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Estimation of the Temperatures in an Asynchronous Machine Using Extended Kalman Filter

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Abstract : In order to monitor the thermal behavior of an asynchronous machine with squirrel cage rotor, a 9th-order extended Kalman filter (EKF) algorithm is implemented to estimate the temperatures of the stator windings, the rotor cage and the stator core. The state-space equations of EKF are established based on the electrical, mechanical and the simplified thermal models of an asynchronous machine. The asynchronous machine with simplified thermal model in Dymola is compiled as DymolaBlock, a physical model in MATLAB/Simulink. The coolant air temperature, three-phase voltages and currents are exported from the physical model and are processed by EKF estimator as inputs. Compared to the temperatures exported from the physical model of the machine, three parts of temperatures can be estimated quite accurately by the EKF estimator. The online EKF estimator is independent from the machine control algorithm and can work under any speed and load condition if the stator current is nonzero current system.

Keywords : asynchronous machine, extended Kalman filter, resistance, simulation, temperature estimation, thermal model
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