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ALGORITHM FOR CALCULATING THE STRESS CONDITION OF THE CONVEYOR TAPE WITH ITS LONGITUDINAL DAMAGE

АЛГОРИТМ РОЗРАХУНКУ НАПРУЖЕНОГО СТАНУ ТРАНСПОРТНОЇ СТРІЧКИ З ПОЗДОВЖНІМ ПОШКОДЖЕННЯМ

Modern mechanical engineering uses fiber composite materials, particularly rubber-strip ropes, and tapes. Fiber composites are used in the elements of machines loaded with tensile forces directed along the fibers. The destruction of one of the components of the conveyor tape as a composite affects its stress state, respectively, the efficiency and reliability of the machine. The definition of such influence is a relevant scientific and technical problem. The article aims to study the influence and development of an algorithm for analytical calculation of the stress-deformed state of a single-layer fiber composite material in the case of longitudinal violation of the continuity of its elastic component (matrix). In the work, the model of the interaction of cables connected by flexible material in the longitudinal violation of the elastic matrix between two arbitrary reinforcement elements was constructed and solved using the mechanics of layered composite materials.

***Keywords**: conveyor tape, fiber composite material, stress-deformed condition, matrix integrity violation, calculation.*

Сучасне машинобудування використовує волоконні композитні матеріали, зокрема, гумотросові канати та стрічки. Волоконні композити використовують в елементах машин що навантажені силами розтягу спрямованими вздовж волокон. Руйнування однієї зі складових конвеєрної стрічки як композиту впливає на її напружений стан, відповідно на ефективність та надійність використання машини. Визначення такого впливу актуальна науково-технічна *задача. Метою статті є дослідження впливу та розробка алгоритму аналітичного розрахунку напружено-деформованого стану одношарового волоконного композитного матеріалу у разі поздовжнього, порушення суцільності його еластичної складової (матриці). В роботі, з використанням методів механіки шаруватих композитних матеріалів, побудова та розв'язана модель взаємодії тросів з'єднаних еластичним матеріалом у разі поздовжнього порушення еластичної матриці поміж двома довільними суміжними елементами армування.*

Робота спрямована на розробку алгоритму визначення напружено-деформованого стану виробу з композитного волоконного матеріалу з довільно розподіленими навантаженнями її кінців та з поздовжнім руйнуванням еластичної матриці.

Встановлено що локальне порушення неперервності еластичної матриці одношарового волоконного композиту типу гумотросова стрічка впливає на його напружено-деформований стан як на ділянці з локальним ушкодженням так і за її межами Екстремальні внутрішні сили навантаження волокон зменшуються у разі ушкодження, дотичні напруження в еластичній оболонці зростають. За відсутності чинників що зумовлюють нерівномірний розподіл сил поміж волокнами поздовжні порізи не впливають на напружено-деформованого стан волоконного композиту.

Визначений кількісний та якісний вплив пошкодження матриці волоконного композиту на його напружено-деформований стан дозволяє передбачити можливі наслідки такої ситуації, розробити заходи зі зменшення негативних наслідків, створити умови забезпечення достатньої ефективності та безпеки експлуатації механізмів, наприклад конвеєрів, обладнаних композитними гумотросовими стрічками.

В подальшому доцільно дослідити вплив поздовжніх локальних порізів одношарового композиту типу гумотросова стрічка з розривами суцільності її тросів на напружено-деформований стан.

Ключові слова: *стрічка конвеєра, волоконний композитний матеріал, напружено-деформований стан, порушення суцільності матриці, розрахунок.*

Problem's Formulation

The current level of development of mechanical engineering is characterized by the introduction of materials with unique properties, particularly materials of parallel fibers reinforced with a system, such as rubber-strip ropes and tapes. Their traction elements — cables are protected from the interaction with the environment, transported material, and structural elements of the machines on which they are installed. Protection of reinforcement elements from external influence prevents their destruction and loss of traction capacity with a rope (tape) and increases the reliability and durability of their operation.

However, practice shows that longitudinal cuts of the tape are possible due to the influence of external factors. Violation of the continuity of the elastic shell of the fiber composite leads to a change in the way the fibers (cables) interact, a stress-deformed condition (SDC) of the rope. Determined quantitative and qualitative effects of damage to the composite fiber matrix on its SDC allows us to solve the urgent problem — to anticipate the possible consequences of such a situation, to develop measures to reduce the negative consequences, to create conditions for ensuring sufficient efficiency and safety of operation of mechanisms, such as conveyors equipped with composite rubber-strip tapes.

Analysis of recent research and publications

Many researchers were engaged in studying the influence of external factors on the SDC. The article [1] emphasizes that the destruction of composites is accompanied by the "pulling" of fibers from the matrix. The stretching is caused by the appearance of tangent stresses in the matrix due to the destruction of fibers. The maximum tensile stresses are proportional to the loss of the material of the total area of the damaged area in the cross-section of the fibers. The dependence of the tangent stresses on the nature of the destruction of the fiber elements of reinforcement (cables) in the rubber-strip tape is investigated in [2], and it is shown that the disturbance of a stress state as a result of cables breaking is local. Maximum stresses in the fiber material of the rubber-strip rope (tape) type are not proportional to the number of damaged cables. They depend on the total number of cables, provided that the number of cables in the rope (tape) exceeds eight.

The article [3], by non-destructive control of the tape, establishes the formation of new damage, the increase in the conveyor size available during the conveyor operation. It is shown that the nature of damage to the tape is not always correlated with the area of damage. This fact is a consequence of the nature of the relative damage arrangement. In [4], shock damage to the tape is considered. The method of assessment of the probability of damage is formulated. The latter allows us to formulate proposals for the maintenance and operation of the conveyor tape.

The development of cracks in rubber and ropes, according to the authors [5], requires further modeling, for example, similar to the impact of cracks in the reinforcement on the SDC of concrete. [6] shows the use of the method of discrete elements for modeling bulk material and determining the forces of its interaction with the conveyor tape in the transportation process. The article [7] describes laboratory tests of the influence of the parameters of the conveyor tape on its resource. The influence of kinetic energy and the shape of the lumps of the material that interacts with the tape is studied on the nature of the damage to the latter [8]. In [9], an failure mode analysis of rubber-fabric tapes was made. The publication [10] constructs a mathematical connection model of the stepped construction as a system of differential equations. Numerous methods solve the system. The analysis of the influence of the mechanical properties of the compounds of rubber-fabric tapes on the distribution of stresses in them is made. It concludes that the connection's strength is reduced mainly due to poor preparation of the surfaces of the connection. The model uses a mechanical parameter — a module of elasticity for the tensile tissue layer. It is taken differently for each layer.

Formulation of the study purpose

Analysis of general studies has shown that the stress-deformed state of rubber-strip tapes, as composite single-layer fiber materials with fibers of considerable rigidity on the bend, with longitudinal disruption of the continuity of the elastic matrix, was not investigated. This fact does not allow us to evaluate the impact of such damage on the efficiency and safety of the tape. The work aims to develop the algorithm for determining the stress-deformed state of the tape with a longitudinal end-to-end violation of the continuity of the elastic matrix, which is an urgent task. It requires the formulation and solution of the model of interaction of elements of reinforcement of the whole parts of the tape and parts formed by a violation of the continuity of the elastic matrix.

Presenting main material

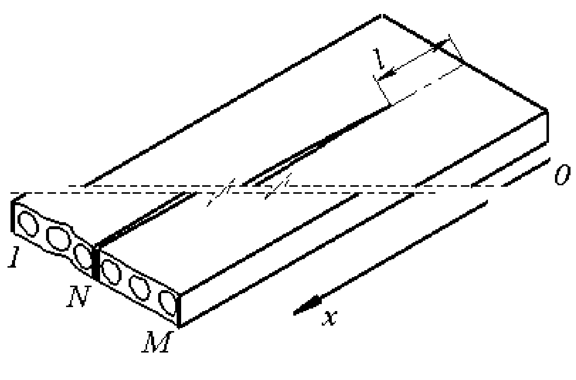

Fig. 1. Scheme of longitudinal cut of composite tape

Within the chosen goal, consider the case of longitudinal violation of the continuity of the elastic matrix of the tape, which is located parallel to the *x*. Let the tape of indefinite length have *M* fibers. It is whole in the area of length *L*. Between the *N*-th and *N*+1 fibers, it is cut. We combine the beginning of the coordinate axis x with the end of the undamaged part of the tape. (Fig.1).

The partial violation of the elastic matrix of the tape divides it into two parallel strips, which are attached to its continuous part. The fibers convey the traction efforts of *p* and interact in the whole part of the tape and within the cuts created. We will identify two parts of the tape. We will consider the part without violations first and denote it by the number *I* and the part of the violation of the continuity of the elastic matrix — the second. Denote it by the number *II*. The formed stripes will be given numbers 1 and 2 (Fig. 2).

We use the patterns of distribution of forces and displacement of reinforcement elements (fibers) in the rubber-strip rope obtained in [11]. We will not additionally mark the quantities of the first part of the tape. The quantities related to the second part in the index will enter the strip number (1 or 2). For the first part of the tape (when $0 \le x \le L$), the movement and internal load forces of fibers (cables), respectively [11], are determined by the dependencies;

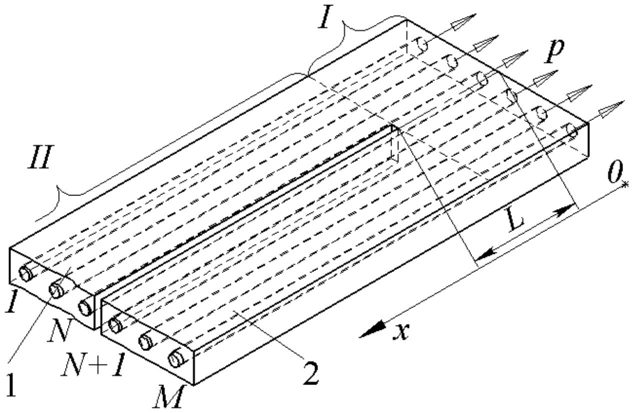

Fig. 2. Scheme of location and interaction of fibers in a damaged tape

$$u_i = \sum_{m=1}^{M-1} \left(A_m e^{\beta_m x} + B_m e^{-\beta_m x} \right) \cos\left(\mu_m \left(i - 0,5 \right) \right) + \frac{P\ x}{M\ E\ F} + \delta\ ; \quad (1)$$

$$p_i = E\ F \sum_{m=1}^{M-1} \left(A_m e^{\beta_m x} - B_m e^{-\beta_m x} \right) \beta_m \cos\left(\mu_m \left(i - 0,5 \right) \right) + \frac{P}{M}, \quad (2)$$

where E — the elastic module of elasticity of the material of the fibers for stretch; F — cross-sectional area of fibers, P is the longitudinal force of loading of the tape; A_m, B_m are unknown constants; δ — moving the tape as a rigid body; $\mu_m = \frac{\pi\ m}{M}$; $\beta_m = \sqrt{2 \frac{G\ b}{h\ E\ F} \left(1 - \cos\left(\mu_m \right) \right)}$; b — the thickness of the tape; G — module of shift of the material of the tape shell; h is the minimum distance between adjacent fibers.

We will assume that the plane of violation of the solidity of the elastic matrix of the tape is located in the middle between the closest ropes to it. The stated above allows us to apply the expressions of displacement and internal forces (1) and (2) for the formed strips, considering the number of fibers in them. However, the first part of the tape is limited, while the two strips formed are infinitely long. Objectively, with the infinite increase in the coordinate x, the value of the movement and internal forces of the fibers cannot grow infinitely. The mentioned above allows us to simplify the expressions of displacement and forces for formed strips ($x > L$)

$$u_{i,1} = \sum_{m=1}^{N-1} B_{m,1} e^{-\beta_{m,1} x} \cos\left(\mu_{m,1} \left(i - 0,5 \right) \right) + \frac{P_1 \left(x - L \right)}{N\ E\ F} + \delta_1 ; \quad (3)$$

$\left(1 \le i \le N \right)$

$$u_{i,2} = \sum_{m=1}^{M-N} B_{m,2} e^{-\beta_{m,2} x} \cos\left(\mu_{m,2} \left(i - 0,5 \right) \right) + \frac{P_2 \left(x - L \right)}{\left(M - N \right) E\ F} + \delta_2 ; \quad (4)$$

$\left(N + 1 \le i \le M \right)$

$$p_{i,1} = -E\ F \sum_{m=1}^{N-1} B_{m,1} e^{-\beta_{m,1} x} \beta_{m,1} \cos\left(\mu_{m,1} \left(i - 0,5 \right) \right) + \frac{P_1}{N} ; \quad (5)$$

$\left(1 \le i \le N \right)$

$$p_{i,2} = -E\ F \sum_{m=1}^{M-N} B_{m,2} e^{-\beta_{m,2} x} \beta_{m,2} \cos\left(\mu_{m,2} \left(i - 0,5 \right) \right) + \frac{P_2}{\left(M - N \right)} , \quad (6)$$

$\left(N + 1 \le i \le M \right)$

where P_1 and P_2 — load of the first and second strips of the second part of the tape, respectively; $B_{m,1}$, $B_{m,2}$ — unknown constants; δ_1, δ_2 — movement of the formed strips of tape as rigid bodies; $\mu_{m,1} = \frac{\pi\ m}{N}$;

$$\mu_{m,2} = \frac{\pi\ m}{M-N};\ \beta_{m,1} = \sqrt{2\frac{G\ b}{h\ E\ F}\left(1-\cos\left(\mu_{m,1}\right)\right)} \quad \left(1 \le m < N\right);$$

$$\beta_{m,2} = \sqrt{2\frac{G\ b}{h\ E\ F}\left(1-\cos\left(\mu_{m,2}\right)\right)} \quad \left(N < m < M-N\right).$$

Note that the expressions (3)—(6) include the amounts of quantities. In the absence of curvature, the values of these components equals zero. Accordingly, the longitudinal disruption of the elastic matrix of the tape will affect its SDC only if the forces are uneven between the fibers or the curvature of the tape section.

Let us accept that the tape is fixed in the cross section $x = 0$, and in the same section there is a rupture of the j-th rope. Accordingly, the following conditions should be fulfilled in the section $x = 0$:

$$u_{i,1} = U_0\begin{cases}0 & i \ne j\\ 1 & i = j\end{cases},\quad a)$$
$$p_j = 0, \qquad б) \tag{7}$$

where U_0 is the unknown displacement value of the j-th cable.

The condition (7. a) is fulfilled by setting the fibers of the first part with the next dependence (a Fourier series on the axis of limited length fibers).

$$u_{i,1} = 2\frac{U_0}{M}\sum_{m=1}^{M-1}\cos\left(\mu_m\left(j-0.5\right)\right)\cos\left(\mu_m\left(i-0.5\right)\right)\ \left(x=0\right). \tag{8}$$

We equate (8) to expression (1) when $x = 0$. After simplification we get.

$$B_m = 2\frac{U_0}{M}\cos\left(\mu_m\left(j-0.5\right)\right) - A_m,\ \delta = \frac{U_0}{M} \tag{9}$$

The expression of displacement (1) considering (9) takes the following form.

$$u_i = \sum_{m=1}^{M-1}\left(A_m\left(e^{\beta_m x} - e^{-\beta_m x}\right) + 2\frac{U_0}{M}\cos\left(\mu_m\left(j-0.5\right)\right)e^{-\beta_m x}\right)\cos\left(\mu_m\left(i-0,5\right)\right) + \frac{P\ x}{M\ E\ F} + \delta. \tag{10}$$

We fulfill the condition (7.$б$). Substitute the value of the vector of the coefficients B_m (9) in (2) for the j-th rope in section $x = 0$. We get the ratio:

$$2\frac{U_0}{M} = \frac{P}{M\ Z\ E\ F} + \frac{2}{Z}\sum_{n=1}^{M-1}A_n\,cos\left(\mu_n\left(j-0,5\right)\right)\beta_n, \tag{11}$$

where $Z = \sum_{n=1}^{M-1}\cos^2\left(\mu_n\left(j-0.5\right)\right)\beta_n$ and expression of fibers (1).

$$u_i = \sum_{m=1}^{M-1}\left(A_m\left(e^{\beta_m x} - e^{-\beta_m x}\right) + 2\sum_{n=1}^{M-1}A_n\cos\left(\mu_n\left(j-0,5\right)\right)\beta_n\frac{\cos\left(\mu_m\left(j-0.5\right)\right)e^{-\beta_m x}}{Z}\right)\times$$
$$\times\cos\left(\mu_m\left(i-0,5\right)\right) + \frac{P}{MZEF}\cos\left(\mu_m\left(j-0.5\right)\right)e^{-\beta_m x}\cos\left(\mu_m\left(i-0,5\right)\right) + \tag{12}$$
$$+\frac{Px}{MEF} + \delta$$

We use the ratio (9). We get an expression of forces distribution between fibers (2) in the following form.

$$p_i = E\ F\sum_{m=1}^{M-1}\left(A_m\left(e^{\beta_m x}+e^{-\beta_m x}\right)-2\frac{U_0}{M}e^{-\beta_m x}\cos\left(\mu_m\left(j-0.5\right)\right)\right)\beta_m\cos\left(\mu_m\left(i-0,5\right)\right)+\frac{P}{M}. \quad (13)$$

The last expression (13), considering (11), takes the look:

$$p_i = E\ F\sum_{m=1}^{M-1}\left(\begin{array}{l}A_m\left(e^{\beta_m x}+e^{-\beta_m x}\right)-\frac{2}{Z}\sum_{n=1}^{M-1}A_n\cos\left(\mu_n\left(j-0,5\right)\right)\beta_m e^{-\beta_m x}\cos\left(\mu_m\left(j-0.5\right)\right)\times\\ \times\beta_m\cos\left(\mu_m\left(i-0,5\right)\right)-\frac{P}{MZ}e^{-\beta_m x}\cos\left(\mu_m\left(j-0.5\right)\right)\beta_m\cos\left(\mu_m\left(i-0,5\right)\right)\end{array}\right)+ \quad (14)$$

$$+\frac{P}{M}$$

The first and second parts of the tape interact. The fibers belonging to them do not have a breakdown. Accordingly, in the section $x=L$ must fulfil the conditions of compatibility and inseparability of deforming parts of the tape.

$$u_{i,1} = u_i \quad \left(1\le i\le N\right), \quad (15)$$

$$p_{i,1} = p_i \quad \left(1\le i\le N\right), \quad (16)$$

$$u_{i,2} = u_i \quad \left(N+1\le i\le M\right), \quad (17)$$

$$p_{i,2} = p_i \quad \left(N+1\le i\le M\right) \quad (18)$$

Substitute into conditions (15)—(18) the value of the movement and internal forces of the fibers (3)—(6), and (13), (14) for $1\le i<M$ without considering the values in the first part of the tape and its continuation in the second strip. The above mentioned is due to the fact that the equation for the M-th rope is linearly dependent on the sum of the equations of other fibers. Let's take into account that $P_2 = P - P_1$ We get the system 2 (M-1) of algebraic linear equations. In the obtained system of equations, for the convenience of forming a system of equations in matrix form, expressions (13) and (14) we write in the following forms:

$$u_i = \sum_{m=1}^{M-1}A_m\left(e^{\beta_m x}-e^{-\beta_m x}+\frac{2}{Z}\cos\left(\mu_m\left(j-0,5\right)\right)\beta_m\sum_{n=1}^{M-1}\begin{array}{l}e^{-\beta_n x}\cos\left(\mu_n\left(j-0.5\right)\right)\times\\ \times\cos\left(\mu_n\left(i-0.5\right)\right)\end{array}\right)\times$$

$$\times\cos\left(\mu_m\left(i-0,5\right)\right)+\frac{P}{M\ E\ F\ Z}\sum_{m=1}^{M-1}e^{-\beta_m x}\cos\left(\mu_m\left(j-0.5\right)\right)\cos\left(\mu_m\left(i-0,5\right)\right)+\frac{P\ x}{M\ E\ F}+\delta$$

$$p_i = E\ F\sum_{m=1}^{M-1}\left(A_m\left(e^{\beta_m x}+e^{-\beta_m x}-\frac{2}{Z}\cos\left(\mu_m\left(j-0,5\right)\right)\beta_m\sum_{n=1}^{M-1}\begin{array}{l}e^{-\beta_n x}\cos\left(\mu_n\left(j-0.5\right)\right)\times\\ \times\cos\left(\mu_n\left(i-0.5\right)\right)\end{array}\right)\right)\times$$

$$\times\beta_m\cos\left(\mu_m\left(i-0,5\right)\right)-\frac{P}{MZ}\sum_{m=1}^{M-1}e^{-\beta_m x}\cos\left(\mu_m\left(j-0.5\right)\right)\beta_m\cos\left(\mu_m\left(i-0,5\right)\right)+\frac{P}{M}$$

As a result of the solution of the system of linear algebraic equations, we determine the unknown expressions (3)—(6) and (11), (12), including the power value of P_1. The definition of the latter allows us to obtain the desired values of the displacements and internal forces of the fiber load.

The rubber-strip tape is a separate case of composite fiber material. The fibers in the form of cables are connected by other material distributed between the ropes — the elastic shell. It provides redistribution of forces between fibers. It has tangent stresses. The article [1] emphasizes that in the composite materials of reinforced parallel fibers, in the case of damage to the latter, there is a stretching of fibers from the matrix — a violation of the conditions of the strength of their adhesive bonds under the action of tangent loads in the material connecting the fibers.

The adhesion bond depends on the tangent stresses in the material that connects the fibers. According to the Hooke’s law, the tangent stresses are equal to the modulus product of the material elasticity on the shift and tangent of the angle of the material displacement. The shape of the elastic shell section between two adjacent fibers is compound. The maximum shift angles are realized in the volumes of the material, in the plane of the location of the fibers, usually a round section. They depend on the mutual shift of the fibers and the minimum distance between them. The values of the shift angles for the first part of the rope $0 \le x \le L$

$$\gamma_i^I = \frac{u_{i+1} - u_i}{h} \left(1 \le i < M\right).$$

For strips created by cutting ($x > L$)

$$\gamma_{i,1} = \frac{u_{i+1,1} - u_{i,1}}{h} \left(1 \le i < N\right), \gamma_{i,2} = \frac{u_{i+1,2} - u_{i,2}}{h} \left(N + 1 \le i < M\right).$$

We calculated the tense deformed condition of the GTS type — 3150 indefinite lengths of five fibers (M = 5). Conditionally arbitrary fixing is modeled by the rigid fixing of all fibers except one (accepted) first. It is not attached at all (broken). We considered the tape before and after its longitudinal cut. In the latter case, N = 2, L = 1m. Figures (3—5) show the calculated distribution of indicators of the tense deformed state of the tape loaded with force, which provides a single average load of one fiber. Thus, the distribution of internal forces corresponds to the distribution of coefficients of the uneven load of fibers.

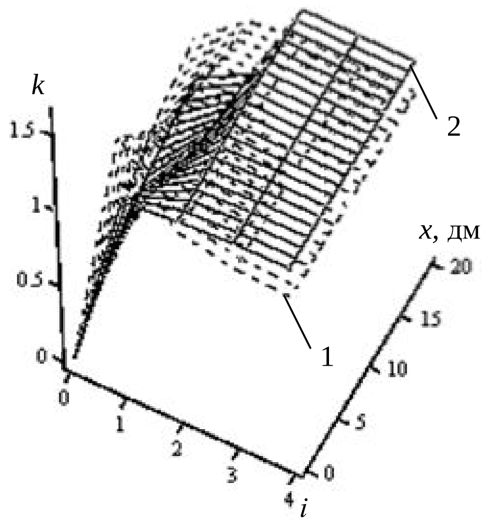

Fig. 3. Distribution of load unevenness coefficients k fibers with numbers and along the x axis: 1 — before longitudinal destruction; 2 — after destruction

Fig. 3 shows the calculated distributions of cable loads, provided that the average load per cable equals one (distribution 1). In addition, the figure shows the results determined by the method [11] for the tape without longitudinal damage to the elastic shell between the ropes (distribution 2). Distributions reproduce the equality of zero of the coefficient k (load force) of the damaged rope in the cross-section of its damage and its increase with an increase in distance from the cross-section of damage. Following distributions obtained, the extreme values of the coefficients of the uneven load of the fibers of the non-damaged fibers have decreased due to the destruction of the continuity of the elastic shell of the tape. In this case, the decrease reached almost 22 %. With a small number of tape fibers, the coefficients of the uneven load of intact fibers exceed one. In general, the nature of the distribution of internal forces of the fibers in the tape in violation of the continuity of the elastic matrix differs from the distribution of forces in the tape without the latter.

Note that the butt connection of the conveyor tapes can be considered a tape with fibers that have continuity breaks. The established effect of longitudinal damage to the tape on the distribution of forces in a tape with damaged fiber makes it possible to conclude that there is a violation of the continuity of the elastic matrix of the tape, even beyond its butt connection on the distribution of forces in the connection and, accordingly, its strength.

The distribution of the fiber load forces is inextricably linked to their deformation. The moving of the latter is shown in Fig. 4.

According to the condition, the fixing of the movement of fibers in section x=0 is absent except for the movement of the damaged first rope. The movements of cross-sections of the fibers of the second strip of the tape, formed by section, are almost the same and different from the movements of the first fibers. At the same time, before cutting the tape, they were practically even. The latter is due to a considerable distance between the cross-section of the damage and a cross-section of x = 2m. The

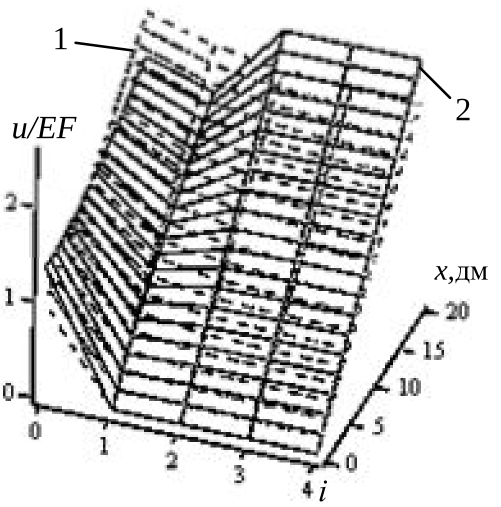

Fig. 4. Distribution of movements of fibers attributed to the longitudinal their stiffness *u/EF* with numbers and along the axis *x*: 1 — defore longitudinal destruction; 2 — after destruction

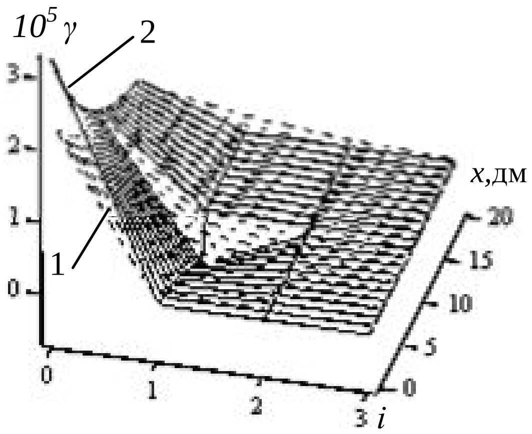

Fig. 5. Distribution of the displacement angles of the elastic shell material γ between the fibers with numbers and along the tape *x:* 1 — to longitudinal destruction; 2 — after destruction

field disturbance does not apply to a stressful deformed state at such a distance. However, even with this feature of deformations, the longitudinal cut of the tape in the specified section increased its extension by almost 3 %. Under the condition of infinite growth, the coordinates of the cross-section of the displacement growth of the cross-sections of the tape as a result of its cutting approach are zero.

The difference in the movement of fibers in the cross-sections of the tape, typical of its axis, determines the mutual shift of the fibers. The latter, the distribution of the displacement angles of the elastic shell between the fibers (Fig. 5), are the factors of the displacement of shear stresses in the composite.

Four layers of elastic material are in a tape made of five fibers. There is only one layer in the first strip on the damaged part. On the whole part of the tape, significant displacements of the fibers occur in two layers before and after the cross-section of discontinuity of the elastic matrix of the tape. This violation affects the nature of the change in tangent stresses both in the area with a violation of the continuity of the elastic matrix and beyond it. The cutting of the strip is accompanied by the increase in the maximum displacement angles of the material connecting the cables. In this case, they increased by almost 40 %.

Accordingly, the discontinuity of the elastic matrix of the tape of composite fiber construction affects its stress-deformed condition on the area with damage to the matrix between the fibers and outside the damage.

Conclusions

An analytical algorithm for calculating the stress-deformation state of a fiber composite of infinite length with a violation of the integrity of the elastic matrix with arbitrary fixation has been developed.

The following is established. Violation of the continuity of the elastic matrix of the tape during its operation on the conveyor affects its SDC on the area with damage to the rubber layer and beyond if the area of local disturbance of the stress does not exceed the distance to the area with longitudinal destruction. The extreme internal load forces of fibers decrease, and tangent stresses in the elastic shell increase due to the discontinuity of the elastic matrix of composite material. In the absence of factors affecting the uneven distribution of forces between the fibers (curvature of the cross-sections of the tape), longitudinal cuts do not affect the SDC tape.

In the future, it is advisable to investigate the effect of longitudinal cuts of rubber-strip tapes of powerful conveyors on the SDC of its butt connections.

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