tensile strength along weft. The artificial leather №1 and natural leather № 1 are not correspond values of the property "tensile strength" along warp. The coefficient of non-uniformity in elongation characterizes the anisotropy of the material. Artificial leather №1 and №2 has fine anisotrophic properties as natural leather. As a result of the analysis we can conclude that artificial leather does not have sufficient physical and mechanical properties. The use of artificial leather in footwear manufacture does not allow to create high-quality footwear.

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TECHNOLOGY FOR PRODUCING LATEX BRAIDED THREADS

ТЕХНОЛОГИЯ ПОЛУЧЕНИЯ ЛАТЕКСНЫХ ОПЛЕТЕННЫХ НИТЕЙ

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Key words: *thread, technology, equipment, formula, tension.*
Ключевые слова: нить, технология, оборудование, формула, натяжение.

Abstract. The offered technology and the created equipment allow to form latex braided threads of a wide range of linear densities. The optimization of the technological process and an analytical description of the main stages of the technology make it possible to obtain the required values of design and technological parameters. The work is implemented and used in real production conditions. Latex *braided threads obtained by the proposed technology implement the import substitution program for the Republic of Belarus.*

Аннотация. Предлагаемая технология и созданное оборудование позволяют сформировать латексные оплетенные нити широкого диапазона линейных плотностей. Оптимизация технологического процесса и аналитическое описание основных этапов технологии позволяет получить требуемые значения конструктивных и технологических параметров. Работа внедрена и используется в реальных производственных условиях. Латексные оплетенные нити, полученные по предлагаемой технологии, реализуют для Республики Беларусь программу импортозамещения.

The authors developed, created and use in production conditions a machine for the production of latex braided yarns. The ORM-1 machine was used as the base machine. The modernization consisted in changing the design of spindles, brake and spreading devices, installing a mechanism for feeding the latex tape into the working zone of the spindles.

It is known that the covering component on the hollow spindle moves to the point of contact with the core component in a spiral with variable pitch. For each mass unit of the thread the following forces act: centrifugal, aerodynamic, gravity, Cariolis. Having considered the movement of the thread element in Cartesian and polar coordinate systems and having carried out the corresponding mathematical transformations, formulas were obtained that make it possible to determine the thread tension at different sections of the thread-forming machine.

It is known that when moving to the point of contact with the core thread, the covering component of length dl and mass dm moves in a spiral with variable pitch. This motion can be represented as the sum of two motions: a spiral motion in the XOY plane perpendicular to the spindle axis and translational along the Z axis, aligned with the axis of the spindle. To move the thread element in the XOY plane, you can use the formula:

$$\rho = \frac{A}{\varphi + \varphi_0}. \qquad (1)$$

Here ρ is the current radius of the filament element with mass dm in the XOY plane, φ - is the rotation angle at time t for uniform rotation with constant angular velocity, φ_0 - is the initial rotation angle, and A is a constant determined from the initial conditions.

At t=0, ρ=R, φ=0, that is, the element of the covering component moves as it rotates by an angle φ_0. Therefore:

$$\varphi_0 = \frac{A}{R}; A = L = \varphi_0 R; \varphi = \omega t. \qquad (2)$$

Finally, the function describing the movement of the thread element:

$$\rho = \frac{LR}{R\omega t + L}. \qquad (3)$$

We superimpose the coordinates of the element with mass dm in the XOY plane (Fig. 1).

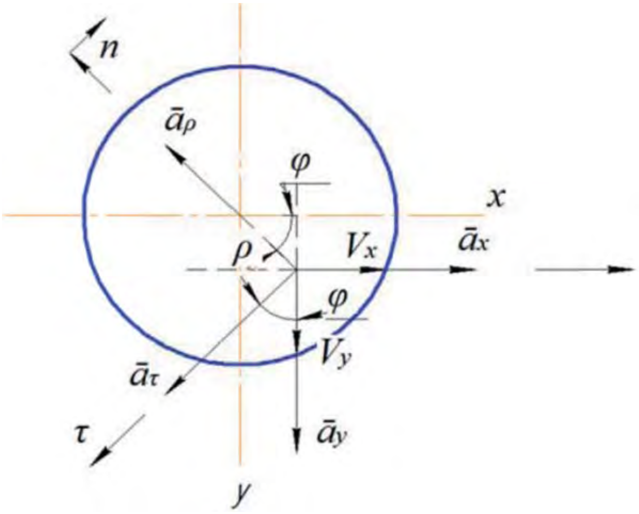

Figure 1 – The calculation scheme

$$x = \rho\cos\varphi = \frac{LR}{R\omega t + L}\cos\omega t, \tag{4}$$

$$y = \rho\sin\varphi = \frac{LR}{R\omega t + L}\sin\omega t. \tag{5}$$

The projections of the element's velocity vector on the X and Y axes:

$$V_x = \dot{x} = -\frac{LR^2\omega}{(R\omega t + L)^2}\cos\omega t - \frac{LR\omega}{R\omega t + L}\sin\omega t, \tag{6}$$

$$V_y = \dot{y} = -\frac{LR^2\omega}{(R\omega t + L)^2}\sin\omega t + \frac{LR\omega}{R\omega t + L}\cos\omega t. \tag{7}$$

The velocity vector of the thread element is decomposed into three components in two ways:

$$\overline{V}_a = \overline{V}_x + \overline{V}_y + \overline{V}_z, \tag{8}$$

$$\overline{V}_a = \overline{V}_\rho + \overline{V}_\tau + \overline{V}_z. \tag{9}$$

Here $\overline{V}_\rho$ and $\overline{V}_\tau$ are the projections of the velocity vector $\overline{V}_a$ on the directions of the radius ρ and the tangent τ of the trajectory of motion in the XOY plane, $\overline{V}_z$- is the projection of the velocity vector $\overline{V}$ on the Z axis, $\overline{V}_x$ and $\overline{V}_y$ are the projections of the velocity vector $\overline{V}_a$ on the X and Y axes, respectively.

On the other hand:

$$V_x = -V_\rho\cos\omega t - V_\tau\sin\omega t, \tag{10}$$

$$V_y = V_\tau\cos\omega t - V_\rho\sin\omega t. \tag{11}$$

Since V_x and V_y represent the decomposition of the same vector V on the X and Y axes, comparing the coefficients for the corresponding trigonometric functions, we obtain:

$$V_\rho = \frac{LR^2\omega}{(R\omega t + L)^2}, \tag{12}$$

$$V_\tau = \frac{LR\omega}{R\omega t + L}. \qquad (13)$$

The projection of the velocity vector V onto the Z axis:

$$V_z = \sqrt{V^2 - V_x^2 - V_y^2} = \sqrt{V^2 - V_\rho^2 - V_\tau^2}, \qquad (14)$$

$$V_z = \sqrt{V^2 - \left(\frac{RL\omega}{R\omega t + L}\right)^2 \cdot \left[1 + \left(\frac{R}{R\omega t + L}\right)^2\right]}. \qquad (15)$$

Here V - is the absolute speed of the thread element, that is, the speed at which the formed thread is withdrawn from the working area.

The acceleration vector $\overline{a}$ of the thread element decomposes into components in two ways:

$$\overline{a} = \overline{a}_x + \overline{a}_y + \overline{a}_z, \qquad (16)$$

$$\overline{a} = \overline{a}_\rho + \overline{a}_\tau + \overline{a}_z. \qquad (17)$$

Here a_ρ and a_τ are the projections of the acceleration to the radius and the tangent of the trajectory of the motion, a_z is the projection of the acceleration to the Z-axis, a_x and a_y are the projections of the acceleration on the X and Y axes, respectively.

$$a_x = \dot{V}_x = \frac{R^2L\omega^2}{(R\omega t + L)^2}\sin\omega t - \frac{RL\omega^2}{R\omega t + L}\cos\omega t + 2\frac{R^3L\omega^2}{(R\omega t + L)^3}\cos\omega t + \frac{R^2L\omega^2}{(R\omega t + L)^2}\sin\omega t, \qquad (18)$$

$$a_y = \dot{V}_y = -\frac{R^2L\omega^2}{(R\omega t + L)^2}\cos\omega t - \frac{RL\omega^2}{R\omega t + L}\sin\omega t + 2\frac{R^3L\omega^2}{(R\omega t + L)^3}\sin\omega t - \frac{R^2L\omega^2}{(R\omega t + L)^2}\cos\omega t. \qquad (19)$$

Here we have the following relation:

$$a_x = -a_\tau \sin\omega t - a_\rho \cos\omega t, \qquad (20)$$

$$a_y = a_\tau \cos\omega t - a_\rho \sin\omega t. \qquad (21)$$

Comparing (18), (19), (20), and (21) we obtain:

$$a_\tau = -2\frac{R^2L\omega^2}{(R\omega t + L)^2}, \qquad (22)$$

$$a_\rho = \frac{RL\omega^2}{R\omega t + L} \cdot \left[1 + 2\frac{R^2}{(R\omega t + L)^2}\right], \qquad (23)$$

$$a_z = \dot{V}_z = \frac{R^3L^2\omega^2}{(R\omega t + L)^3} \cdot \frac{1 + 2\frac{R^2}{(R\omega t + L)^2}}{\sqrt{V^2 - \left(\frac{RL\omega}{R\omega t + L}\right)^2 \cdot \left[1 + \left(\frac{R}{R\omega t + L}\right)^2\right]}}. \qquad (24)$$

From the known acceleration parameters, we find the projections of the force acting on the filament element dm. From the formulas (18) - (24) after the necessary transformations we obtain:

$$\Delta F_\tau = -2dm\frac{R^2L\omega^2}{(R\omega t + L)^2} = -2dm\frac{\omega^2}{L} \cdot \rho^2. \qquad (25)$$

The obtained value of the yarn tension increment allows us to conclude that for fixed parameters ω, L, dm the increment of tension is proportional to the square of the radius.

With the development of the technology the optimization of the technological process was carried out. Criteria for optimization are the breaking in the process of formation and the filling of the core by the pile component. It has been experimentally established that the most influential parameters on the breaking are the velocities of the core and covering components fed into the formation zone, as well as the linear density of the core component.

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HYDROCARBON POLLUTION OF THE RIVERS OF THE INDUSTRIAL CENTERS IN VITEBSK REGION

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Key words: *environmental risk, industry, petroleum products, pollution, water object.*

Abstract. The greatest amount of environmental pollution comes from industrial enterprises. Pollutants are transferred at large distances falling into watercourses in different ways. This can cause contamination of adjacent territories. The Vitebsk region is a developed industrial region, which contains many organizations or production units, where used oil and oil products. There is always the risk of accidents and emergencies at industrial complex, including the risk of pollutant transfer into water bodies. A study of the state of the region's water bodies under these conditions is very relevant.

The aim of the work is an analytical assessment of watercourses flowing through the largest industrial centers of the Vitebsk region, from the position of ecological risk of pollution of water areas with oil products.

The State Water Cadastre materials were used for the work, including summary data on water resources and their quality in previous years. We used a statistical and contrastive-comparative method of investigation.

The result of statistical analysis of the data set [1]:

– Value of runoff highly variable. From year to year the amount of precipitation varies, because of the specific circulation. All this is reflected in the river runoff, the same dynamics which can be seen in the basins of the Western Dvina and the Dnieper rivers. Since 2013 a sharp decrease in river flow has been noticed, which is favorable from the point of view of ecological risk of water pollution, because with the reduction of volume of melted snow and rain water fills the river, which is surface runoff, and decreases the probability of falling pollutants from industrial areas and industrial facilities into the waters.