 1

Selection of levels and intervals of changes in the factors under investigation

Name and designation of factors	Change levels			Change interval
	-1	0	+1	
x_1 - thread tension , sN	250	400	550	150
x_2 - thread winding speed, m/min	350	500	650	150
x_3 - puck weight, grams	14,2	20,1	26	5,9

The parameters of change were obtained as test results to determine the hardness and shrinkage of the studied yarn. Based on the central non-composite test matrix, 15 different test cases of 3 fighting factors were accepted for analysis and evaluated according to the test results (Table 2).

Table 2

Central non-composite experience matrix

№	Factors x_1	x_2	x_3	x_1x_2	x_1x_3	x_2x_3	x_1^2	x_2^2	x_3^2	Y_1	Y_2	$S_u^2(Y_1)$	$S_u^2(Y_2)$
1	+	+	0	+	0	0	+	+	0	1185	3,8	68,4	0,98
2	+	-	0	-	0	0	+	+	0	921	6,8	29,8	1,2
3	-	+	0	-	0	0	+	+	0	951	7,2	48,9	0,68
4	-	-	0	+	0	0	+	+	0	695	11,5	62,7	1,26
5	+	0	+	0	+	0	+	0	+	1105	7,8	39,4	1,4
6	+	0	-	0	-	0	+	0	+	958	8,2	74,6	1,9
7	-	0	+	0	-	0	+	0	+	924	7,6	68,4	0,89
8	-	0	-	0	+	0	+	0	+	768	11,6	49,7	0,62
9	0	+	+	0	0	+	0	+	+	1108	5,8	52,7	0,14
10	0	+	-	0	0	-	0	+	+	995	7,8	72,6	0,97
11	0	-	+	0	0	-	0	+	+	820	8,2	67,4	0,78
12	0	-	-	0	0	+	0	+	+	701	10,5	94,2	0,38
13	0	0	0	0	0	0	0	0	0	1105	6,8	82,4	0,02
14	0	0	0	0	0	0	0	0	0	1128	5,9	76,9	0,14
15	0	0	0	0	0	0	0	0	0	1139	6,1	98,4	0,11

In order to determine the regression coefficients, Student and Fisher's criteria were used to check the adequacy of the mathematical model. As output factors, Y_1 was selected according to the hardness (N) of the thread [4].

Based on the results of the experiment, we look for a second-order regression multifactorial mathematical model. As a result of this experiment, the regression model of the following general form can be obtained:

$$Y_R = b_0 + \sum_{i=1}^{M} b_i x_i + \sum_{\substack{i=j=1 \\ j\neq 1}}^{n} b_{ij} x_i x_j + \sum_{i=1}^{M} b_{ii} x_i^2$$

Or, since three factors are involved in our experiment, the above expression takes the following form:

$$Y_R = b_0 + b_1x_1 + b_2x_2 + b_3x_3 + b_{12}x_1x_2 + b_{13}x_1x_3 + b_{23}x_2x_3 + b_{11}x_1^2 + b_{22}x_2^2 + b_{33}x_3^2$$

Taking into account the determined regression coefficients, the equation is written as follows:

$$Y_{R1} = 1124 + 103{,}88x_1 + 137{,}75x_2 + 66{,}88x_3 + 2x_1x_2 - 2{,}25x_1x_3 - 1{,}5x_2x_3 - 77{,}75x_1^2 - 94{,}12x_2^2 - 93{,}75x_3^2$$

It is known that if the calculated value of the criterion is smaller than the table value, then that coefficient is not significant and it is removed from the equation. In research b_{12}, b_{13}, b_{23} It turned out that the coefficient is insignificant for the studied parameters:

The equation with significant coefficients is rewritten:

$$Y_{R1} = 1124 + 103{,}88x_1 + 137{,}75x_2 + 66{,}88x_3 + 77{,}75x_1^2 + 94{,}12x_2^2 - 93{,}75x_3^2$$

The resulting Y_1 is an adequacy test of the equations for determining the significance of the regression coefficients on yarn hardness. The test is performed using Fisher's test. The estimated value of Fisher's criterion is determined. The calculated value of the factor being optimized is calculated by putting the coded values of all the columns of the Y1 equation matrix (–1, 0 and +1). Values are taken row-wise, not column-wise. The calculations for formula Y are as follows, and the calculation results are included in Table 3.

Table 3

Calculation results of values coded into the equation for adequate dispersion

№	Y_1– The hardness of the thread (N)				Y_2- According to the elongation at break (%).			
	Y_{1i}	Y_{1i}	$(Y_{1i}-Y_{R1i})$	$(Y_{1i}-Y_{R1i})^2$	Y_{2i}	Y_{2i}	$(Y_{2i}-Y_{R2i})$	$(Y_{2i}-Y_{R2i})^2$
1	1185	1194	8,8	76,7	3,8	4,89	1,09	1,19
2	921	918	-2,7	7,5	6,8	7,99	1,19	1,42
3	951	986	35,0	1225,0	7,2	7,71	0,51	0,26
4	695	711	15,5	240,3	11,5	10,8	-0,69	0,48
5	1105	1123	18,3	333,4	7,8	6,99	-0,81	0,66
6	958	990	31,5	992,3	8,2	7,37	-0,83	0,69
7	924	916	-8,5	72,3	7,6	8,01	0,41	0,17
8	768	782	13,7	188,8	11,6	12	0,39	0,15
9	1108	1141	32,8	1073,2	5,8	5,59	-0,21	0,04
10	995	1007	12,0	144,0	7,8	7,77	-0,03	0,00
11	820	865	45,3	2048,5	8,2	8,69	0,49	0,24
12	701	732	30,5	930,3	10,5	10,9	0,37	0,14

$$\sum_{u=1}^{N-N_S+1} (Y_{R1.u} - \overline{Y}_{1u})^2 = 7332{,}146$$

$$S_{nad}^2\{Y_1\} = \frac{7332{,}146}{4} = 1833{,}04$$

$$\sum_{u=1}^{N-N_S+1} (Y_{R2.u} - \overline{Y}_{2u})^2 = 5{,}428$$

$$S_{nad}^2\{Y_1\} = \frac{5{,}428}{4} = 1{,}36$$

It is known that if the calculated value of the criterion is smaller than the table value, then that coefficient is adequate and proves that the calculations were carried out correctly [5,6]

$F_{R1} = \frac{S^2_{nad}\{Y\}}{S^2\{\overline{Y}\}} = \frac{1833,04}{128,85} = 14,2$ $F_{R2} = \frac{S^2_{nad}\{Y\}}{S^2\{\overline{Y}\}} = \frac{1,36}{3,135} = 10,01$

$$F_j \left[P_D = 0,95;\ f\left\{S^2_{nad}\{Y\}\right\} = 15 - 6 - (3-1) = 5; f\{S^2_u\} = 3 - 1 = 2\right] = 4,74$$

$F_{R1} = 14,21 < 19,25 = F_j$ $F_{R2} = 10,01 < 19, = F_j$

Therefore, obtained regression mathematical models represent the researched process with sufficient accuracy.

Research results. Since the equation constructed to determine the characteristics of the output parameter for the study is three-dimensional, one of the input factors in the analysis is assumed to be Xi=0 (central state), and we construct a two-dimensional graph by transforming the models into 3 equations [7].

$$Y_{R1} = 1124 + 103,88x_1 + 137,75x_2 + 66,88x_3 + 77,75x_1^2 + 94,12x_2^2 - 93,75x_3^2$$

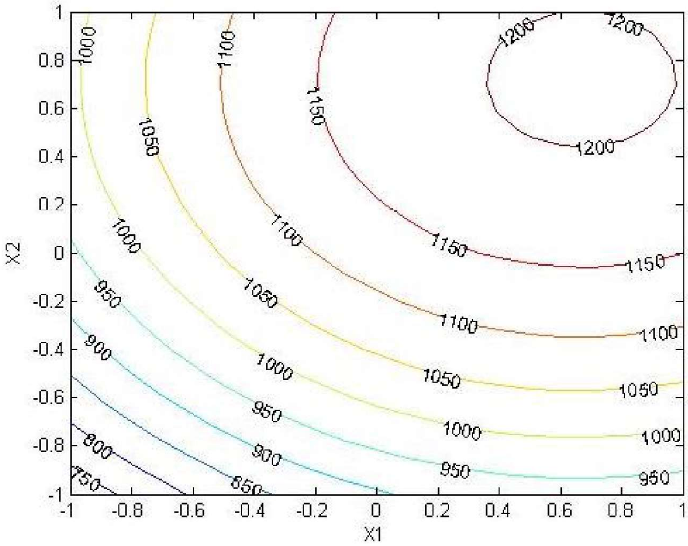

Figure 1. Graphs of the yarn tension dependence model of yarn winding speed

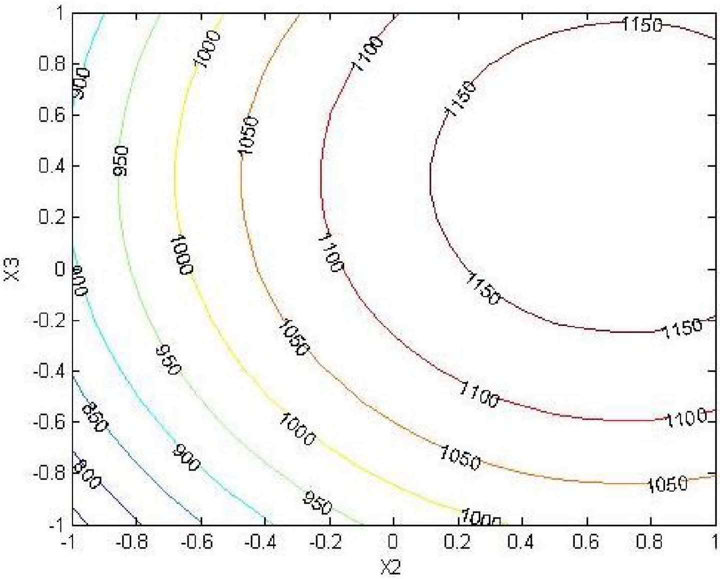

Figure 2. Graphs of the model of the dependence of the weight of the puck on the speed of winding the yarn

The graphs in Figure 1 illustrate the effect of two x_1 (yarn tension) on yarn stiffness as a function of x_2 (yarn winding speed). As in any experiment, in this study, the influence of the input factors was studied. The output parameter Y_1 values should be selected in the case of maximization.

The graphs in Fig. 2 show the effect of two other main factors x_2 (winding speed) on yarn stiffness as a function of x_3 (puck weight). In this case, the study of the effect of two factors on the output parameter was carried out using the method of small experiments, and the main values were determined through optimization.

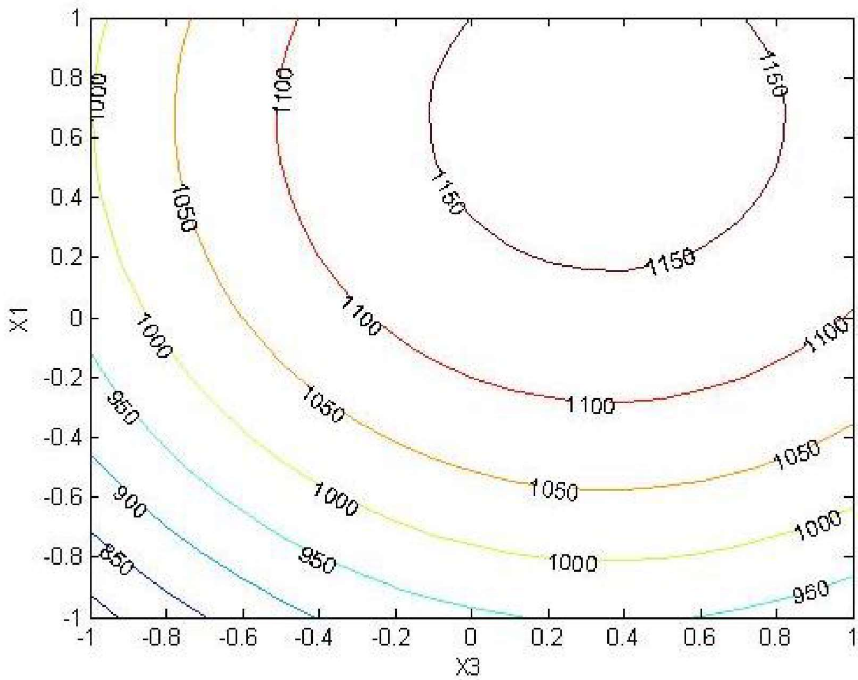

Figure 3. Graphs of the model of the dependence of the string tension on the weight of the puck

The graphs in Figure 3 illustrate the effect of x_1 (thread tension) on thread stiffness as a function of x_3 (puck weight). We determine the output parameter values for all cases.

Summary. In these studies, the deviation of the surface of the isolines obtained from the yarn tension (sN), yarn winding speed (m/min) and puck weight (grams) in the yarn adding device (analysis) is described. As can be seen from the graphs, the maximum yarn tension x_1=400 high, is achieved when the yarn winding speed is x_2=500 m/min and the tension washer weight is x_3= 20.1 grams.

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ASSESSMENT OF THE TECHNICAL CONDITION OF THE WEIGHT CHECKING WAGON TYPE 640-VPV-271

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Abstract:

Objective. When carrying out strength calculations of the metal structure of a weighing wagon, it is necessary to take the wall thickness into account, taking into account its reduction by the value of the average wear value. Thus, it is necessary to subtract the average amount of wear from the value of the size of the thickness of the sheets of elements. In this way, it will be possible to determine whether the design of the weighing wagon with existing wear will withstand the loads required by the standards.

Methods. The study was conducted using two different methods.

Visual method. By examining the analysis of the technical condition of the metal structure of the scales, the faults that could affect their service life were identified. Experimental method. To compare them with the normative values and to take them into account when conducting strength studies, the values of the magnitude of the impact on the elements of the metal structure of the scales were determined.

Results. Thus, when calculating the metal structure of a weighing car, the wall thickness be taken taking into account its decrease by the average wear value to determine whether the strength of the wagon structure complies with the required standards.

Conclusion. When carrying out strength calculations of the metal structure of a weighing wagon, it is necessary to take the wall thickness into account, taking into account its reduction by the value of the average wear value. Thus, it is necessary to subtract the average amount of wear from the value of the size of the thickness of the sheets of elements. In this way, it will be possible to determine whether the design of the weighing wagon with existing wear will withstand the loads required by the standards.

Keywords: railway, six-axle semi-wagon, freight wagon, longitudinal beam, pivot beam, end beam.

Introduction. One of the conditions for the gradual development of railway transport in the Republic of Uzbekistan is to replenish the fleet of domestic wagons with modern wagons manufactured in accordance with world standards, to extend their service life in order to optimize the operation of existing wagons [1-3].

Wagons for various purposes make up the wagon fleet, which is one of the most important parts of the rolling stock of the railway. Wagons of various types are used to transport goods and passengers.

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