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Author Ying-Hsien Li
Author's Email Address No Public.
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Abstract
The requirements of high speed and high accuracy become more demanding in the trend of industry development. Positioning systems of high accuracy and great tracking performance, such as X-Y stages in wafer transportation, play an important role therewith. Such a system can be realized by a magnetic levitation (maglev) stage, driven by voice coil motors (VCM). The magnetic levitation endows it with the contact-free characteristics, which makes it suitable in clean room and vacuum operation. Nevertheless, the controller used must be robust enough in the presence of uncertainties. Therefore, we first build a model of a dual-axis maglev system, for which we design a suitable controller to meet the requirements of high tracking performance. Both backstepping method and sliding mode control are used for comparison. Finally, direct adaptive control laws are implemented into either controller to ensure sufficient robustness to parameter variation. Convergence is guaranteed since every controller is derived using the Lyapunov stability theorem. The MATLAB simulation demonstrates that the dual-axis maglev system settles very fast with negligible errors for arbitrary trapezoidal trajectories using any of the proposed adaptive controllers.
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