ELECTROMECHANICAL PROCESSES IN INDUCTION-TYPE MAGNETIC LEVITATION

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Magnetic levitation allows for qualitative improvements to existing technologies and finds applications in transportation, aerospace, chemical, biomedical engineering, and other fields of science and technology.

Electromechanical processes in one-dimensional magnetic levitation of the induction type are considered, in which a fixed inductor is connected to a high-frequency voltage source, and a coaxially mounted conductive armature can move along only one spatial coordinate. A mathematical model of levitation is considered, in which the armature moves strictly vertically relative to a fixed inductor. To describe the processes of magnetic levitation, we use electrical circuits with lumped parameters of the inductor and armature. To take into account the interconnected electrical, magnetic, mechanical and thermal processes, the solutions of the equations describing the mentioned processes are presented in a recurrent form [1, 2].

Using a mathematical model describing induction-type magnetic levitation, the influence of the frequency of the alternating current source and the parameters of a multi-turn short-circuited armature on the electromechanical processes that occur during start-up was established. It was shown that due to the phase delay of the induced armature current with respect to the inductor current, at certain moments of their period, both a lifting and downward electrodynamic force acting on the armature arise. The total force acting on the armature, due to the electrodynamic component, is of alternating sign, which causes pulsations in its speed. When magnetic levitation is started, an oscillatory electromechanical process arises, which is established after 1 s. The results of experimental studies on the levitation of an aluminum disk with an attached load with an accuracy of up to 10% coincided with the calculated results obtained using the proposed mathematical model. The proposed magnetic levitation can be used in high-precision ballistic gravimeters, in the vacuum chamber of which the optical angular reflector of the measuring system of the Michelson laser interferometer moves freely in the Earth's gravitational field, it can reduce autoseismic oscillations [3].

Literature:

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