Fuzzy-neural sliding-mode control for DC-DC converters using asymmetric Gaussian membership functions

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Abstract

A fuzzy-neural sliding-mode (FNSM) control system is developed to control the power electronic converters. The FNSM control system is comprised of a neural controller and a compensation controller. In the neural controller, an asymmetric fuzzy neural network is utilized to mimic an ideal controller. The compensation controller is designed to compensate for the approximation error between the neural controller and the ideal controller. An on-line training methodology is developed in the Lyapunov sense, thus the stability of the control system can be guaranteed. Finally, to investigate the effectiveness of the FNSM control scheme, it is applied to control a PWM-based forward DC-DC converter. Experimental results show that the proposed FNSM control system is found to achieve favorable regulation performances even under input voltage and load resistance variations.

Keyword：converter, asymmetric Gaussian membership function, fuzzy neural network, adaptive control, sliding-mode control