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MODELING OF COUPLED ELECTROMECHANICAL AND THERMAL PROCESSES IN A LINEAR PERMANENT MAGNET MOTOR BASED ON THE MULTIPHYSICS CIRCUIT THEORY

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Abstract

The paper presents a computer multiphysics model that has been developed for calculating the related electrical, mechanical, and thermal processes in a linear permanent magnet motor for two-mass vibration system. The model is based on the theory of multiphysics circuits, in the framework of which for each of the indicated physical processes its own equivalent circuit is built, and all of them are combined into a single model that carries out the connection between all these circuits. According to the results of calculating the motor starting mode and reaching a stable thermal mode, it is shown that the transient thermal process for the motor lasts more than 2 hours of operation, and at the same time its most heated element – the winding, is heated to a temperature of more than 130° C. The application of the developed multiphysics model allows one to predict the electromechanical and thermal characteristics of the motor when using various cooling systems – natural cooling, forced cooling using air or liquid, both in transient and steady-state operation modes. References 8, figures 7.

Key words: electromechanical and thermal processes, linear permanent magnet motor, mechanical circuit, thermal circuit, two-mass vibration system.

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