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DTC-SVM Sensorless Control of Five-Phase Induction Motor Based on Two Different Rotor Speed Estimation Approaches

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Abstract: This paper deals with the study and analysis of the five-phase induction motor (FFIM) sensorless control based on the combination of the direct torque control (DTC) technique and the space vector modulation (SVM) technique. Indeed, this sensorless control applied to the FFIM is achieved using two different rotor speed estimation approaches. The first approach is based on the adaptive flux and speed observer for ensuring the estimation of the rotor speed and rotor flux at once. The second approach is performed based on the model reference adaptive system estimator for ensuring the estimation of the rotor speed. The applications of both estimation approaches with the combined techniques for ensuring the sensorless control of the FFIM are presented and analyzed to shed light on their main performances compared with each other based on the main predominant constraints such as the processor computation time and memory size costs, robustness against the machine parameter variation and the accuracy of estimation. The analysis of the results obtained by simulation allows the validation of both approaches in ensuring the sensorless control of the FFIM using the DTC-SVM with some limited differences.

Keywords: *direct torque control (DTC); space vector modulation (SVM); stator flux oriented control (SFOC); five-phase induction machine (FFIM); speed sensorless; adaptive observer; model reference adaptive system (MRAS).*

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