Experimental Consideration on Vibration Suppression Control of a Magnetically Levitated Thin Steel Plate Using Sliding Mode Control

by

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Abstract

We have proposed a magnetic levitation control system for a sheet steel and confirmed the realization by digital control experiment. However, because of the strong nonlinearlity of the attractive force of an electromagnet and various uncertainties in circuit current such as changes in resistance due to the heat generation of the electromagnet, the stability of levitation is not sufficiently ensured. As one of the effective control methods for solving this problem, sliding mode control, which enables easy handling of nonlinear models, is attracting attention, and an attempt to use this sliding mode control in electromagnetic bearing control has been reported. In this study, we aim to develop a noncontact support system for thin steel plates with high robustness using sliding mode control, which is tolerant to factors such as disturbance with respect to control signals and the external force of the system. We applied a 1-degree-of-freedom model and a continuous model for the modeling of sheet steel. Then, experiments were carried out under several conditions, and the obtained results were compared with the optimal control results. As a result, it was verified that the suppressive effect of the sliding mode control on disturbance is sufficient and the application of the continuous model enables the construction of a system with robustness to the disturbance of the external force.

Keywords: Steel Plate, Electromagnetic Levitation, Disturbance, Elastic Vibration, Continuous Model, Optimal Control, Sliding Mode Control

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