

Abstract of Ph.D. Thesis
“Design and Development of Solar PV Integrated Light Electric Vehicle using
Switched Reluctance Motor”
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This research focuses on the progression of sensorless control techniques for switching reluctance motor (SRM) drives to minimize supplementary costs associated with integrated motor drive units in electric vehicle application. The use of solar photovoltaic array to charge installed battery packs during daylight hours provides a significant benefit in extending the mileage of light electric vehicles (LEVs).

This research concentrates on the development of a sliding mode observer (SMO) for position sensorless management of switching reluctance motor (SRM) drives in solar and battery-powered light electric vehicles. Unlike look-up table-based methods, the SMO-based algorithm offers a direct and robust framework, obviating the necessity for pre-stored magnetic data. Alongside the utilization of SMO for position estimate, a two-phase excitation-based method is integrated into SRM control to guarantee unidirectional operation during starting. This method, however, encounters chattering, which is subsequently alleviated by the application of an adaptive gain sliding mode observer. The drive employs a sensorless method and sophisticated angle control for speed regulation of the SRM drive, thereby minimizing switching losses associated with the hysteresis controller. This research aims to develop a compact and economical motor technology by reducing the reliance on electrical sensors. The research introduces a modern reconstruction method for a three-phase 12/8 switched reluctance motor driven by an asymmetric bridge converter. This enhancement decreases sensor expenses while preserving vehicle driving performance. Moreover, the solar PV array for the continuous charging of the installed battery pack during both operational and non-operational hours enhances mileage and earnings while substantially decreasing vehicle operating costs. All generated configurations are modeled and simulated in the MATLAB/Simulink environment using the Simpower System toolbox to assess performance under diverse environmental conditions, and the system's operability is validated across initial, dynamic, and steady-state scenarios. Simulated results are verified by an experimental test prototype.