УДК 62-83

# ВЕРИФИКАЦИЯ ПАРАМЕТРОВ ЭЛЕМЕНТОВ С РАСПРЕДЕЛЕННОЙ УПРУГОСТЬЮ В ЛАБОРАТОРНЫХ УСЛОВИЯХ

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At present due to the increased performance demands of industrial plants, requirements for automated control of electric drives also increase. This is through the means of the automated electric drive which in most cases can be the most rational way to solve the problem of formation of transient and control system coordinates.

For extraction of mineral resources located at great depth, the most appropriate is the mining closed method. For these purposes the rope hanging mine hoisting installations for cargo delivery are used. With considerable lift heights elastic properties of suspended cables are revealed. When operating such plants the regimes in which the vibrations of elastic elements reach unacceptable amplitude which can cause accidents, may occur.

Synthesis of control systems of electric drives with elastic bonds is a more complicated task than the synthesis of drives control systems with a single-mass electric design scheme. Additional difficulties are caused by inequality of velocities of the drive unit and the servo element, and the need to develop the control effect on the drive for vibrations damping.

In the synthesis of control systems of the electric mine hoist installations to date there exist still many unresolved issues. In this case, in order to achieve high degree of quality control it is necessary to use adaptive control systems that are able to manage the electric drives as the parameters of the system in operation alter.

Of particular interest is the formation of the transient start-up of a mine hoist when one of the tanks filled with cargo is in the downward position.

The characteristic feature of these systems (figure 1) is the inability to measure directly the rate of the container being lifted to build a closed system of automatic control on a given coordinate. In connection with the given circumstances there is a need to use either monitoring encoder or control methods that do not require the rate feedback of the servo element. This feature provides a control means based on the applications of additional parallel correction devices [1].

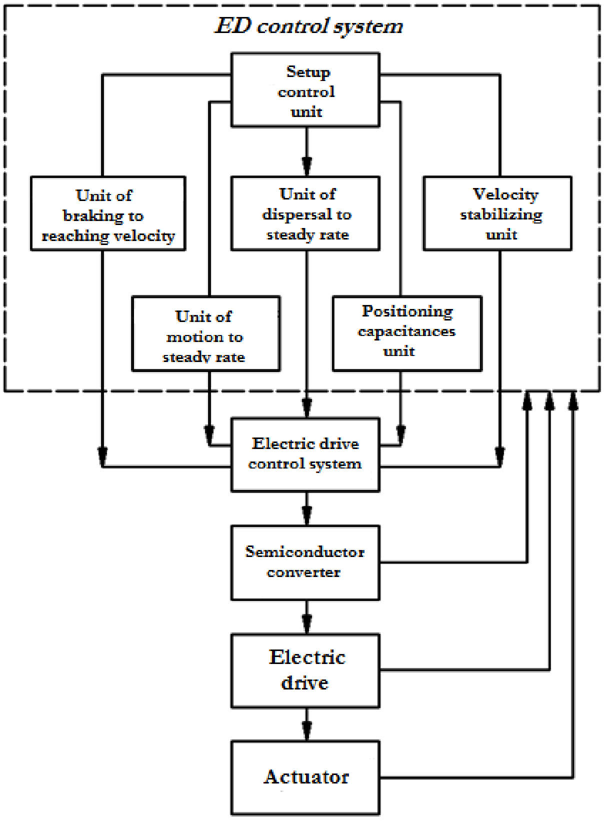


Fig. 1. Automated electric drive control system

Under this circumstance the research focuses on the definition of the applications sphere of controlling ways above stated. The area of applications is determined based on the lifting height and requirements for electric drive control systems.

In most calculations the structural schemes of electric drives with elastic elements are represented as two-mass or three-mass models. However, with a lifting height of more than 1000 meters, there appears the effect of resonance frequencies of the higher orders on the dynamics of the system. In this case to obtain a mathematical model most adequate to a real object it is necessary to consider the distribution of the elasticity and masses along the extended elements. For this purpose one has to make a transition to systems of partial differential equations [2].

To determine the area of applications of controlling ways being examined it is necessary to obtain a reliable mathematical description of the elements with distributed parameters suitable for modeling the behavior of electric drive systems in the time domain. For modeling purposes the approximation of transcendental transfer functions is carried out [3]. Of great importance are the simulation control systems with additional correction devices under condition of distributed parameters in the scheme of the mechanical part of the drive while the synthesis of such systems is based on the fact that the system parameters are concentrated. Therefore, the current research is aimed at verifying the mathematical description of the line element with distributed elasticity included in the kinematics of mine hoist installations. During the verification the correspondence between calculated and experimental logarithmic amplitude-frequency characteristics of the transfer function of the examined element from force to velocity is being investigated. The research work is held in a laboratory with a specialized installation simulating the behavior of extended elastic elements.

The laboratory installation at the Chair of Automated Electric Drive and Industrial Installations allows us to obtain logarithmic amplitude-frequency characteristics of the conditionally motionless line element with distributed elasticity. It represents a spring of several meters long located in a horizontal plane to provide the conditions for neglecting the static load in the electric drive. The static load is not considered in the mathematical calculations due to the fact that the hoisting systems being examined at the initial time are considered statically balanced.

The preliminary laboratory research has shown an adequate level of compliance with the experimental characteristics calculated within a selected range. In future it is supposed to improve the laboratory installation with a view to enhance the measurement accuracy of the input frequency and coordinates oscillation amplitude of an element with distributed elasticity. It is also necessary to provide an advanced system of frequency stabilizing the input impact when operating in low frequency range.

In order to draw a conclusion on the applicability of the mathematical descriptions of the object for modeling and synthesis of automatic control of electric drives it is necessary to obtain experimental characteristics of the element with distributed elasticity with different values of propagation velocity of elastic longitudinal strain wave and different values of the concentrated masses.

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