Adaptive wavelet neural controller design for a DC-DC power converter using an FPGA chip

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Abstract

The DC-DC power converters are widely used; however, the controller design for the DC-DC power converters cannot easily design if the load dynamics vary widely. This paper proposes an adaptive wavelet neural control (AWNC) system for a forward DC-DC power converter. The proposed AWNC system is composed of a neural controller and a robust controller. The neural controller uses a wavelet neural network to online mimic an ideal controller and the robust controller is designed to cope with the approximation error between the neural controller and the ideal controller. A proportional-integral (PI) type parameter tuning mechanism is derived based on the Lyapunov stability theory; thus not only the system stability can be guaranteed but also the convergence of the tracking error can be speeded up. Finally, a comparison among the PI controller, the fuzzy controller, the adaptive neural fuzzy control, the adaptive neuro-wavelet control and the proposed AWNC is made. The experimental results show that the proposed AWNC system is robust with regard to different input voltages and load resistance variations.

Keyword：adaptive control; robust control; sliding-mode control, wavelet neural network; DC-DC power converter.