Abstract of Ph.D. Thesis
"Control and Implementation of Induction Motor Drive for Light Electric Vehicle"
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This research presents control and implementation of battery fed induction motor drive based electric drive train system. In this work, five different topologies of induction motor based drivetrains are developed in which battery is used as primary energy source and solar PV array is considered as auxiliary energy source. First, to enhance the efficiency of the propulsion induction motor, optimized reference points based field oriented control is implemented. The speed of the motor is estimated using second order super twisting sliding mode observer (ST-SMO) and motor parameters like stator resistance and rotor time constant are continuously updated online with the help of model reference adaptive system (MRAS). Secondly, to improve the performance of the induction motor at various operating speeds, predictive torque control (PTC) is implemented where adaptive full order observer is used for speed estimation. Comparative analysis is made between the PTC over conventional torque control methods. Third, to improve the robustness and to reduce the dependency of model sliding model based predictive torque control and model free predictive torque control methods are implemented for induction motor. To make the speed estimation robust against DC-offset present in the measured signal, generalized integrators (GI) based speed estimation is performed. Further, to improve the robustness of the indirect field oriented control (IFOC), predictive current control is incorporated. Finally, to reduce the number of current sensors, current reconstruction is algorithm is implemented to estimate three phase current from the DC-link current. The presented works are simulated in MATLAB / Simulink based software platform and verified experimentally in dSPACE based hardware test bench. The comparative analysis is made between control and speed estimation algorithms to determine the suitability of control.