FPGA-based intelligent power regulator IC design for forward DC-DC converters

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Abstract

The DC-DC converters are used extensively in personal computers, computer peripherals, and adapters of consumer electronic devices to provide a fixed dc voltage. From the control viewpoint, the controller design must cope with their wide input voltage and load resistance variations to ensure the stability in any operating condition while providing fast transient response. For many years, the control approaches for the DC-DC converters are limited to PI controller structures. However, it gives the overshoot in output voltage as the rise time of response is reduced. To tackle this problem, an adaptive recurrent fuzzy neural network control (ARFNNC) system is developed. The proposed ARFNNC system is comprised of a neural controller and a compensate controller. The on-line adaptive laws of the proposed ARFNNC scheme are derived based on the Lyapunov stability theorem, so that the stability of the system can be guaranteed. Finally, the hardware implementation of the ARFNNC scheme is developed on a field programmable gate array (FPGA) chip in a real-time mode. Experimental results show the proposed ARFNNC scheme can achieve good regulation performances.

Keyword：DC-DC converters; FPGA chip