But in concordance with the chart 1 $t_1/\tau = U_{d(t_1)}/U_{d(\tau)}$, where U_d is the half-period average voltage. Thus, $I_{кр}/I_t = U_{d(t)}/U_{d(\tau)}$, from which $I_{кр} \cdot U_{d(\tau)} = I_t \cdot U_{d(t)} = const$ at any t < τ.

So, in the field $I_{кр} < I < I_{раб.\min}$ the supplementary power supply has got a hyperbolical voltage regulation characteristic with load constant power: $P_d = U_d \cdot I_d = const$, that is ideally suited for the electric arc in the air.

At $I > I_{раб.\min}$ the supplementary supply is locked as its voltage is lower than that of the main source, and, finally, at $I = I_{\max}$ the voltage of both sources verges towards the null tight under the influence of the current feedback within the system of the invert circuit control.

From the quoted diagrams one can see that in the field of operating load currents (welding) the supplementary source, i.e. diode bridge, is locked. At the same time relatively high open circuit and small current voltage provides an easy "ignition" and the arc maintenance at small currents.

In the known secondary power sources the secondary winding voltage of the matching transformer, as it is shown above, ≈ 100 V.

In the offered device voltage is lowered up to 35 V, it means that at the load current equal to those of the specified devices, the voltage excursion in the invert circuit transistors will be 100/35 ≈ 2,85 times as little, that is rather vital as the power transistors or solid-state compound modules, first, make up an essential part of the total cost of the device; second, the reduction in current reduces losses. Notice, that the losses in the secondary power source are ignorable as it is switched on only for short time. Thus, the offered device doesn't trail the known one in the sense of generality, and, at the same time, possesses essential advantages in the mode of welding in the air: the 2 invert circuit current of the transistors is lowered almost three-fold compared to the current (voltage excursion) in the known devices, and the conditions of the electric arc "ignition" are even somehow improved as the electrode contact with a weldment is attended by a forced energy discharge accumulated in the filter capacitor.

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EFFICIENCY OF MODELING NUMERICAL METHODS USE FOR ANALYSIS OF TEXTILE EQUIPMENT WORK INTENSITY

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In recent time in connection with stiff competition of textiles at fresh stock fabrics manufacturing in domestic market of Russia the problems of accelerated development of production cycles and performing express-monitoring of textile equipment work intensity for providing optimum performance of its work and obtaining high quality fabrics have become ones of the current interest.

The work intensity valuation of textile equipment is carried out with the help of special means of measurement using tensometry method. The advanced native weaving machinery work intensity measuring device is express-diagnostic tools of various modifications.

The thread tension is known to be the main parameter characterizing the tools' and machines' work intensity. In textile production activity threads are affected by stretching forces and frictional ones taking place between the thread and guiding devices of the machines and tools. If the parameters are preset rationally the deterioration of physical and mechanical properties of the thread doesn't occur. Only insignificant decrease of thread linear density on account of trash removal and thread elongation decrease as the result of their extension because of axial forces action are observed. Thus, the production cycle should be organized in such a way that yarn and plies were subject to different on direction and scale tensile loads as less as possible.

In this investigation for valuation of work intensity of weaving machinery the express diagnostic tool of the firm "Metrotex", into which a stretch tester designed for running thread stretch measuring and applied for the diagnostics, processing equipment setup, stretch values nominal deviations elimination is included, is used. The result of thread tension measuring with the help of this installation is an experimental diagram of thread tension dependence on time.

For the weaving machinery work intensity valuation and the subsequent analysis of the process it is necessary to modify the experimental diagram into a mathematical model. The advanced methods for the equipment potential stress valuation and obtaining mathematical models are numerical methods of modeling. These methods were not in use earlier in connection with a large amount and computational complexity. Nowadays, in the context of powerful and effective software support appearing, the application of the specified methods, which allow achieving the result visually and quickly, became possible. At the orientation on the new process variables it will allow estimating the subsequent change of the equipment work intensity effectively.

For getting mathematical relations the numerical methods of modeling over interpolation polynomials of Stirling, Lagrange, Newton, Bessel and Chebyshev were used in this work. The subject matter of these methods lies in the substitution of one function, which most often is known only empirically, with another one of a more simple form. In this case the opportunity of substitution of the experimental diagram or oscillogram, describing the dynamics of thread tension change through time, by mathematical models was considered.

Obtaining mathematical models with the help of the above mentioned methods is associated with a great amount of calculations and it is practically impossible without using a computer. That is why, algorithms of computerized analysis of mathematical models, describing the dependence of thread tension on time in different processes of weaving production, were developed for these methods' effective using. The realization of the developed algorithms was performed on the basis of Mathcad program.

The efficiency estimation of the obtained mathematical models was carried out in the tabular processor Excel by means of computation of relative quadratic standard error for all argument values.

In table 1 the results of efficiency estimation of the obtained mathematical models are quoted.

Note – the most accurate values are underlined and marked.

The analysis of the table 1 data allows making the following conclusions:

1. At weaving production activities it is preferable to use the considered in this paper numerical modeling methods as they allow obtaining the mathematical models which reflect the real process with a high enough accuracy ($\delta < 10\%$);

Table 1. Relative quadratic standard error indexes δ (%) for different weaving production activities.

Activity	Stirling polynomial	Newton polynomial	Lagrange polynomial	Bessel polynomial	Chebyshev polynomial
Reeling	1,45	**0,87**	1,45	2,41	11,03
Warping	**6,58**	**6,58**	6,59	7,45	7,53
Dressing	**7,10**	**7,10**	**7,10**	7,60	14,27
Weaving	2,76	**2,37**	**2,37**	4,82	37,22

2. The most effective method for mathematical modeling of 25 tex linear density cotton yarn reeling process on reeling machine M-150-2 is the method with use of Newton polynomial, the relative quadratic standard error at the interpolation step h=2 makes δ = 0,87 %;

$$P(x) := 0.5 - 0.0815 u + 0.51 \cdot u^2 - 0.4 \cdot u^3 + 0.15 u^4 - 0.0215 u^5 - 0.000555 u^6 + 0.000393 u^7 - 0.0000246 u^8$$

3. The most effective method for mathematical modeling of 35,7 tex linear density cotton yarn warping process on warping machine СП-180 is the method with use of Stirling and Newton polynomials, the relative quadratic standard error at the interpolation step h=2 makes δ = 6,58 %;

The mathematical model obtained with use of Stirling polynomial:

$$P(x) := 10.3 + 35.99 u - 92.5 u^2 + 90.72 u^3 - 44.45 u^4 + 11.99 u^5 - 1.81 \cdot u^6 + 0.14 u^7 - 0.00456 u^8$$

The mathematical model obtained with use of Newton polynomial:

$$P(x) := 10.3 + 35.99 u - 92.5 u^2 + 90.72 u^3 - 44.45 u^4 + 11.99 u^5 - 1.81 \cdot u^6 + 0.14 u^7 - 0.00456 u^8$$

4. The most effective method for mathematical modeling of 18,5 tex linear density cotton yarn dressing process on slashing machine ШБ-11/180 is the method with use of Stirling, Newton and Lagrange polynomials, the relative quadratic standard error at the interpolation step h=4 makes δ = 7,10 %;

The mathematical model obtained with use of Stirling polynomial:

$$P(x) := \mathbf{8 - 0.18 \cdot u - 3.53 \cdot u^2 + 0.11 \cdot u^3 + 0.72 \cdot u^4}$$

The mathematical model obtained with use of Newton polynomial:

$$P(x) := 4.88 - 7.81 \cdot u + 13.13 u^2 - 5.67 \cdot u^3 + 0.72 u^4$$

The mathematical model obtained with use of Lagrange polynomial:

$$P(x) := 4.88 - 1.95 x + 0.82 x^2 - 0.0886 x^3 + 0.00282 x^4$$

5. The most effective method for mathematical modeling while manufacturing sheeting cotton fabric art. 262 on textile machine СТБ-2-216 is the method with use of Newton and Lagrange polynomials, the relative quadratic standard error at the interpolation step h=40 degrees (the shaft angular deflection of the machine tool station) makes δ = 2,37 %.

The mathematical model obtained with use of Newton polynomial:

$$P(x) := 0.25 - 2.32 u - 0.019 u^7 + 0.001 u^8 - 0.95 u^5 + 3.13 u^4 - 6.03 u^3 + 6.12 u^2 + 0.17 u^6 - 0.000027 u^9$$

The mathematical model obtained with use of Lagrange polynomial:

$$P(x) := 0.25 - 5.79 \cdot 10^{-2} \cdot x + 3.83 \cdot 10^{-3} \cdot x^2 - 9.41 \cdot 10^{-5} \cdot x^3 + 1.22 \cdot 10^{-6} \cdot x^4 - 9.24 \cdot 10^{-9} \cdot x^5 \ldots$$
$$+ 4.21 \cdot 10^{-11} \cdot x^6 - 1.14 \cdot 10^{-13} \cdot x^7 + 1.67 \cdot 10^{-16} \cdot x^8 - 1.03 \cdot 10^{-19} \cdot x^9$$

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