

Optimization of dynamic processes of the belt conveyor hydraulic drive with the control device

Leonid Polishchuk, Oleh Piontkevych, Mykola Burdeinyi, Oksana Adler, and Dmytro Lozinskyi

Vinnytsia National Technical University

aleo.polishchuk@gmail.com, bpiontkevych@vntu.edu.ua, c1m.14b.burdeinyi@gmail.com,

doksana_adler1983@ukr.net, elozinskiy_dmitriy@ukr.net

ABSTRACT

The peculiarities of the operation of technological machines affect the design parameters and dynamic processes of hydraulic drives. For example, the conditions of variable load during the operation of the hydraulic drive of a belt conveyor lead to significant problems in its dynamics or even to a complete stop. Therefore, research aimed at optimizing the static and dynamic characteristics of the hydraulic drive, calculating the parameters for the control device, as well as its three-dimensional modeling are urgent tasks. Possible methods for optimizing transient processes are considered. Under overload conditions for the hydraulic drive, the linear programming method is chosen to optimize transient processes. The schemes of the hydraulic drive and the control device for the belt conveyor are developed and described. The minimum value of the complex optimization criterion is found, which allows choosing rational parameters of the control device. A three-dimensional model of the control device is simulated based on the found rational parameters.

KEYWORDS: optimization; hydraulic drive; belt conveyor; control device; mathematical model/

Introduction

The primary type of drive for the executive units of mobile machines and complexes is hydraulic, which provides quite extensive functional capabilities with relatively small dimensions and metal consumption. The development of hydraulic drives based on new or improved hydraulic equipment with optimized dynamic processes to improving both the technical indicators and the efficiency and productivity of these machines [1, 2].

Methods and Materials

This section covers the transition from fundamental scheme of the hydraulic drive with the control device for the belt conveyor to describing its mathematical models in MATLAB Simulink software package.

The next function, supplying power to the mechanical system during overload, is provided by switching the spool of the second stage.

Research Results

Let's consider the optimization of dynamic processes based on static and dynamic characteristics in the hydraulic drive according to the results of mathematical modeling. The load on the belt conveyor will increase from the nominal mode of 5 kN·m to the overload mode of 11 kN·m.

Modeled dynamic processes in the conveyor belt hydraulic drive under adverse static and dynamic characteristics within this range of

pressure p_n in the pumping hydraulic line and rotational velocity $d\phi/dt$ of the hydraulic motor shaft are shown in Fig.

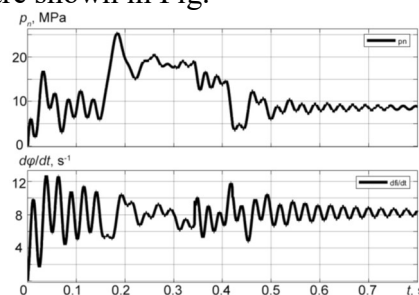


Fig. Adverse dynamic processes within the pressure p_n in the pumping hydraulic line and the rotational velocity $d\phi/dt$ of the hydraulic motor shaft

Conclusions

The aim of optimizing the dynamic processes of the belt conveyor hydraulic drive through the selection of rational control device parameters has been achieved. The results and methods of scientific research on hydraulic drives of conveyors with various technological purposes have been analyzed, and the main directions for solving the set tasks have been identified.

References

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