In paper the considered features of analytical approaches to systemacity of restoration of working capacity of mashines for forestry works.

Restoration, working capacity, forest mashine.

UDC 621,873

DYNAMIC ANALYSIS OF TRAFFIC bridge cranes

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The paper analyzes the dynamic movement of the bridge crane based mechanical characteristics of the drive motor mechanism for horizontal movement. The task solved by numerical integration of differential equations of motion of the bridge crane. The results of the illustrated graphs that characterize the transition process of overclocking overhead crane.

Crane, truck, dynamic loading, dynamic model, mathematical model, reduced weight, beam crane, optimization.

Formulation of the problem. When using metal bridge crane subjected to significant dynamic loads. At various stages of movement is fluctuation bridge crane, end-beams and other cargo units and their components that make up a mechanical system. Note transient dispersal mechanism for moving the bridge. This process is accompanied by the highest values of dynamic loads that directly affects the speed of operations performed, additional power consumption, reliability and tap in case of failure results in additional material costs for repairs. Therefore, further research of these negative factors necessary to conduct a dynamic analysis of the motion of the mechanical system.

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Analysis of recent research. The authors of [1] investigated the transverse vibrations of the bridge when it is moving with various provisions of the cart. It used trymasova dynamic model for which is illustrated graphics transients movement of the mechanical system. The authors of this paper have proposed modal regulator [2], which allows extinguish elastic vibrations in a linear model and a model with distributed parameters. For further research dvomasova used a dynamic model in which it was assumed that rigid truck in the middle of the beam. A simplified model allows to synthesize the state regulator for effective vibration damping construction of the bridge in the direction of its movement. In [3] studied the fluctuations beam bridge crane. Based on Lagrange equations of the second kind mathematical model of vibrations beam with variable mass and load. The result is a schedule change flex beams at certain times.

The equations solved by numerical method. The authors [4] proposed a mathematical model to study the oscillation parameters span beams to different modes of carts and beams for areas span the length of the run. In the study takes into account impulse shock.

In [5] trymasova used a dynamic model in which assumptions that the flexible suspension of cargo replaced by elastic coupling with conventional horizontal rigidity and does not account for the gaps in the drive. The strength of the resistance movement adopted crane constant connection of the main and end beams regarded as hinge, the driving force and constant drive made no slipping wheels. Calculation of the acceleration process crane performed numerical method of Runge-Kutta.

The purpose of research is conducted dynamic analysis of bridge crane movement considering the mechanical characteristics of the electric motor mechanism for horizontal movement.

To achieve this goal it is necessary to solve the following tasks: to build dynamic and mathematical models describing the movement of the bridge crane; Depending get that characterize the transition process starting crane; analyze the results;

Results. For the study used a dynamic model chotyrymasovu bridge crane (Fig. 1):

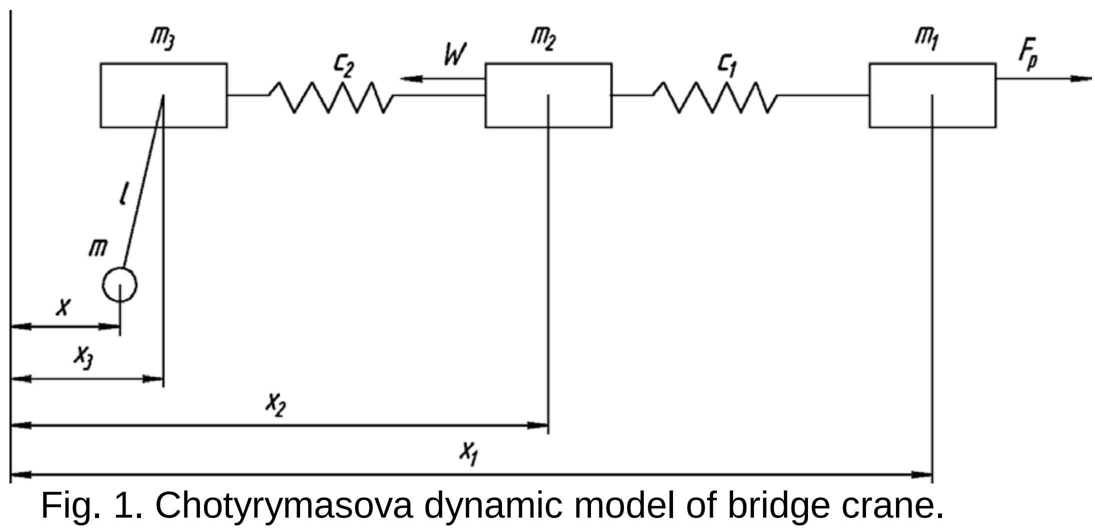

Fig. 1. Chotyrymasova dynamic model of bridge crane.

Fig. 1 shows the reduced mass m, m_1, m_2, m_3 under load, drive, end girders and beams of crane truck. Weight drive coupled with a present weight of the final beams elastic element of stiffness c_1. To drive the mass applied motive force F_p. The weight of the final beams coupled with a present mass of beams and crane trolley elastic element of stiffness c_2. By the end weight beams attached the resistance movement of the crane beam W. Present mass beam of the crane trolley load connected to the flexible element of length l. In this model, x, x_1, x_2, x_3 generalized coordinates reduced weight load, drive, end girders and beams of crane trolley respectively.

Dynamic model (Fig. 1) is described by the following system of differential equations of motion (dot over the symbol means differentiation time):

$$\begin{cases} m_1\ddot{x}_1 + c_1(x_1 - x_2) = F; \\ m_2\ddot{x}_2 - c_1(x_1 - x_2) + c_2(x_2 - x_3) = -W \\ m_3\ddot{x}_3 - c_2(x_2 - x_3) + \dfrac{mg}{l}(x_3 - x) = 0; \\ \ddot{x} - \dfrac{g}{l}(x_3 - x) = 0. \end{cases}; \tag{1}$$

Navigating rolling resistance tires on rails is determined by the following formula [6]:

$$W = k_p(m_1 + m_2)\left(f\frac{d}{2} + \mu\right)\frac{2}{D_к}, \tag{2}$$

where: m_1 - Weight of the final beams driven; m_2 - Weight of the crane beams and elektrotali; f - Coefficient of friction in the bearings running wheels; d - Diameter pin shaft (axle) tires; $D_к$ - Diameter running wheels; μ - Friction bearings; k_p - Additional resistance coefficient (determined by friction flange at the head rails and friction elements tokoz'yemnoho device).

The driving force reduced to running wheels and is calculated as follows:

$$F = M_{дв} \cdot i \cdot \eta_{пер}\frac{2}{D_к}, \tag{3}$$

where: $M_{дв}$ - Pr torque on the motor shaft; i - Gear ratio of the drive mechanism; $\eta_{пер}$ - Efficiency drive.

The torque of the engine changes Kloss formula [7]:

$$M_{дв} = \frac{2M_{мах}(1+S_{кр})}{\frac{S_{кр}}{S} + \frac{S}{S_{кр}} + 2S_{кр}}. \tag{4}$$

Glide engine:

$$S = \frac{\omega_0 - \omega_д}{\omega_0}. \tag{5}$$

The angular velocity of the motor shaft:

$$\omega_д = \frac{\pi \cdot n_н}{30}, \tag{6}$$

where: $n_н$ - rated speed of the motor shaft.

The angular velocity ideal idling:

$$\omega_0 = \frac{2\pi \cdot f}{p}, \tag{7}$$

where: f - frequency voltage motor; p - number of pole pairs of the motor.

Critical sliding engine:

$$S_{кр} = S(\lambda + \sqrt{\lambda^2 - 1}), \tag{8}$$

where: λ - Reloading ratio engine.

Maximum torque:

$$M_{\max} = M_{дв} \cdot \lambda. \tag{9}$$

Solution of differential equations (1) is made using numerical integration with the following calculated data:

$$k_p = 1{,}1;\ m = 3200\ кг;\ m_1 = 200\ кг;\ m_2 = 300\ кг;\ m_3 = 670\ кг;$$

$$f = 0{,}015;\ d = 0{,}014м;\ \mu = 0{,}003;\ D_к = 0{,}2м;\ i = 29;\ \eta_{пер} = 0{,}88;$$

$$W = 407{,}4H;\ n = 1400;\ c_1 = 96 \cdot 10^4\ H/м;\ c_2 = 69 \cdot 10^4\ H/м;$$

$$\omega_д = 146{,}33 рад/с;\ f = 50Гц;\ p = 2;\ \omega_0 = 157 рад/с;\ S = 0{,}068;\ \lambda = 2{,}3;$$

$$S_{кр} = 0{,}3;\ M_{\max} = 6{,}29H \cdot м;\ J_x = 7293см^4;$$

As a result of numerical integration of differential equations (1) describing the movement of the bridge crane received graphics that are shown in Fig. 2 - Fig. 7.

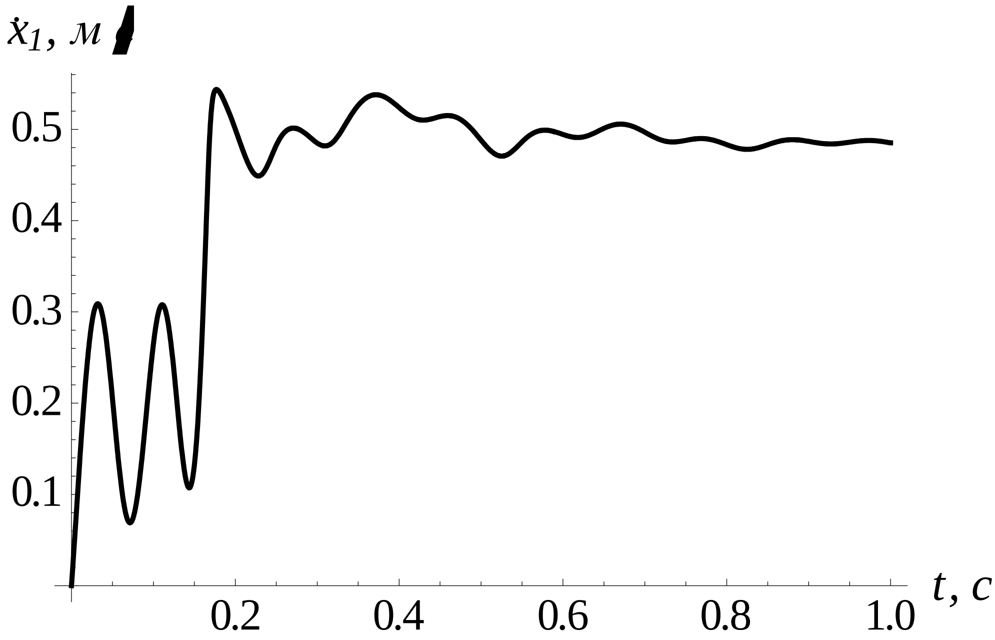

Fig. 2. Schedule changes speed drive.

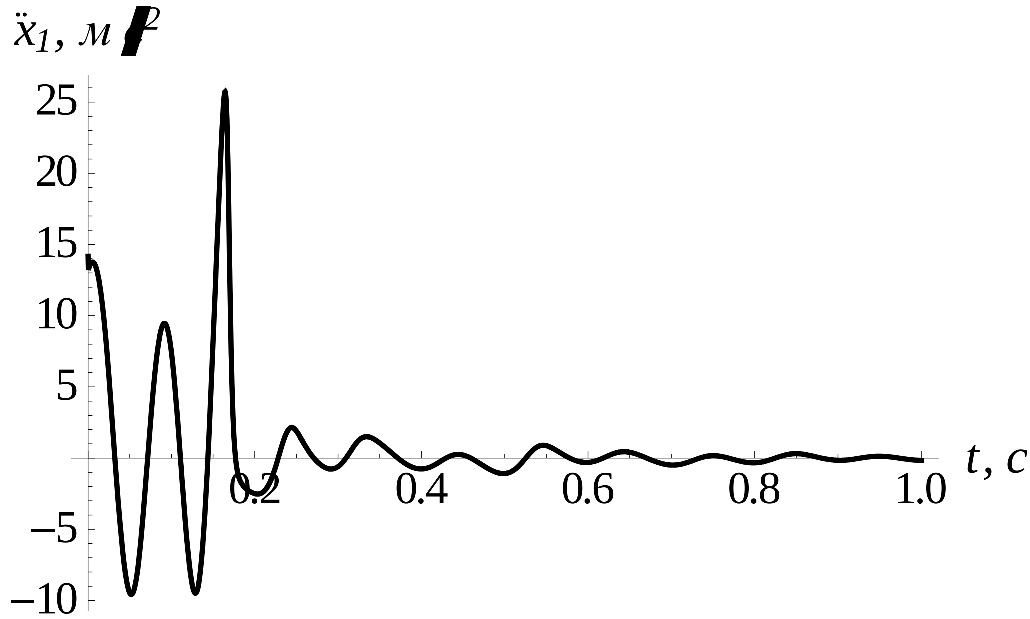

Fig. 3. Schedule changes accelerating drive.

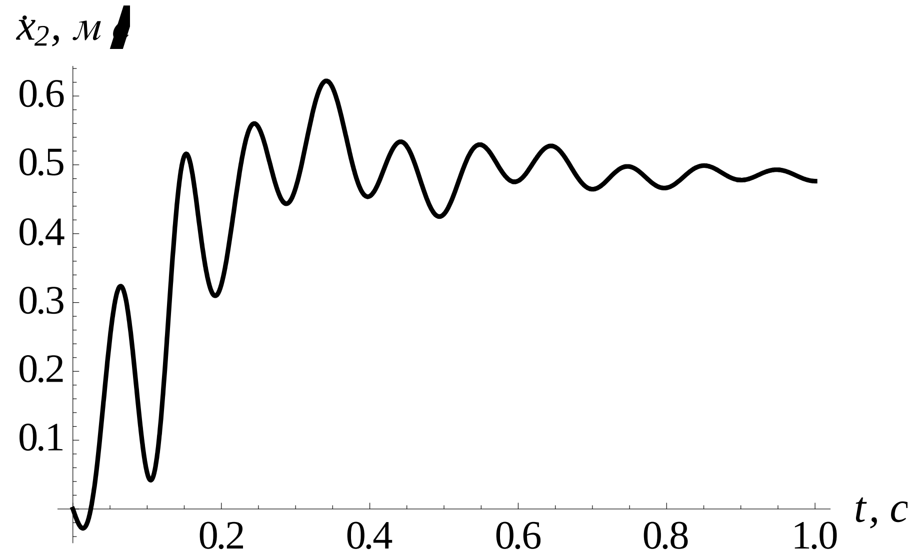

Fig. 4. Schedule change speed end-beams.

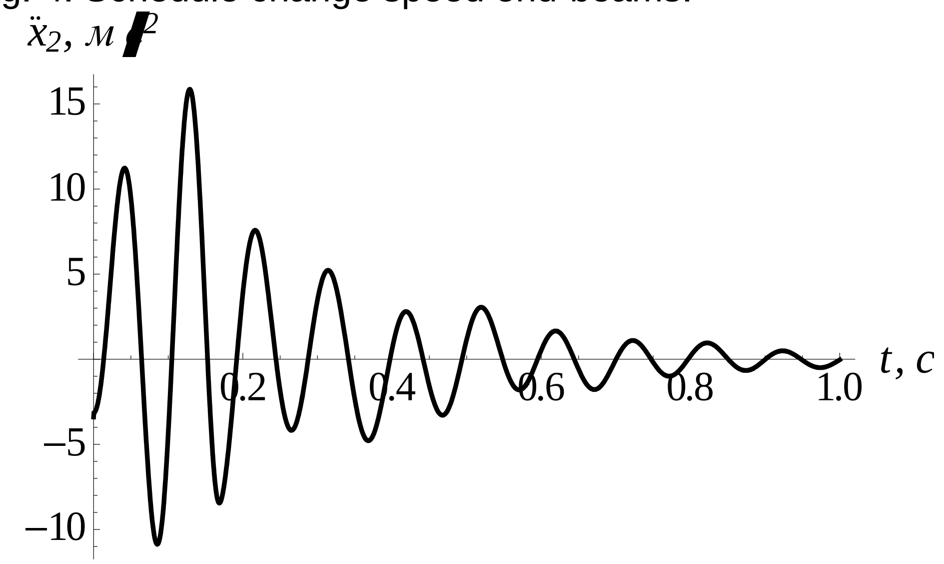

Fig. 5. Schedule changes accelerate end-beams.

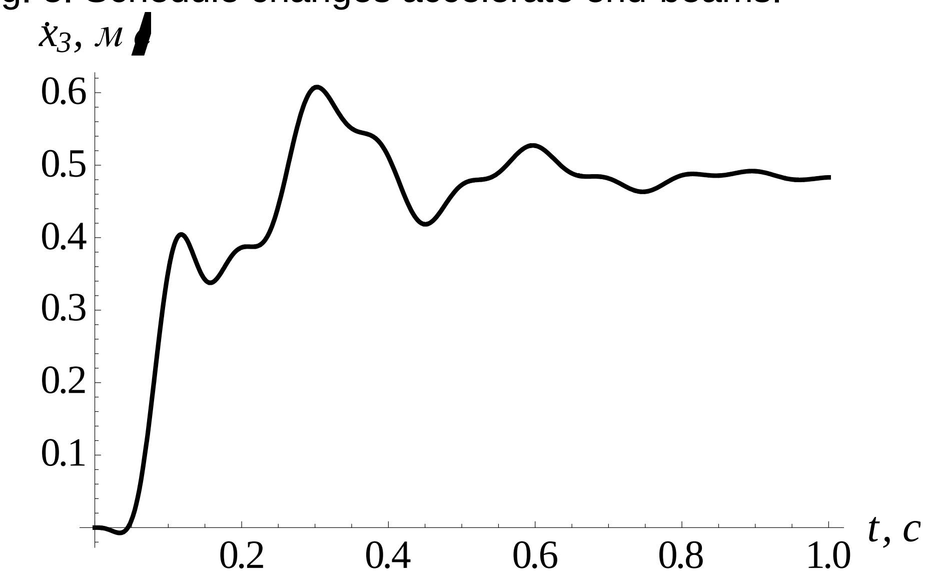

Fig. 6. Schedule change the speed of the beam bridge crane truck.

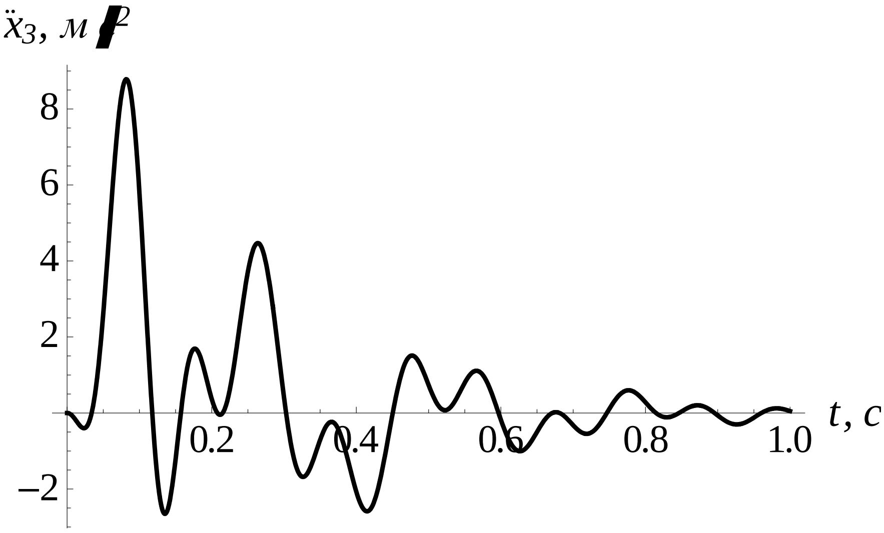

Fig. 7. Schedule changes accelerate beams of bridge crane truck.

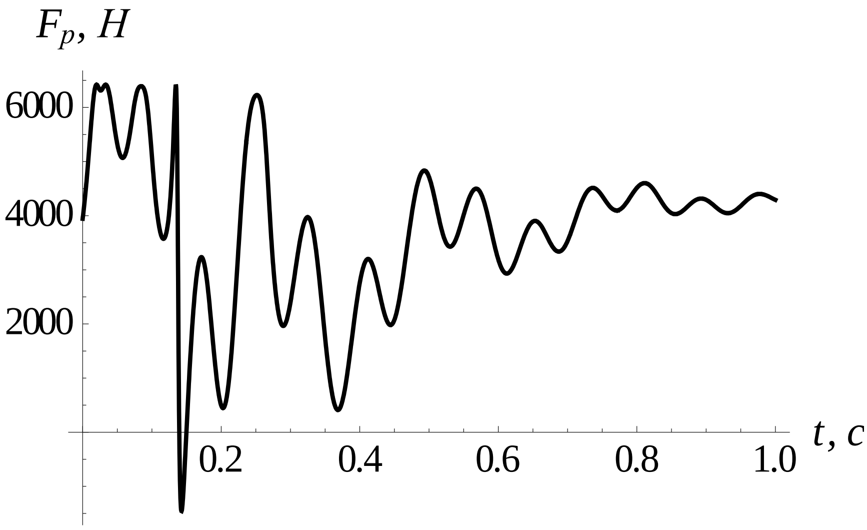

Fig. 8. Schedule changes the driving force of the crane.

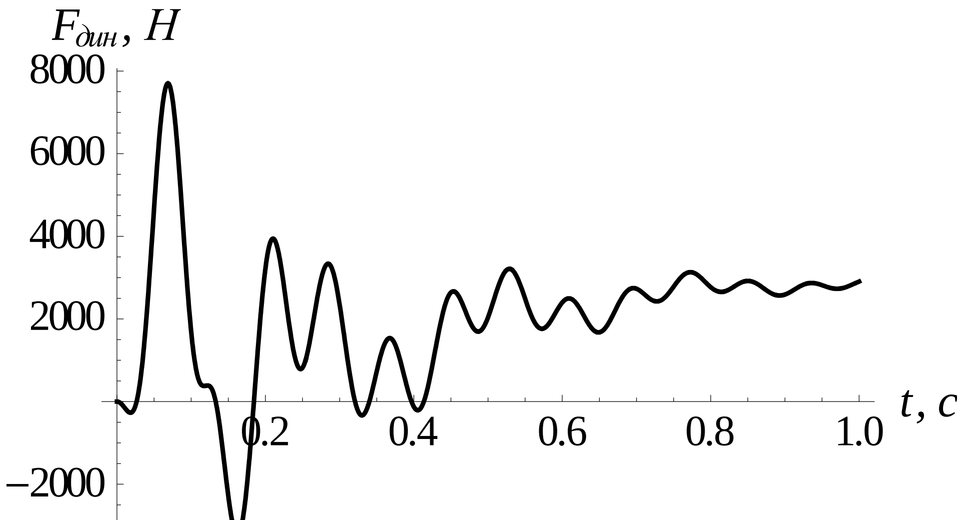

Fig. 9. Schedule changes resilient effort in the beam of bridge crane.

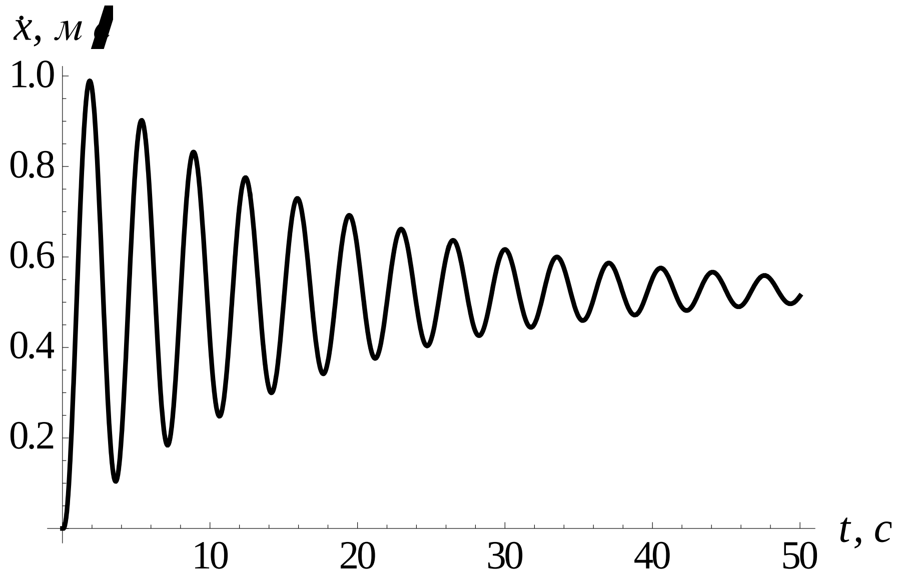

Fig. 10. Schedule changes speed cargo.

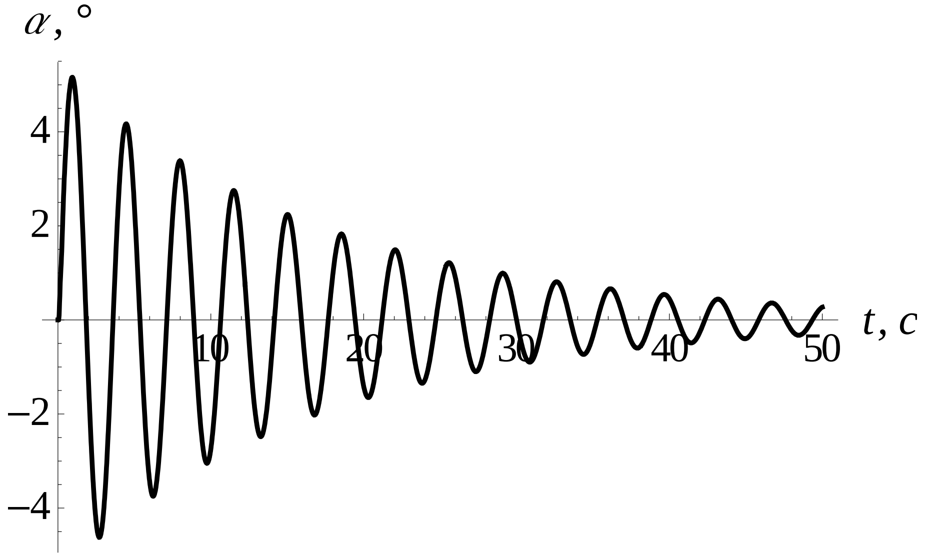

Fig. 11. Schedule changes regarding load deflection bridge beams.

Conclusions

In solving differential equations describing motion chotyrymasovoyi dynamic model obtained graphs of transient start-up overhead crane. The graphs in Fig. 2 - Fig. 7 reflect the change in velocity and acceleration of reduced mass drive end beams and bridge beams from cart transient start-up overhead crane. The graph shows that the transition process is accompanied by vibrations acceleration speed and acceleration, but the speed achieved established mechanism moving smoothly damped oscillations. The transition process is accompanied by dynamic loads, as shown in Fig. 8, Fig. 9, reflecting the change in driving force and elastic force in the beam of bridge. Also, due to the action of the electromagnetic force of the engine, changing the equation is nonlinear and Clos. Also received graphics speed fluctuations and load rejection of its center of mass relative to the beam with a cart (fig. 10, fig.

11) which shows that the peak load fluctuation occurs in the early start-up of the system and is more 4˚ and is gradually fading nature.

Eliminate fluctuations elements of construction cranes and cargo traffic early as possible by optimizing transient acceleration / braking. Optimization of the transition process will reduce dynamic loads on the metal bridge crane and improve dynamic performance crane moving mechanism.

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In the work movement analysis Dynamic wires overhead crane with uchetom mehanycheskoy characteristics of the drive mechanism of the horizontal engine SHIFT. Postavlennaya problem solutions with numerous pomoshchju yntehryrovanyya dyfferentsyalnыh equations of motion of the bridge crane. Results proyllyustryrovanы work schedule, harakteryzuyuschye perehodnыy process razhona bridge crane.

Crane, cart, Dynamic load, dynamycheskaya model matematycheskaya model Present Massa, beam crane optimization.

The paper analyzes the dynamic movement of bridge crane with mechanical characteristics of mechanized drive motor horizontal displacement. The task solved by numerical integration differential equations of bridge crane motion. The results are illustrated graphs that characterize the transition process of overclocking overhead crane.

Crane, truck, dynamic loading, dynamic model, mathematical model, reduced weight, beam crane, optimization.

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ANALYSIS METHODS controls lifting machinery

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The article analyzes modern control systems of hoisting machines. Described intelligent control algorithms lifting devices, based on the solution of inverse problem of dynamics and application of fuzzy logic. Control algorithm reduces the qualifications of operators of lifting mechanisms and allow you to move the "intelligence" of trained personnel in the control system.

Daily motion sensor, control valve, drive, feedback.

Formulation of the problem. Cranes are increasingly used in transport and construction. They are also becoming bigger, faster and higher, requiring effective management to ensure a smooth movement of goods and to meet the safety requirements. Working movement when moving the crane trolley characterized by transient modes, that is systematic accelerator and brake. At such speeds as short-term changes in the details of the mechanisms and sites to dynamic loads occurring metal that can be detected using the chosen calculation model.

In operation crane trolley with flexible suspension hanging on a load continuously moving the carrier along farms and consoles. The process of moving the trolley includes acceleration, moving from nominal speed and braking. Such transient conditions cause significant dynamic loading mechanism to drive the trolley and crane generally affecting the reliability and durability, and rocking load performance and ergonomic operation.

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Also known [1] that are observed when using cranes load pendulum oscillation, which cause irregular movement of hoisting machinery, trolley, additional load on the power elements, creating inconvenience for their operation and increase the risk of accidents.