Adaptive growing-and-pruning neural network control for a linear piezoelectric ceramic motor

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Abstract

In this paper, an adaptive growing-and-pruning neural network control (AGPNNC) system is developed for a linear piezoelectric ceramic motor. The AGPNNC system is composed of a neural controller and a robust controller. The neural controller uses a self-constructing neural network (SCNN) to mimic an ideal computation controller, and the robust controller is designed to achieve tracking performance with desired attenuation level. If the approximation performance of the SCNN is inadequate, the SCNN can create new hidden neurons to increase learning ability. If the hidden neuron of the SCNN is insignificant, it should be removed to reduce computation loading; otherwise, if the hidden neuron of the SCNN is significant, it should be retained. Moreover, the adaptive laws of controller parameters are derived in the sense of Lyapunov function and Barbalat's lemma; so the system stability can be guaranteed. Finally, experimental results show that a perfect tracking response can be achieved using the self-constructing network mechanism and the on-line parameter learning algorithm.

Keyword： Adaptive control, neural network control, self-constructing, linear piezoelectric ceramic motor.