Self-organizing adaptive fuzzy neural control for a class of nonlinear systems

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Abstract

This paper proposes a self-organizing adaptive fuzzy neural control (SAFNC) via sliding-mode approach for a class of nonlinear systems. The proposed SAFNC system is comprised of a computation controller and a supervisory controller. The computation controller including a self-organizing fuzzy neural network (SOFNN) identifier is the principal controller. The SOFNN identifier is used to online estimate the controlled system dynamics with the structure and parameter learning phases of fuzzy neural network, simultaneously. The structure learning phase possesses the ability of online generation and elimination of fuzzy rules to achieve optimal neural structure, and the parameter learning phase adjusts the interconnection weights of neural network to achieve favorable approximation performance. The supervisory controller is used to achieve the -norm bound tracking performance with a desired attenuation level. Moreover, all the parameter learning algorithms are derived based on Lyapunov function candidate, thus the system stability can be guaranteed. Finally, simulation results show that the SAFNC can achieve favorable tracking performances.

Keyword：adaptive control, sliding-mode control, fuzzy neural network, rule generation, rule elimination