Intelligent position tracking control for LCM drive using stable online self-constructing recurrent neural network controller with bound architecture

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Abstract

In this paper, an intelligent position tracking control (IPTC) is developed for a linear ceramic motor (LCM) drive system. The IPTC system is comprised of a neural controller and a robust controller. The neural controller utilizes a self-constructing recurrent neural network (SCRNN) to mimic an ideal computation controller, and the robust controller is designed to achieve tracking performance with a desired attenuation level. If the approximation performance of SCRNN is insufficient, SCRNN can create new hidden neurons to increase the learning ability. If the hidden neuron of SCRNN is insignificant, it should be removed to reduce the computation load; otherwise, if the hidden neuron of SCRNN is significant, it should be retained. Moreover, the adaptive laws of controller parameters are derived in the sense of Lyapunov, so system stability can be guaranteed. Finally, the experimental results of the LCM drive system show a perfect tracking response can be achieved using the self-constructing mechanism and the on-line learning algorithm.

Keyword：Adaptive control, recurrent neural network, on-line self-structuring, Lyapunov stability, linear ceramic motor