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Effective Conveyor Belt Control Based on the Time-Of-Use Tariffs

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Abstract. The paper proposes a method for constructing an algorithm for the speed control of a conveyor belt, based on the change in the price of electricity during the day. The analysis of methods for improving the energy efficiency of conveyor-type distributed transport systems is carried out. The influence of the uneven distribution of material along the transportation route on the cost of transportation of a unit weight of the material is demonstrated. The advantages of using Time-Of-Use (TOU) tariffs when designing belt speed control systems for long conveyor systems are considered. The TOU periods with peak, standard and low energy consumption depending on time are presented in detail, as well as the values of the tariff coefficients for the TOU periods. The dependence of the value of the tariff coefficient on time is an essential factor that must be taken into account when designing control algorithms. When developing the control algorithm, it was assumed that the resistance to motion in accordance with DIN 22101 is determined on the basis of the primary friction coefficients. To describe a separate section, an analytical model of the conveyor in a dimensionless form was used. The problem of constructing an optimal algorithm for controlling the speed of a conveyor belt for a steady-state is formulated. The criterion of the quality of the control process in the conditions of using a constant amount of electricity during the day has been determined. The Pontryagin function and the conjugate system of equations are written, taking into account the uneven distribution of material along the transport route.

Keywords: transport conveyor, distributed transport system, energy management, conveyor belt speed control, transport delay, the uneven distribution of material.

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