Nonlinear Dynamics and Control in a Magnetic Levitation System

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ABSTRACT
This study verified chaos motion of a magnetic levitation system with a ferromagnetic ball suspended in a voltage-controlled magnetic field and then elucidates a system for chaotic control. The detailed dynamic behaviors are numerically investigated by Poincare maps, phase portraits, time responses and frequency spectra. The simulation results reveal that, due to the realistic nonlinear characteristics of magnetic forces, chaos results from period-doubling bifurcation. The largest Lyapunov exponent analysis is also used to identify the onset of chaotic motion. Finally, the proposed technique is applied in a chaotic magnetic levitation system by adding an external input, called a dither signal, to the system. Simulation results confirm the feasibility of the developed approach.

Keywords: chaos, bifurcation, Lyapunov exponent, dither

REFERENCES