УДК 62-83:681.51

HEIGHT ADJUSTMENT OF THE CABIN STOP OF THE TWO-SPEED ELEVATOR ACCORDING TO THE LOAD IDENTIFICATION METHOD

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Abstract. *Modern elevators are equipped with high-tech equipment that provides comfort of interfloor movement and high safety. Smoothness is achieved through, the use of frequency converters in elevator control systems. At the same time, a fairly large percentage of elevators operated in Ukraine use conventional two-speed asynchronous motors and outdated control system. That is why the improvement of control systems and replacement of obsolete equipment with new ones, to ensure safe inter-floor transportation, is relevant for Ukraine.*

Constant development and improvement of modern means of transport in buildings and structures requires the application of new technical solutions to improve the efficiency and cost-effectiveness of the use of equipment. A lot of attention is paid to the reliability and safety of the use of equipment when developing new elevators [1]. The main task of upgrading outdated elevators is that the updated equipment meets the high technical requirements and does not give way to its parameters of the new kit, but significantly save money. Thus, the development of new passenger elevators and improvement of the quality of existing elevators is relevant not only in Ukraine but also in other countries [2]. This study offers one of the options for solving the problem of modernization for two-speed elevators, by making small changes to the control system, which does not require large material costs.

The aim of the work is to increase the accuracy of height adjustment of the cabin stop of the two-speed elevator according to the load identification method.

To achieve this goal, the following tasks were solved: development of a simulation model of the elevator, confirmation of the adequacy of the computer model to the physical laboratory bench, to increase the accuracy of its positioning according to the load identification method.

Thanks to the research conducted in previous works, a mathematical model of the elevator with parameters corresponding to the present system was developed. The results of the calculations were compared with laboratory studies, during which a stand simulating an elevator was developed [3]. It is proved that the simulation model of the elevator, which was created in the environment of Matlab Simulink, can be used to study the real control system of a two-speed elevator (Fig. 1).

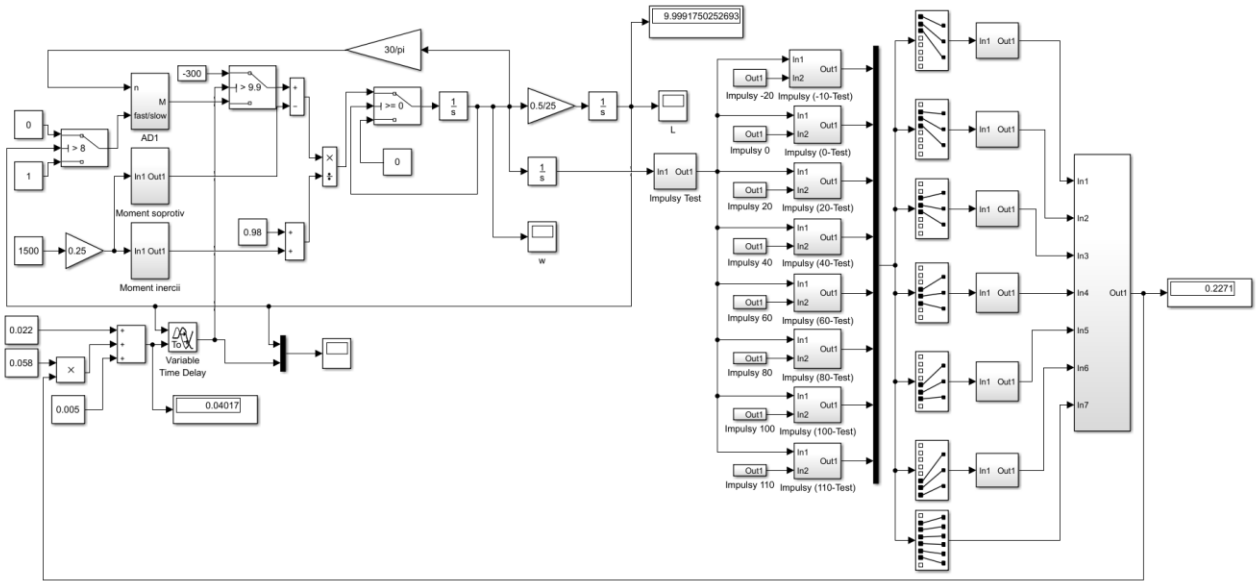

Figure 1. Simulation model of the elevator

The calculations are as follows. At the beginning of the movement of the cabin on the transients is determined by the approximate degree of loading of the cabin. The more the cab is loaded, the slower the transition. After mathematical processing of the obtained results, the system compares the latter with a set,

conditionally, standard, which are calculated specifically for a particular elevator and are in the memory of the controller. Finding the largest number of matches, the system selects the braking algorithm according to the selected load. Namely, the required braking time is determined, the delay and the moment of brake application are adjusted. The simplicity of the method allows the use of inexpensive equipment, which saves a lot of money, but the system increases energy efficiency and increases transportation safety.

For comparison, a simulation was conducted in which there was no feedback from the calculated boot load level. In this case, when calculating the start time of braking, the average value of the load rating was chosen 50%.

Before starting the simulation, the weight of the load is set, which is conventionally located in the cabin. This operation allows to simulate the real weight of a person (several people) in the elevator cabin. After running the simulation in the initial time of the cabin movement the percentage of loading degree is calculated by the method previously developed. The obtained value falls into the system of calculating start time of braking, thereby adjusting the height of the cab stop [4].

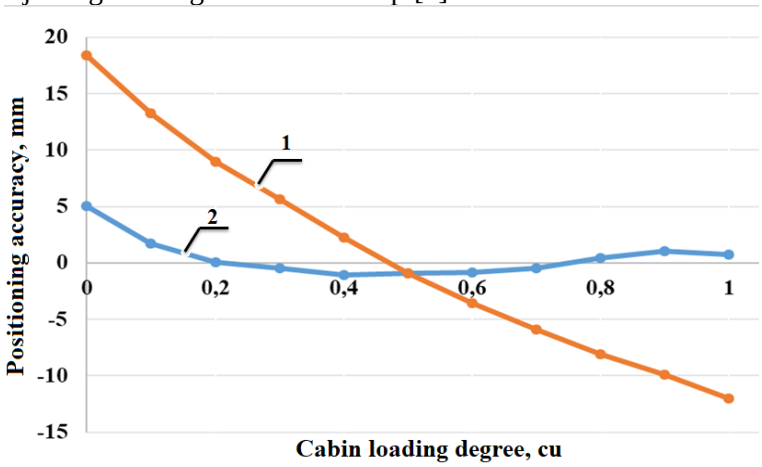

Figure 2. Dependence of position accuracy on the loading degree

For the sake of graphic representation, the dependencies of position accuracy on the loading degree by applying the load-line identification method (line 2) and using a constant value of 50% of the loading degree (line 1) for calculating the start time of braking (Fig. 2).

CONCLUSIONS

As a result of calculations and mathematical modeling, it was proved that the loading degree of the cabin affects the speed characteristics of the elevator, as well as the error of the height of the stop of the cabin from a given position. The obtained dependence of the stopping error on the loading degree of the elevator car, allows sensors to automatically determine the loading degree of the car, the required braking and stopping time, which allows to increase the accuracy of positioning of the elevator. Based on the experiments conducted on the mathematical model, it is determined that the developed method of identifying the loading degree of the elevator allows to increase the accuracy of its positioning to ± 5 mm (without using the method of positioning accuracy ± 18 mm) by changing the time the beginning of braking.

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