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STATEMENT OF A PROBLEM OF A TWO-LINKED ROBOT MOVEMENT OPTIMIZATION

Y. O. ROMASEVYCH, associate professor, doctor of technical sciences,
O. G. SHEVCHUK, philosophy doctor of technical sciences,
M. R. PUNDYK, student,
K. R. PUNDYK, student
National university of life and environmental sciences of Ukraine
E-mail: pundik.kirill@yandex.ua

The first step in the statement of a problem is to describe a robot under consideration. Its scheme is presented in fig.1.

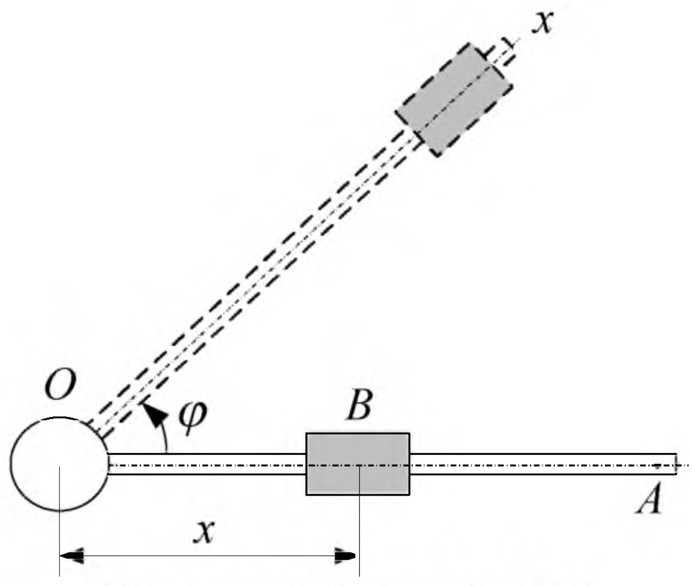

Fig.1. Scheme of the two-linked robot

Mathematical model of system motion is as follows:

$$\begin{cases} M - M_{cm} = \dfrac{d}{dt}[(J_0 + mx^2)\dot{\varphi}]; \\ F - F_{cm} = m\ddot{x} - m\dot{\varphi}^2 x, \end{cases} \qquad (1)$$

where x - the distance from the point ***O*** to the center of inertia ***B***, J_0 - the total moment of inertia ***A*** and ***B*** for the axis ***O*** (when x=0), M - torque that rotates the bodies ***A*** and ***B***; M_{cm} - static torque of resistance that impacts the rotation of the system; φ - the angular coordinate of body ***A***; F - driving force that impacts the body

B; F_{cm} - the force of static resistance that impacts the body ***B***; m - the mass of the body ***B***.

The criterion to minimize is an integral functional, which determines the weighted sum of the root mean square values of dynamic components of the driving force of the torque:

$$I_{\grave{I}} + \delta I_F = \int_0^{t_1} (M - M_{\tilde{n}\grave{o}})^2 dt + \delta \int_0^{t_1} (F - F_{\tilde{n}\grave{o}})^2 dt =$$
$$= \int_0^{t_1} ((J_0 + mx^2)\ddot{\varphi} + 2mx\dot{x}\dot{\varphi})^2 + \delta (m\ddot{x} - m\dot{\varphi}^2 x)^2 dt \to \min, \tag{2}$$

where δ - the weight that reduces the measurement of the forces to torque (Nm) and takes into consideration the significance of the RMS force minimization; t_1 – duration of the controlled mode. A dot under character denotes the derivative on time.

The next step in the statement of the optimal control problem is to write down the boundary conditions of the system movement:

$$\begin{cases} \varphi(0) = \dot{\varphi}(0) = 0, \ \tilde{o}(0) = \tilde{o}_0, \ \dot{\tilde{o}}(0) = 0; \\ \varphi(t_1) = \varphi_{t_1}, \ \dot{\varphi}(t_1) = 0, \ \tilde{o}(t_1) = \tilde{o}_1, \ \dot{\tilde{o}}(t_1) = 0, \ \varphi \in [0, \ \pi], \end{cases} \tag{3}$$

where x_0 and x_1 – the initial and the final position of the body ***B***; φ_{t_1} - the final position of the link ***A***.

The stated optimal control problem should be solved in further investigations.