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Static Recycling of Break Indicators of High Linear Density Woven Silk Yarn Used in Carpet Manufacturing

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Abstract: In this article, the static processing of the breaking indicators of high linear density woven silk yarn used in carpet production is analyzed, the relationships between the linear density of woven silk, the number of twists, the linear density of silk, the breaking strength of the yarn, and the indicators of the uniformity of the yarns are studied and the following results are obtained. . The non-linear relationship between the first (linear density) and the second (number of twists) factors is this interval of the output parameter (string breaking strength) It has been determined that it can exist between.

Key words: Carpet, silk, blown silk, tensile strength, linear density, uniformity, static, tex.

I.INTRODUCTION

Enter. Thread weaving is an independent process that provides certain useful properties, and attempts are made to create the necessary appearance, improve the processing properties of raw silk threads, increase their hardness, and create consumer properties.

As a result, a specific efficiency is achieved, the density and hardness of finished yarns increases, and uniformity in linear density is ensured. Flexibility, resistance to repeated bending and abrasion increases.

At the same time, it is necessary to increase the hardness and tensile strength of the threads during tensioning. In most cases, in order to change the properties of the threads, they are given a twist that exceeds their tension [1-2].

II. METHODOLOGY

It is known that when the analytical expression of the response function is unknown, it can usually be expressed in the form of a polynomial regression equation of the response function.

$$y = b_0 + \sum_{i=1}^{k} b_i x_i + \sum_{i=1}^{k} b_{ii} x_i^2 + \sum_{i<1}^{k} b_{ij} x_i x_j + \sum_{i<j<l}^{k} b_{ijl} x_i x_j x_l \qquad (1)$$

Here: y – the calculated value of the optimization parameter, x_i - independent input parameters that vary during the experiment, b_0, b_i, b_{ij}, b_{ijkb} - regression coefficients determined from experimental results. (1) to construct a mathematical model in the form of Eq **"y"** the optimization criterion is selected; independent variable $\mathbf{x_i}$- factor is selected; b_0, b_i, b_{ij}, b_{ijkb} regression coefficients are calculated, and the appearance of the response and plan function is determined. Small for writing the experimental plan and processing the experimental results X_1, X_2 coded values of the factors specified in letters are used X_i encoded (dimensionless magnitude) and X_i physical (natural) variables are interconnected in the following ratio. $X_i = \frac{x_i - x_{i0}}{\Delta i}$

(2)

Here: $\mathbf{\Delta i}$ – natural value variation interval; $\mathbf{X_{i0}}$ – natural value of zero level, $X_{i0} = \frac{x_н - x_в}{2}$, $\mathbf{x_н}$, $\mathbf{x_b}$ – The natural value of the lower and upper levels of the factor.

Encoding the factors is equivalent to moving the coordinate origin to the point of the main factor level of the factors (the central point O of the experiment) and changing the scale.

All encoded factors are dimensionless and normalized quantities. During the experiment, they take the values -1, 0, +1.

These values are called the level of factors. (1) coefficients in the estimated polynomial independent variables indicate the degree of influence of the factors. If the coefficient is positive, the output factor increases with the increase of the factor, and when the coefficient increases with a negative factor, its magnitude decreases [3-4-5].

A fully factorial experiment is one in which all possible combinations (sets) of factor levels are realized. If "k" factors vary in two levels, all possible sets are $N^2=2^k$. If "k" factors change to three levels, then $N3=3^k$.

We construct a regression equation for fractions. Initially two levels ($k = 2$),Let's design a three-factor experiment, where the first factor X_1 linear density of woven yarns, second X_2 - number of twists of woven silk threads, singleness coefficient of woven silk threads X_3 coded, are two parallel experiments that determine the tensile strength and elongation to break of spun silk threads. In the research work, the breaking parameters of woven yarns obtained from 40.0 x 6 texels of high linear density raw silk for carpets were statically processed (Table 1).

In the first experiment ($p = 1$)The effect of the number of twists on the breaking strength of silk yarn Table -1

Factors	x_{max}	x_{min}	Δ	x_0
	Experiment 1	Experiment 1	Experiment 1	Experiment 1
Linear density of woven silk, (tex)	216	214	215	1
Number of turns, *N/t*	350	364	357	7
Singleness of threads	16,98	15,79	16,38	0,50
The tensile strength of the woven thread, *cN*	5896,76	5806,53	5851,64	45,12

In the first experiment ($p=2$)Effect of spun silk uniformity on yarn breaking strength

Table - 2

Factors	x_{max}	x_{min}	Δ	x_0
	Experiment 2	Experiment 2	Experiment 2	Experiment 2
Linear density of woven silk, (tex)	216	216	216	0
Number of turns, *N/t*	350	339	344,5	5,5
Singleness of threads	17,62	17,0	17,31	0,31
Breaking strength of the wound thread, *cN*	5814,03	5786,97	5800,05	48,06

Processing matrix of experimental results Table - 3

Range of factors				Breaking strength y_{ij}					
				Deviation					
№	X_1	X_2	X_3	y_{i1}	y_{i2}	y_u	S_u^2	y_{1U}	$\|R_u\|(\%)$
1	-	-	-	5600	5600	5600	0	5600.0	0
2	+	-	-	5897	5897	5897	0	5886.5	0.18
3	-	+	-	5700	5721	5710,5	220.5	5765.5	0.96
4	+	+	-	5864	5898	5881	578	5874.0	0.12
5	-	-	+	5600	5600	5600	0	5600.0	0
6	+	-	+	5897	5855	5876	882	5886.5	0.18
7	-	+	+	5800	5841	5820,5	840.5	5785.5	0.94
8	+	+	+	5900	5834	5867	2178	5814.0	0.12

Using the program for statistical processing of experimental results, we calculate on electronic calculators in the following order:

III. RESULTS AND DISCUSSION

1) Parallel experiments, their same m characterizing the spread of their results in number S_u^2 characterizing the spread of their results in number characterizing the spread of their results in

numbers $S_u^2 = \dfrac{\sum_{p=1}^{2}(\bar{y}_{up}-\bar{y}_u)^2}{m-1}$ (3)

In this: u - option serial number ($u=1.2..N$), $p=1.2.3..m$ - serial number of parallel experiments, m - number of experiments per parallel, $\bar{y}_u = \dfrac{1}{m}\sum_{p=1}^{m}\bar{y}_{up}$ - average of parallel experiments. Results S_u^2 we enter the values into the table and calculate these statistics

$$G = \frac{S^2_{u(\max)}}{\sum_{u=1}^{N} S_u^2} \quad (4)$$

Here: $S^2_{u(\max)}$ - maximum value of variance in parallel experiments (3) We calculate the value according to the formula

$S_u^2 = (\bar{y}_{u1} - \bar{y}_u)^2 + (\bar{y}_{u2} - \bar{y}_u)^2$, $(u = 1,2,3,4,5,6,7,8)$,

$S1 := 0.$ $S2 := 0.$ $S3 := 220.5000000$ $S4 := 578.$ $S5 := 0.$ $S6 := 882.$ $S7 := 840.5000000$
$S8 := 2178.$

S_u we put the values of s in 8 columns

We accept $S_{u\max} = S_8^2 = 2178$, $\sum_{u=1}^{8} S_u^2 = 4699$ and (2) calculating statistics

$$G = \frac{S^2_{u(\max)}}{\sum_{u=1}^{N} S_u^2} = .4635028730$$

2) We check the Koxren criteria,, G_{α,k_1,k_2} - values are taken from tabular data, α - significant level $(0 < \alpha < 1)$, $k_1 = N$, $k_2 = m-1$- number of degrees of freedom, as we look $\alpha = 0.05$, $m = 3$, $N = 8$, $G_{\alpha,k_1,k_2} = G_{0.05,8,3} = 0.52$, $G = .$ $.4635028730$

Observed inequality in sheep

$$G < G_{\alpha,k_1,k_2} \qquad (5)$$

because of this, the Koxren criterion is appropriate and ensures that the variances are in the same category. All are in one category of dispersion m since the parallel experiment is performed in all variants, it is possible to use this average value of the variance in the calculations. $S_y^2 = \frac{1}{N}\sum_{u=1}^{N} S_u^2 =$ 587.3750000
(6)

Then (4) is used to evaluate the adequacy of the variance model.

If the inequality (3) is not obeyed, then the variance of the options is one-class and they are not averaged, and the following actions should be taken: a) determine the maximum variance of the measurement data in the option; b) increase the number of m experiments in each option; c) perform more accurate measurement of output parameters.

3) We calculate the regression coefficients with the following formula.

$$b_0 = \frac{1}{N}\sum_{u=1}^{N}\bar{y}_u\ ,\ b_i = \frac{1}{N}\sum_{u=1}^{N}X_{iu}\bar{y}_u\ ,\ b_{ij} = \frac{1}{N}\sum_{u=1}^{N}X_{iu}X_{ju}\bar{y}_u\ ,\ b_{ijk} = \frac{1}{N}\sum_{u=1}^{N}X_{iu}X_{ju}X_{ku}\bar{y}_u \quad (7)$$

Коэффициентлар аниқлангандан сўнг кодлашган ўзгарувчан регрессия тенгламасини ёзамиз. $\hat{y} = b_0 + \sum_{i=1}^{k} b_i x_i + \sum_{i<1}^{k} b_{ij} X_i X_j + \sum_{i<j<l}^{k} b_{ijl} X_i X_j X_l$

Using formulas (5), we calculate the coefficients and get the regression
$b0 := 5781.500000$ $b1 := 98.7500000$ $b2 := 38.2500000$ $b3 := 9.3750000$
equation
$b12 := -44.5000000$ $b13 := -18.1250000$ $b23 := 14.6250000$ $b123 := -12.8750000$

$$y := 5781.500000 + 98.7500000\,X1 + 38.2500000\,X2 + 9.3750000\,X3 - 44.5000000\,X1\,X2 - 18.1250000\,X1\,X3 + 14.6250000\,X2\,X3 - 12.8750000\,X1\,X2\,X3 \quad (6)$$

We check the significance of the regression coefficients from the Student's criterion. Initially in the same confidence interval Δb All regression coefficients are the following formula

$$\Delta b = t_{\alpha,k}\frac{S_y}{\sqrt{N}} \quad (8)$$

$t_{\alpha,k}$ - Student criteria, α - level of importance, $k = N(m-1)$ - number of degrees of freedom. If the regression coefficient is above the confidence interval, then the coefficients are significant. $|b_0| \geq \Delta b, |b_i| \geq \Delta b, |b_{ij}| \geq \Delta b, |b_{ijk}| \geq \Delta b$ (8)

The appendix is from the table and from (4). $t_{0.05,16} = 2.16$ we define and (4) we calculate (7) using the formula $\Delta b = t_{\alpha,k}\frac{S_y}{\sqrt{N}} = 2.16\frac{\sqrt{587.375.}}{\sqrt{8}} = 18.50829813$

According to inequalities (8) above in regression equation (6)., b_3 , b_{13} , b_{23} and b_{123} coefficients are considered insignificant, we write the regression equation without these coefficients $y1 := 5781.500000 + 98.7500000\,X1 + 38.2500000\,X2 - 44.5000000\,X1\,X2$

5. We evaluate the adequacy of the model, when insignificant coefficients are not involved in the regression equation.

If the regression equation is taken in the form (6), then the variance of the experiments is zero. In this case, all $N=2^k$ regression coefficients are estimated with y values on N, in which case there are no degrees of freedom to test the adequacy of the model. In this case, the adequacy condition is fully controlled and the experimental plan is called complete. If some non-significant coefficients are omitted in the regression equation (6), degrees of freedom are generated, and the adequacy of the model (9) should be checked. Adequacy check experimental values of output parameter, $\hat{y}$ It consists in comparing the input parameters with their calculated values of different levels and determining their difference in percentage according to the formula [6].

$$R_i = 100\left|\frac{\hat{y}_i - y_i}{y_i}\right| \quad (9)$$

Usually the error does not exceed 5%. According to the formula (9), the results of the calculation are as follows $R1 := 0.$ $R2 := -.1780566390$ $R3 := .9631380790$ $R4 := -.1190273763$

$R5 := 0.$ $R6 := .1786929884$ $R7 := -.9449360021$ $R8 := .1193114028$

(9) based on the calculation results in the formula $R_i(\max) < 5\%$ because it is $\hat{y}$ is accepted $\hat{y}_i$ R_i we show the values of in columns 9 and 10 of Table 2

6. Determining whether linear regression according to Fisher's criterion is appropriate $y2 := 5781.500000 + 98.7500000\,X1 + 38.2500000\,X2 + 9.3750000\,X3$ we use Fisher's criterion to evaluate the adequacy of the model

To check the adequacy, we find the variance of the residual by the formula $S_{oc}^2 = \frac{\sum_{u=1}^{8}(\tilde{y}_u - y_u)^2}{N-k-1} = 5552.625$

here: $\tilde{y}_u$ - N The calculated value for the linear regression indicator in the variant, y_u - the actual value of the indicator,N - number of options, k- number of factors. Let's see the statistics $F = \frac{S_{oc}^2}{S_y^2} = 9.453287934$

According to Fisher's criterion F_{α,k_1,k_2} , the value g from the table (here

α - important satchi, look $k_1 = N-k-1 = 4, k_2 = N(m-1) = 16$), we find, This inequality $F < F_{\alpha,k_1,k_2}$ if fulfilled, the adequacy hypothesis is fulfilled. $F_{\alpha,k_1,k_2} = 3.01$ from $F > F_{\alpha,k_1,k_2}$ Fisher's criterion for linearity is not fulfilled due to the fact that linear regression is not appropriate Geometric representations of regression relationships and their analysis.

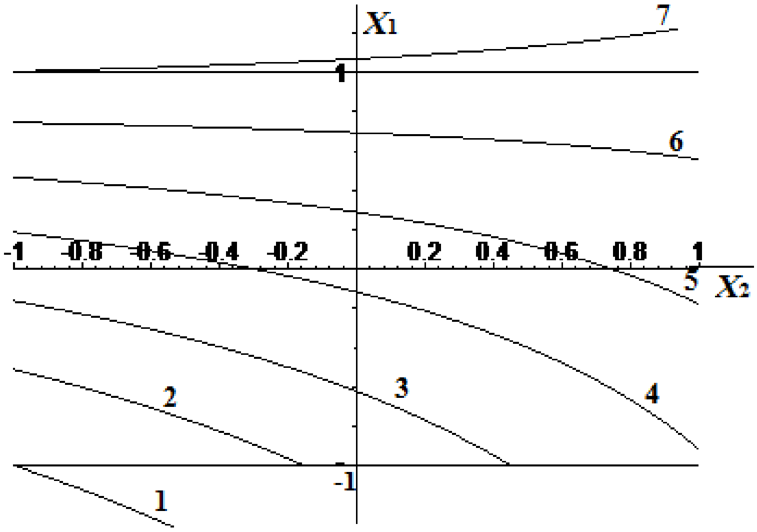
The regression equation

$$y1 := 5781.500000 + 98.7500000\,X1 + 38.2500000\,X2 - 44.5000000\,X1\,X2$$

X_1 and X_2 determines the non-linear connection between

Output parameter (relative tensile strength of the thread) at different values of (3.12) equality X_1 we solve with respect to

$X_1 = (y_0 - 5781.5 - 38.25X_2)/(98.75 - 44.50X_2)$.



1- Fig. Thread breaking strength y_0(cH) Graphs of the non-linear relationship between the number of turns (bur/meter) and the linear density (tex) at different values of: $1 - y_0 = 5600$, $2 - y_0 = 5670$, $3 - y_0 = 5720$, $4 - y_0 = 5770$, $5 - y_0 = 5810$, $6 - y_0 = 5850$, $5 - y_0 = 5887$,

1- Fig. (12) graphs for different values of the output parameter of the connection (the relative break of the thread) are presented

IV.CONCLUSION

The following conclusions can be drawn from the analysis of the graphs. The non-linear relationship between the first (linear density) and the second (number of twists) factors is this interval of the output parameter (string breaking strength) $5600\,(cH) < y_0 < 5887$ indicates that it may exist between In addition, if the breaking strength of the yarn is given (the second factor), the value of the linear density (the first factor) for each turn should be calculated using the obtained graphs. For example, the breaking strength of a thread $y_0 = 5810\,(cH)$ let it be If the number of turns in the coding $X_2 = 0.4$ if is the value of linear density in encoding $X_1 = 0.163$ to be chosen. Breaking strength $y_0 = 5720\,(cH)$ the linear density at the same number of turns $X_1 = -0.948$ should be equal to (in coding).

REFERENCES

1. N.M.Islambekova, U.N. Azamatov, J.A.Akhmedov, S.S.Khaydarov, G.A.Yusupkhodjayeva, N.Muxiddinov “Investigation of unwinding speed based on the process of separating the thread from the surface of the cocoons” International journal of advanced research in science engineering and technology Vol.6. Issue 5, May 2019 y. 9136-9141 b.
2. S.S. Khaydarov, N. M. Islambekova, N.M.Muxiddinov, N.F.Rasulova (2020). Increasing the yield of raw silk based on the study of reducing the anisotropy of the cocoon shell. The American Journal of Engineering and Technology, 2(09), 91-97.
3. https://cyberleninka.ru/article/n/dizayn-i-sovremennye-tehnologii-proizvodstva-kovrov-i-kovrovyh-pokrytiy-s-ispolzovaniem-polimernyh-volokon
4. В.П.Щербаков. Прикладная и структурная механика волкнистых материалов. «ТИСО ПРИНТ» Москва-2013. 306 с.
5. П.Шоҳайдарова, Ш.Шозиётов, Ж.Зоиров. Назарий механика. Тошкент “Ўқитувчи нашриёти” 2-нашри, 1991 й. 408 б.
6. T.M Mavlanov., G.B Abdieva., M Abduvaxidov. Ip va to’qimalar mexanikasi. “O’quv qo’llanma” Toshkent-2011. 150 b.
7. S. K. Gupta, A. Majumdar and K. K. Goswami, Compressional Behavior of Persian Hand Knotted Wool Carpets using Response Surface Methodology, Indian Journal of Fibre & Textile Research, 2017, Vol. 42, 399-406.