FPGA-implemented adaptive RCMAC design for BLDC motors

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Abstract

This paper proposes an adaptive RCMAC system for a brushless DC (BLDC) motor. This control system is composed of a recurrent cerebellar model controller (RCMAC) and a compensation controller. RCMAC is used to mimic an ideal controller, and the compensation controller is designed to compensate for the approximation error between the ideal controller and RCMAC. The Lyapunov stability theory is utilized to derive the parameter tuning algorithm, so that the uniformly ultimately bound stability of the closed-loop system can be achieved. The stability analysis shows that the output of the system can exponentially converge to a small neighborhood of the trajectory command. Then, the developed adaptive RCMAC system is implemented on a field programmable gate array (FPGA) chip for controlling a brushless DC motor. Experimental results reveal that the proposed adaptive RCMAC system can achieve favorable tracking performance for the brushless DC motor control.

Keyword：Adaptive control; Recurrent CMAC; Uniformly ultimately bound stability; Brushless DC motor, FPGA