Development of a Hybrid Current Controller for Electric Motor Drives

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Abstract

The current control uses the principle of hysteresis or pulse width modulation (PWM) techniques to enforce the commanded current into machine windings with very little error both in phase and magnitude from their command values. Both these techniques have strong advantages and disadvantages. A combination of their advantages such as the fast speed of response of the hysteresis with that of the frequency limitation of the PWM and elimination of the disadvantages such as the high switching requirement of the hysteresis and the unnecessary switching of the PWM even when the current has not reached its command level, could result in an ideal current control technique. Such a technique, referred hereafter as hybrid current control technique is explored in this paper for electric motor drives from the viewpoints of its advantages, disadvantages, its applicability to various motor drives, its impact on the converter losses and hence on the thermal design, its effect on the speed of response of the current loop, and the resulting complexity in implementation for systems with and without inner current loop control. Applications of the proposed hybrid controller would be cited and its experimental verification on a switched reluctance motor (SRM) drive is presented to correlate the key claims in the paper.

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