ANALYSIS OF THE LAWS OF COTTON BLEND MOVEMENT IN THE RUBBER PLANK SEPARATION DRUM OF THE COTTON REGENERATOR

АНАЛИЗ ЗАКОНОМЕРНОСТЕЙ ДВИЖЕНИЯ ХЛОПКОВОЙ СМЕСИ В БАРАБАНЕ ДЛЯ РАЗДЕЛЕНИЯ РЕЗИНОВЫХ ДОСОК РЕГЕНЕРАТОРА ХЛОПКА

U.M.Ismailov

JSC "Cotton Industry Scientific Center", Uzbekistan.

Abstract

In the article, a system of equations describing the movement of cotton on the surface of an improved rubber-plate drum for separating cotton pieces from the cleaning saws of the cotton regenerator was developed, and graphs of the dependence of the rubber-plate deviation angle and the cotton piece mass on the time of transportation of cotton pieces in the rubber-plate drum were made according to the numerical solution of the problem.

Key words: Regenerator, plank, rubber, separation, effect, drum.

Абстрактный

В статье разработана система уравнений, описывающая движение хлопка по поверхности усовершенствованного резино-пластинчатого барабана для отделения кусочков хлопка от чистящих пил регенератора хлопка, и графики зависимости угла отклонения резино-пластинчатого барабана и массы кусочка хлопка от времени транспортировки из кусочков хлопка в барабане с резиновыми пластинами были изготовлены в соответствии с численным решением задачи.

Ключевые слова: регенератор, планка, резина, сепарация, эффект, барабан.

In the recommended cotton regenerator, the fiber seeds caught by the drum teeth are pulled out by a rubber-plate drum and moved along the axis and transported to the exit zone. In this case, the rubber plates are located perpendicular to the axis of the drum. As a result, a large piece of cotton creates an additional force moving along the axis. Therefore, it is important to theoretically analyze the movement of the fibrous seed on the surface of the planks. To solve the problem, a calculation scheme was built in which the forces acting on the piece of cotton were applied [1, 2]. This calculation scheme is presented in Figure 1.

The forces affecting the calculation scheme are as follows: $\bar{G}$-gravity force vector; $\overline{F_{мқ}}$-centrifugal force vector; $\overline{F_{ҳ}}$- air resistance force vector; $\overline{F_{кор}}$- coriolis force vector; $\overline{F_{иш}}$ -friction force vector; $\bar{N}$-reaction force vector.

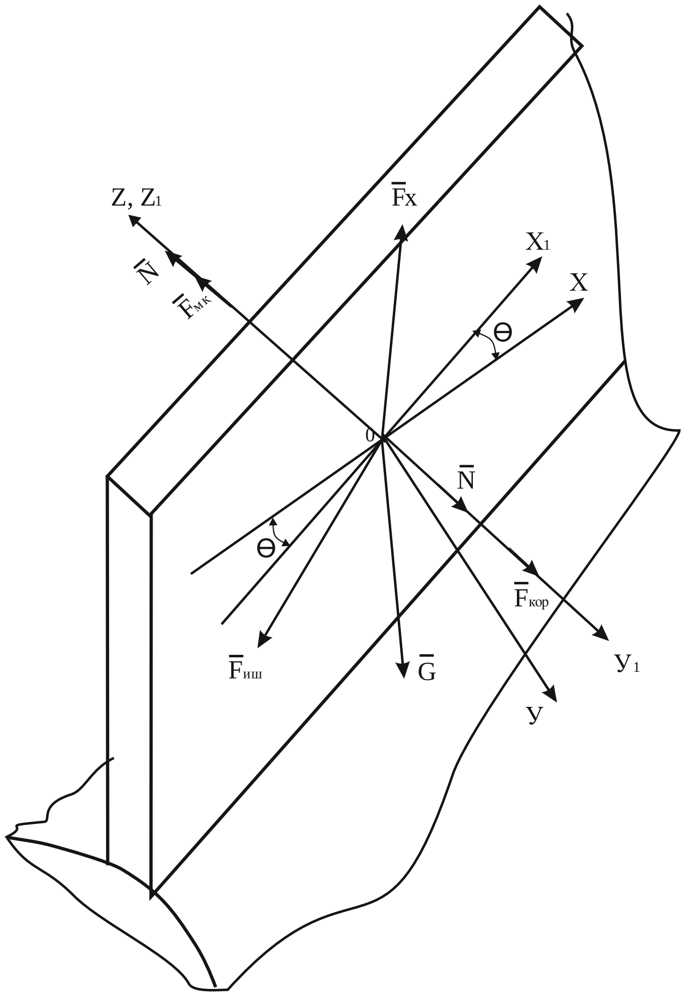


Figure 1. Calculation scheme representing the movement of a piece of cotton on the surface of a rubber sheet.

Taking these forces and the projection of the inertial force on the coordinate axes X, U, Z, we create the equilibrium condition based on the Dalamber principle [3, 4]:

$$\sum_{i=1}^{n} F_{ix} = 0; \qquad \sum_{i=1}^{n} F_{iy} = 0; \qquad \sum_{i=1}^{n} F_{iz} = 0 \qquad (1)$$

We take the projections of all forces and form a system of differential equations representing the law of motion of a piece of cotton on the surface of a rubber plate:

$$m_n\ddot{x} = -kV^2_x Cos\beta_1 - NCos\beta_2 - F_{кор}Cos\beta_3 - F_{иш}Cos\beta_4;$$
$$m_n\ddot{y} = -kV^2_x Sin\beta_1 + NSin\beta_2 + F_{кор}Sin\beta_3;$$
$$m_n\ddot{z} = -G - F_{иш}Sin\beta_4 + F_{мк}. \quad (2)$$

where β_1, β_2, β_3, β_4 are the angles formed by the corresponding forces with the X coordinate axis.

Accordingly, we form the acting forces as follows.

$$m_n\ddot{x} = -kV^2_x Cos\beta_1 - NCos\beta_2 - 2m_n\dot{x}\omega_b Cos\Theta;$$
$$m_n\ddot{y} = -kV^2_x Sin\beta_1 + NSin\beta_2 + 2m_n\dot{x}\omega_b Cos\Theta;$$
$$m_n\ddot{z} = -m_n g - NfSin\beta_4 + m_n\omega_b^2 (R_b + h/2 + Z). \quad (3)$$

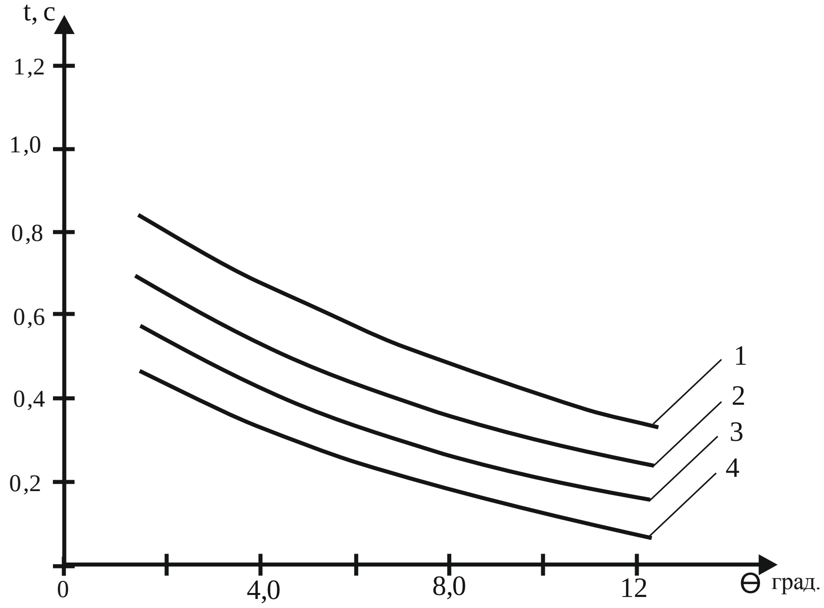
The parameters of the numerical solution of the problem were implemented in the initial calculation values:

$m_n=(0,2-2,0)*10^{-3}$кg; $f=(0,25-0,3)$; $g=9,81$ m/c^2; $\Theta=5^0-10^0$; $\omega_b=(95-110)c^{-1}$; $l=1,9*10^3$m; $V_x=(2,0-3,0)$ m/c; $k=1,5-2,5$; $\beta_1=30^0-45^0$; $\beta_2=25^0-60^0$; $\beta_3=30^0-50^0$; $\beta_4=15^0-35^0$.

In the recommended cotton regenerator, the dimensions of the drum that separates the cotton pieces from the teeth should be selected in such a way that it first completely removes the cotton pieces from between the teeth, secondly, it is necessary to transfer them to the transportation zone faster, and thirdly, it is necessary not to damage the cotton fibers as much as possible. In this case, after the fiber seed is removed from the saw tooth several times, the rubber-plates are affected along the axis and ejected. These repetitions, depending on the mass of the cotton piece, are transported up to (3-7) times on the surface of the rubber plate to the moving zone. Therefore, it is important to determine the time to remove the cotton piece from the drum with rubber plate.

In this case, the transportation time was assumed to be at a distance equal to (0.6-0.7) l m of the average drum. Because not all cotton pieces move along the full length of the drum. Also, by determining the speed of movement along the X axis, then the time of transportation is found. In this case, the numerical solution of the system of differential equations (2) was carried out on a computer. The time of transportation of a piece of cotton is determined by the equation (3):

$$t = \frac{x}{\dot{x}} \qquad (3)$$



1-m_n=2,0*10^{-3} кg; 2-m_n=1,5*10^{-3} кg; 3-m_n=1,0*10^{-3} кg; 4-m_n=0,5*10^{-3} кg.

Figure 2. Graphs of the dependence of the time of transportation of cotton pieces in a rubber-plate drum on the angle of deviation of rubber-plates and the mass of the cotton piece.

Figure 2. shows graphs of the dependence of the time of transportation of cotton pieces in a rubber-plate drum on the angle of deviation of rubber-plates and the mass of the cotton piece. Based on the analysis of the obtained studies, it can be seen that when the angle of deviation of the rubber plates increases from 50 to 150, the transportation time of fiber seed with m_n=0.5*10^{-3} kg decreases from 0.42 s to 0.097 s in nonlinear connection. Accordingly, when the mass of a piece of cotton is 2.0*10^{-3} kg, its transportation time decreases from 1.0 s to 0.39 s in non-linear mode.

Conclusion

Therefore, for faster transportation of cotton pieces of different mass, it is recommended to make the deviation angle of the rubber plates $\Theta=7^0$.

Reference

1. Kuliev T.M., Ismailov U.M. Test results of the machine for the regeneration of cotton pellets in cotton waste. Innovative development of cotton: Theoretical and practical principles. Materials of the scientific-practical conference dedicated to the International Cotton Day (October 7, 2022). 219 p.

2. Kuliev T.M., Ismoilov U., Djamolov R.K. Results Of Improved Test Of Cotton Regenerator In. ISSN 2774-3918 (online), https://ksshr. kresnanusantara. co.id. Published by Kresna Nusantara Copyright © Author(s). This is an open-access article distributed under the terms of the Creative Commons Attribution License (CC BY). To view a copy of this license, visit https://creativecommons.org/licenses/by/4.0/.2022.

3. Torg S. M. Kratki kurs teoreticcheskoy mechaniki.12-izd"vysshaya shkola " M-2005, p439.

4. Djuraev A. Dynamika rabochikh mechanizov holpko-pererabatybayushchih mashin.Tashkent. IZD-vo fan UzSSR, 1987, p168.