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SYNTHESIS CONTROL OF TWO LINKED ROBOT

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During operation of cranes there are pendulum oscillations of cargo which cause uneven movement of load-lifting mechanisms, cargo carts, additional load on power elements, create inconvenience during their operation, and also increase the risk of emergencies. Therefore, the urgent task is to eliminate the oscillations of the load with simultaneous lifting or lowering of the load (this is how in practice reloading works experienced cranes). This will shorten the duration of the reloading cycle and will ultimately increase the efficiency of the existing crane equipment. The relevance of research in this area is also indicated by the large number of papers devoted to solving this problem.

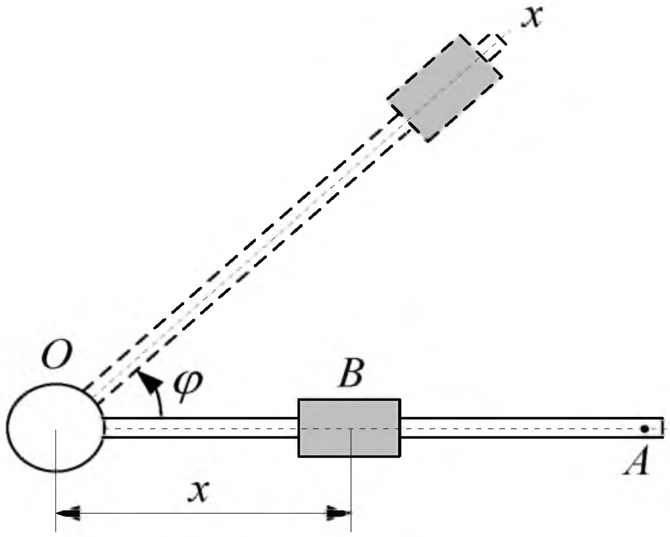

Fig. 1. Block diagram.

Consider a mechanical system on fig.1, which consists of two bodies **A** and **B**. Body **A** can rotate about the vertical axis **O**, and cargo **B** of mass **m** can move along a horizontal guide **Ox,** which is rigidly connected to body **A** and passes through the axis **O**. In the coordinate system, which is connected to point **A**, body B moves in a continuous manner. Therefore, the moment of inertia of the whole system with respect to the **O** axis is:

$$J = J_0 + mx^2, \qquad (1)$$

Where is the distance from point **O** to the center of inertia of body **B** (generalized coordinate of body motion **B**); J_0 is the total moment of inertia of bodies **A** and **B** relative to the axis **O** at $x = 0$. It is controlled by two motors, one of which creates a torque that drives the system and the other moves the body **B** along the guide **Ox**. The equations that describe the motion of a given mechanical system are represented as nonlinear differential equations:

$$\begin{cases} M - M_{st} = \frac{d}{dt}[(J_0 + mx^2)\dot{\phi}]; \\ F - F_{st} = m\ddot{x} - m\dot{\phi}^2 x, \end{cases} \quad (2)$$

Where is M the moment that drives body **A** together with body **B**; M_{st} - the moment of static resistance to the angular movement of bodies **A** and **B** relative to the axis **O**; φ - angular coordinate of rotation of body **A**;F - the driving force of the actuator acting on the body **B** is brought to the translational motion; F_{st} - the force of static resistance to body movement **B**; m - body weight **B**. A dot above a symbol indicates, as always, time differentiation.

System (2) is a model of the rotary movement of the boom crane, with body **A** playing the role of the boom along which the load **B**. The load fluctuations relative to the vertical are not taken into account here (they are either small or the load is fixed on a rigid suspension). Equation (2) can also be used to describe other mechanical systems with similar kinematics, such as robot manipulators.

How synthesize control a two-link robot:

-Optimize by single criteria;

-Complex optimization;

-Optimize of motion of mechanical systems by low order criteria;

-Complex optimization of modes of motion of mechanical systems using weights;

-Optimize of the crane cart movement according to kinematic criteria.