Induction motor fault detection based on multi-sensory control and wavelet analysis

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Abstract:

Detection and fault-tolerant control (FTC) of faults in the early stage is desirable in improving efficiency. An implementation strategy is proposed for the individual controllers that work collectively in induction motor (IM) drive by interswitching from one form of a control strategy to another. The interswitching occurs between voltage by frequency (V/f) open-loop control, closed-loop (V/f) control, sensorless vector control and sensor vector control. Optimal performance capabilities are attained with vector control, whereas V/f is a setup that is affordable but with increased speed. In this study, the faults are open and short circuits winding faults, speed sensor failures and stator winding faults. When the severity of the fault is high, an embedded protection entity interrupts the motor. Daubechies 10 wavelet is used due to its significant vanishing moments compared to the other types of Daubechies as fault index with the stator current of 1 kW IM. A novel enhanced model reference adaptive system is employed for sensorless vector control to assess the motor speed. Both the simulation and experiment (using the F28335 DSP controller) indicate that the framework is effective in detecting the fault, ensuring the robustness of the FTC scheme and proving the effectiveness of the proposed algorithm.