High Precision Motion Control of Linear Motor Drive Systems Using Intelligent Cross-Coupled Control

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ABSTRACT

This thesis proposes supervisory FLS control for the trajectory tracking of gantry type permanent magnet linear synchronous motor (PMLSM) systems. Although the adaptive fuzzy logic control (FLC) with adaptive laws assures system stability, the learning procedure degrades its transient performance in the presence of uncertainties. The sliding-mode control (SMC) uses discontinuous control to compensate the bounded uncertainties. Nevertheless, this enhances the chattering. In order to overcome their drawbacks and take merits of the adaptive FLC and the SMC, a supervisory control law is proposed to integrate the adaptive FLC and the SMC by using a modulation function based on tracking errors. Simulations and experiments performed on a two-axis PMLSM system for different trajectory contours and loads demonstrate the effectiveness of the proposed control methodology, and its superiority is validated in comparison with the conventional PID control. The experimental setup is comprised by a host computer, MRC-6810 servo control cards, Cornet motor drives and a two-axis gantry type PMLSM. The MATLAB software is run for simulations, and the proposed control algorithm is implemented using the Microsoft Visual C + +.

Keywords : Permanent Magnet Linear Synchronous Motor (PMLSM)、Supervisory control、Adaptive FLC、Sliding-mode control (SMC)

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