2. Analysis of the effectiveness of technologies making plant residues and solid organic fertilizer to the soil show the advantage of the first of them - less labor costs by 6.7 times, fuel consumption - 3.2 and brought cost - 4.6 times.

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Present Importance and Need yzmelchenyya rastytelnыh ostatkov. Apply commercial-characteristic sovremennыh mulchyvachey predstavlennыh in Ukraine firms - manufacturers. Opredelena Efficiency Technologies vnesenyya of organic fertilizers in the soil.

Technology, orhanycheskoe zemledelye, mulchyvach, commercial-characteristic, machine assembly, Economic effectiveness.

The importance and need of crushing of plants remains is given. The technical characteristics of modern mulching machines presented by firms-producers in Ukraine is given. Technologies efficiency of putting of organic fertilizers to soil is defined.

Technology, organic agriculture, mulching machine, technical characteristics, machine unit, economic efficiency.

UDC 621.87

Comparison of theoretical and experimental studies of the dynamics PUSKU Screw conveyor mixer

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AV Hudova, applicant

The results of theoretical and experimental studies of the dynamics of motion screw conveyor-mixer during start-up.

The dynamic model optimization criterion, reliability design.

Problem. During the transition process in the elements of design and dynamic loads over there oscillatory nature that may be several times the average statistics [1]. The effect of these dynamic loads may reduce the lifetime machines and reduce the reliability of the design, lead to significant deformation of structural elements [4].

To eliminate this factor is proposed to reduce the dynamic loads by selecting the optimum laws of motion.

Analysis of recent research and publications. Significant research into the kinematics and dynamics of spiral conveyors made by such scientists as Hevko BM [15] Rohatyn RM [11] Davydov BL [12] Komarov MS [13] LK Polishchuk [14]. Kinematic and dynamic parameters of the screw conveyor-load and shock load parameters to screw your body during start-up is shown in [2]. The dependence of the efficiency of the mechanisms of performance modes of motion in areas transients considered in [3].

Analysis of the literature shows that it is necessary to extend the study of the effect of optimization of motion to work the conveyor screw-type mixer.

The purpose of the article is to confirm the adequacy of previously obtained theoretical research results [6] With experimental results and impact in setting optimization to reduce dynamic loads.

Research results. For theoretical studies

dynamics of screw conveyor-mixer in areas transients developed a dynamic model as chotyrymasovoyi elastic-oscillatory systems with lumped masses and weightless elastic links (Figure 1), the movement of which is described by second order differential equations (1) [5].

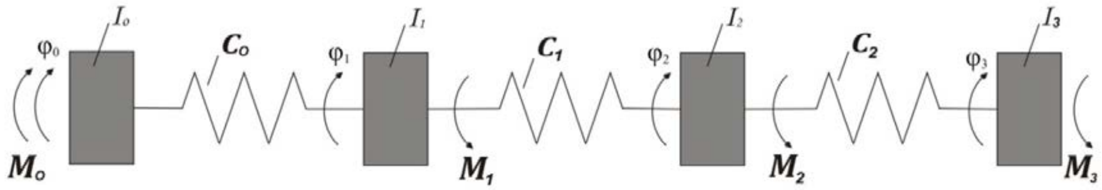


Fig. 1. Dynamic model of the conveyor-mixer.

$$\begin{cases} I_0\ddot{\varphi}_0 = M_O - C_0\left(\varphi_0 - \varphi_1\right); \\ I_1\ddot{\varphi}_1 = C_0\left(\varphi_0 - \varphi_1\right) - C_1\left(\varphi_1 - \varphi_2\right) - M_1; \\ I_2\ddot{\varphi}_2 = C_1\left(\varphi_1 - \varphi_2\right) - C_2\left(\varphi_2 - \varphi_3\right) - M_2; \\ I_3\ddot{\varphi}_3 = C_2\left(\varphi_2 - \varphi_3\right) - M_3, \end{cases} \quad (1)$$

where I_0, I_1, I_2, I_3 - According moments of inertia of the drive mechanism parts and components screw shaft of cargo transported, which brought to the axis of the screw; $\varphi_0, \varphi_1, \varphi_2, \varphi_3$ - Generalized angular coordinate rotation lumped mass accordance drive mechanism and elements of screw shaft with the load; M_0 - Driving time of the motor shaft, brought to the axis of the screw shaft; M_1, M_2, M_3 - Moments of the resistance movement of goods in areas screw shaft; C_0, C_1, C_2 - Accordingly reduced to the axis of the screw shaft drive mechanism links rigidity and stiffness screw shaft sections that are individual elements.

Results of the study of the dynamics of start-mixer screw conveyor type shown in Figure 2 [6].

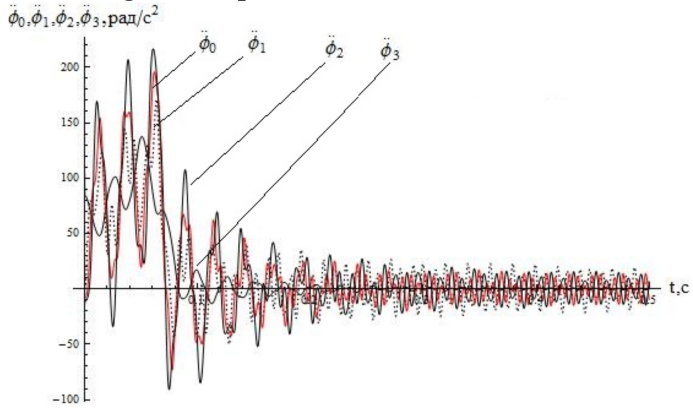


Fig. Figure 2. The change of angular acceleration during start-mixer conveyor screw type.

The resulting graph shows the oscillatory processes of change of acceleration mass conveyor-mixer to get started. The presence of oscillatory processes leads to dynamic loads in the elements of design and drive. One way to reduce stress is optimization mode motion screw conveyor-mixer at the site launch.

For optimization of motion selected quantitative assessment of the dynamic properties of the conveyor-mixer as integral criterion, which reflects undesirable properties throughout the life movement.

For criterion for evaluating motion mode mixer at the site launch will take the standard deviation of the angular velocity of the second $\dot{\varphi}_2$ and third $\dot{\varphi}_3$ weight:

$$\Delta\dot{\varphi}_{231} = \left[\frac{1}{t_1}\int_0^{t_1} f_{231}dt\right]^{1/2}, \qquad (2)$$

where t - time; t1 - the final time complete cycle of movement of the conveyor-mixer; $f_{231} = \left(\dot{\varphi}_2 - \dot{\varphi}_3\right)^2 = \left(\frac{I_3}{C_2}\ddot{\varphi}_3\right)^2$ - Squared deviations of the angular velocity of the second and third masses.

The condition of a minimum criterion (2) is the Euler-Poisson [10]:

$$\frac{\partial f_{231}}{\partial \varphi_3} - \frac{d}{dt}\frac{\partial f_{231}}{\partial \dot{\varphi}_3} + \frac{d^2}{dt^2}\frac{\partial f_{231}}{\partial \ddot{\varphi}_3} - \frac{d^3}{dt^3}\frac{\partial f_{231}}{\partial \dddot{\varphi}_3} = 0. \qquad (3)$$

Since the function f_{231} depends on $\dddot{\varphi}_3$ Then equation (3) becomes:

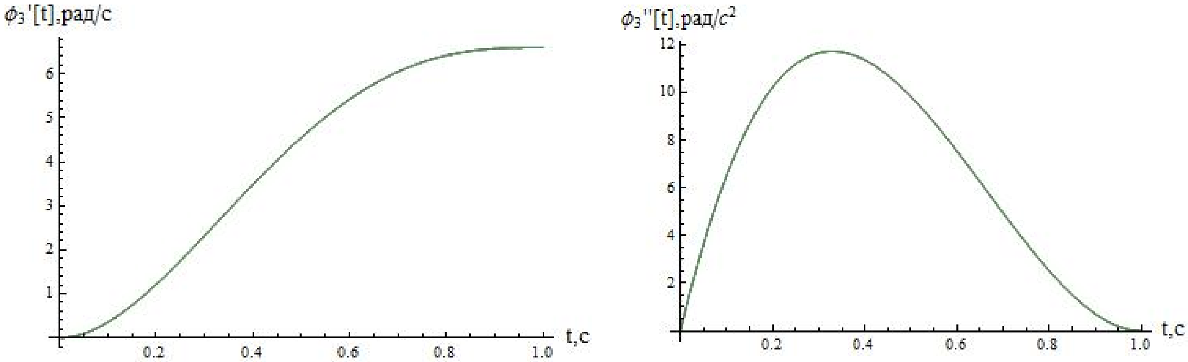
$$\frac{d^3}{dt^3}\frac{\partial f_{231}}{\partial \dddot{\varphi}_3} = 2 \cdot \left(\frac{I_3}{C_2}\right)^2 \overset{VI}{\varphi_3} = 0. \qquad (4)$$

Equation (4) makes sense when $\overset{VI}{\varphi_3} = 0$. Then the general solution of the equation is as follows:

$$\varphi_3 = \frac{1}{120}A_0 t^5 + \frac{1}{24}A_1 t^4 + \frac{1}{6}A_2 t^3 + \frac{1}{2}A_3 t^2 + A_4 t + A_5. \qquad (5)$$

where A0, A1, A2, A3, A4, A5 - constant of integration, which are determined from the boundary conditions of the system: $t = 0 \to \varphi_3 = \dot{\varphi}_3 = \ddot{\varphi}_3 = 0;\ t = t_1 \to \dot{\varphi}_3 = w_y, \ddot{\varphi}_3 = \dddot{\varphi}_3 = 0$ Where w_y - Set speed of the screw shaft.

Based on the relationship (1) and (5) based on the optimum integration constant motion modes, which are presented in graphs in Fig. 3.



a) b)

Fig. 3. Charts speed change (a) and acceleration (b) best mode start-mixer conveyor screw type

Let us analyze the results of the study of the dynamics of start-up conveyor-mixer screw type without (Fig. 2) and with (Fig. 3, b) conduct optimization.

For the best mode of motion (Fig. 3, a) speed gradually increases from zero to nominal value. The rated speed is achieved in 1 s.

Figure Fig. 3 b illustrates that initial moment you start mixing time shift is accompanied by a smooth increase in load acceleration to maximum 12 boards / c2 for 0.4 sec, which gradually decreases with time. At the same time in Fig. 2 acceleration curve has a pronounced oscillatory character. Acceleration is the maximum value (200 councils / c2), then decreases to a value of -100 councils / c2, and then gradually fades oscillation amplitude. The data show that the optimal mode start maximum acceleration components of the system 16 times less than the corresponding acceleration mode at suboptimal, leading to more than an order of magnitude reduction in dynamic loads elements of design.

Analyzing the results presented, we see that by optimizing reduced to a minimum fluctuation components of the system, and as a result, virtually disappearing effect of dynamic loads in cell drive and screw conveyor shaft mixer.

To implement the optimal modes of motion applied frequency converter, which is able to control the current, voltage or frequency, thereby providing smooth continuously variable rotational speed induction motor. This will reduce the shock overload by reducing inrush currents; reduce the chance of overheating of the engine; realize optimal soft start mixer (loaded or unloaded) [7].

Results. To confirm the results of theoretical studies conducted experiment, for which developed laboratory setup (Fig. 4).

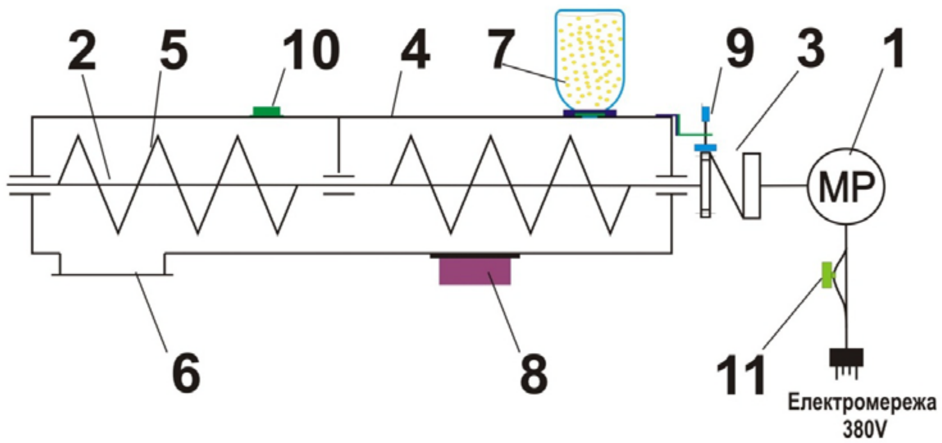


Fig. 4. The scheme developed by the laboratory setting.

The installation consists of a screw conveyor-mixer and a drive that is mounted on a welded frame. The drive model is made of three-phase AC motors 1, 2.2 kW power and rotor speed of 1420 rev / min via a planetary gearbox with gear ratio of 22.5.

The conveyor screw mixer has 5 Trench 4, 6 window handling, material supply system 7 and 8. Install vibrator allows full experimental research to determine the dynamic loads during start-screw mixer.

Power on the drive shaft of the values measured voltage and current, received via current sensor 11 and a multimeter respectively. The angular velocity on the drive shaft measured using the angular velocity sensor 9. Measurement of vibrations carried accelerometer 10 attached to the gutter angles. Optimization motion mode is implemented by means of frequency converter. To read the signals from these sensors used power-converter and PC.

Experiments on research conducted for the dynamics of such combinations as start-up mode mixer with no load and load; simulated shock mode (which happens when the mixer resumes its work after an emergency stop, that is filled with groove). Implemented various modes start, namely manual (sharp) and automatic (smooth).

The results of experimental studies of the dynamics of start-conveyor-mixer, schedule changes are accelerating for real-mode start-belt laden state (Fig. 5) and dependencies angular velocity and acceleration for optimal treatment start (Fig. 6).

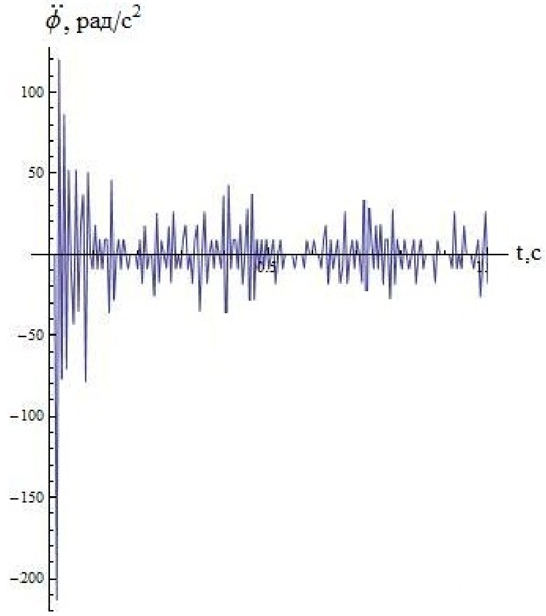
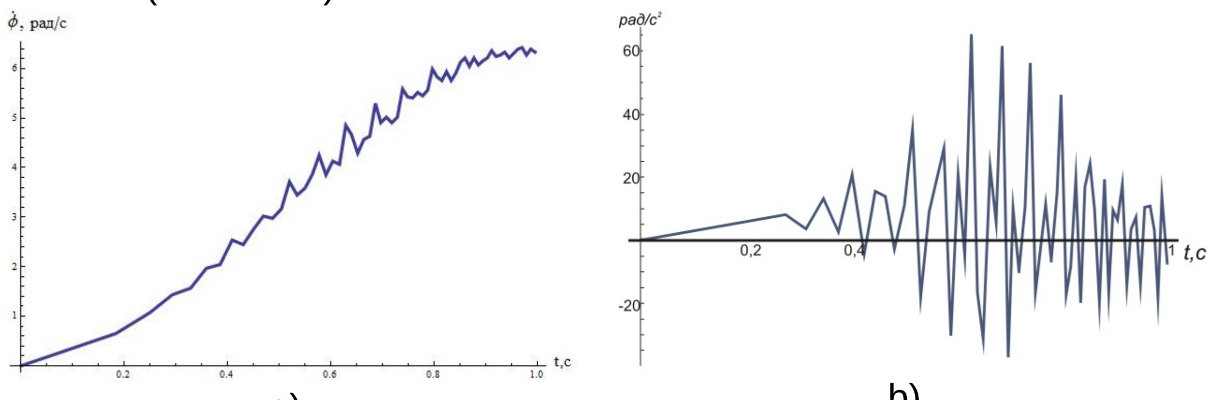


Fig. 5. Schedule changes the angular acceleration of the shaft at the start (real mode).



a) b)

Fig. 6. Schedule changes the angular velocity (a) and acceleration (b) screw shaft at start-up (optimum mode).

Based on the graphs (Figure 5 and Figure 6, b), with variable acceleration oscillatory nature of both the first and the second mode of oscillation amplitude of -200 to 100 rad / s2 for real mode and start from -35 to 65 rad / s2 for smooth start-up mode.

When comparing the experimental data with the study of dynamics of mixing obtained theoretically, we see that most of the theoretical and experimental curves are similar in size and nature of change. Only exception is a graph of acceleration when the best mode, where the experimental data (Fig. 6, b) observed large amplitude oscillations compared with the corresponding graph (Fig. 3, b) Theoretical where the curve has a smooth nature of the change. This difference in the results occurred because of assumptions made in the theoretical calculations and experimental equipment through error.

In general, the comparison of theoretical and experimental results confirmed the adequacy of the proposed mathematical models legitimacy drawn from the research findings and the effectiveness of new strategic modes of motion (as smooth movement when starting reduces dynamic loads).

Conclusions

1. As a result of theoretical studies obtained showing the real and the best mode motion screw conveyor-mixer.

2. Comparison of theoretical studies of the dynamics of experimental data confirmed the adequacy of the proposed mathematical models and legitimacy drawn from the research findings.

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In the work predstavlenы Theoretically Results of research and эksperymentalnыh movement dynamics vyntovoho conveyor-mixer t START TIME.

Dynamycheskaya model optimization criterion, nadezhnost constructions.

In paper results of theoretical and experimental studies of dynamics of motion screw conveyor-mixer are presented.

Dynamic model, optimization criterion, reliability of construction.

UDC 621,867,133

METHOD OF EXPERIMENTAL RESEARCH driving dynamics Conveyor

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VM Rybalko, Ph.D.
OY Tkachenko, Assistant

The basic results of theoretical research and Optimization motion mode scraper conveyor to handle the fluctuations that occur in the body of traction during launch. The method of experimental studies of the dynamics of motion scraper conveyor.

Dynamic load drive, drag coefficient, the optimal mode of movement.