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CALCULATION OF THE PARAMETERS OF CLEANER FROM COTTON FINE WASTE

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Abstract
The article presents the construction scheme and principle of operation of the machine for cleaning cotton from small waste with drums with multi-faceted piles. Based on theoretical studies, the results of justification of cleaner parameters are given. Recommendations for the use of a cotton cleaner from small impurities recommended for production are given.

Keywords: Cotton raw material, small waste, cleaner, piles, drum, angle of deviation, mass, inertia, friction, coordinate, force, bond, displacement, velocity, acceleration.

Introduction

A calculation scheme representing the behavior of a fiber seed pile as an aggregate is presented in Fig. 1. The fibers exert the following forces on the seed.

Gravity G=mg (1)

Here, m is the mass of the fiber, g is the acceleration of free fall, and centripetal force is ,

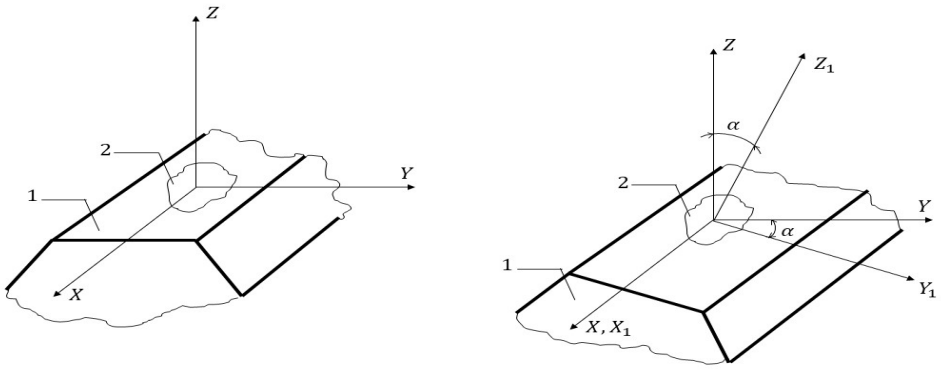
F_(M.q)=〖〖mW〗_δ〗^2 (R_δ+h/2+x_1) (2)

Where W_δ, R_δ are the angular velocity and internal radius of the pile drum, x is the pile height, x is the coordinate,

Inertial force, in coordinates m x1, m y1, m z1 ,

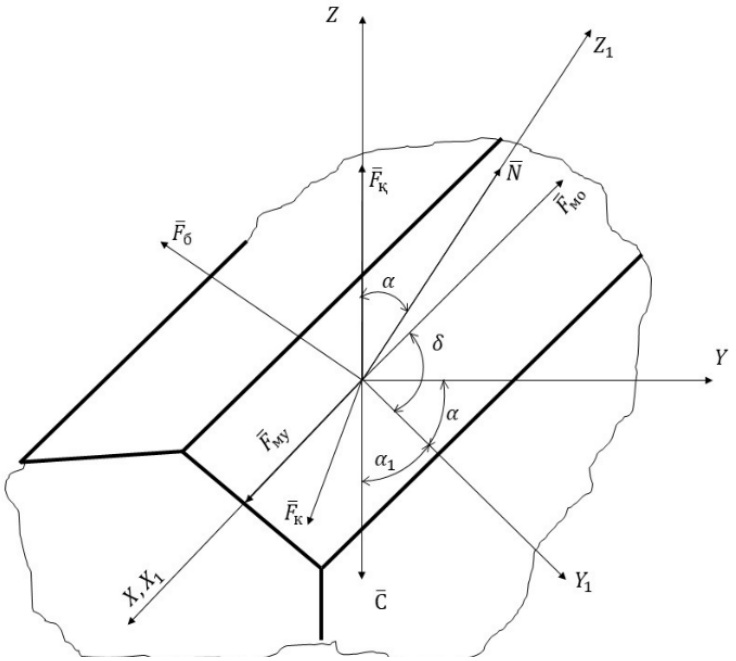
Pile force, F_Ky=2mW_(δ) X_ (1) cos⁡θ (3)

Here X1 is the velocity along the x-axis, θ is the velocity vector, and the angle between the velocity vector and the axis is



а) б)

1) Figure 1. Coordinates of the movement of a fibrous grain located on the surface of a multi-faceted pile.
2) a) – on a flat surface; b) – on a curved surface
3) 1) – pile 2) – fibrous grain



2- Fig. Calculation scheme for the motion of a fibrous seed on a flat curved surface of a multi-sided pile

Friction force, F_work=1N (4)

Here, F- friction force between the pile surface and the fiber, N- reaction force,

Fδ - bonding force.

The drag force,

F_H=kV_H^2 (5)

K- drag force factor Vh - air velocity

Based on the Dalambir principle [10], taking into account the equilibrium conditions of the fiber, inertial force modifiers,

∑_(c=1)^n⁡〖F_x (F_i)〗=0; ∑_(c=1)^n⁡〖F_y (F_i)=0; ∑_(c=1)^n⁡〖F_z (F_i)=0〗〗 (6)

Based on the above (5), taking into account all the forces along the coordinate vertices …, we obtain the following system of differential equations expressing the law of motion of a fibrous seed on a multi-sided pile-like curved surface:

m (d^2 x_1)/(dt^2)=mW_δ^2(R_δ+h/2+x-ϕHsin⁡〖β+F_δ cos⁡γ 〗);

m (d^2 y_1)/(dt^2)=mg cos⁡〖α_1 〗-F_δ sin⁡〖γ-fN cos⁡〖β-kv_x^2 〗 〗 cos⁡〖θ_1 〗;

m (d^2 y_1)/(dt^2)=N-mg cos⁡〖a+〗 kv_x^2 cos⁡a+F_d sin⁡〖g cos⁡〖z-2m (d^2 x_1)/dt W_b 〗 〗 cos⁡〖θ_1 〗; (7)

Here, a, d, g, a_1, th_1 are the angles formed by the force vectors with the coordinate axes.

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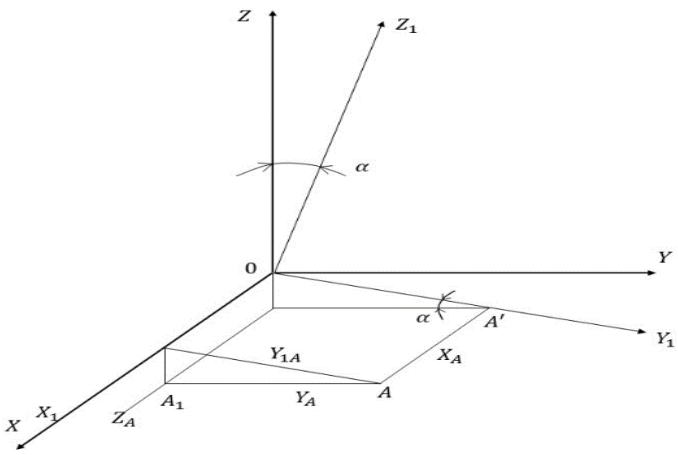

3- Fig. Scheme for determining the displacement of a fiber grain from the Z axis to the δ axis during its movement.

It is important to emphasize that it is important to determine the displacement of a fiber grain along the vertical Z axis during its movement along a curved textured surface. According to the scheme in Fig. 4.

Z_A=Y_1A sin⁡α (8)

Here, Y1A is the coordinate of point A along the Y axis.

To obtain a numerical solution of the obtained system (7), the following values of the parameters were taken into account:

M=(0.2÷0.65)* 10-3kg; Wδ =(45÷55)c-1; φ =(0.25÷0.4); κ=(0.65÷0.70);

Pδ = (0.16÷0.20)*10-3 m; r = 9.81m/c2; α = (300 ÷450) ; δ= (250 ÷450) ;

Bx = (0.5÷0.6) 10 m/s; Φδ =(4.0÷6.0); λ = (100÷300);

Conclusion

A new scheme for cleaning cotton from fine and coarse impurities has been developed. The rules of cotton fiber movement on the surface of a multi-faceted pile are determined. The parameters based on the binding graphs are recommended.

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