

## ABSTRACT

Transportation plays a very important role in every society. Thus, for the balanced development of economic and social systems of a country the transportation system has a significant importance. These include improvement in vehicle technology and clean fuels. Electric Vehicle (EV) technology is rapidly gaining popularity in recent times. There are possibilities of immense environmental benefits as well, as the EVs can extensively reduce the greenhouse gas emissions produced by the transportation sector.

Among all the energy resources, solar photovoltaic power generation is one of the most promising renewable energy technologies. A single or multistage power electronic converter is necessary to convert PV generated power into useful power. A multistage power conversion involves DC-DC boost converter and DC-AC inverter. The solar PV powered Electric Vehicle solves the key downside of fuel and pollution is described in this thesis. It is an initiative in implementing eco-friendly transportation in the world to build a green environment. In general, an electric vehicle uses a battery that is charged from an external power supply, but in the proposed method solar PV modules are used to charge a battery by means of absorbing radiation from the sun and converting it into an electrical power. The electrical power to batteries is obtained from solar PV modules which might be associated either in series or parallel and charge controllers.

Power electronic converters are used to step up or step down the system voltage level. The power converter topologies depend on the motors to be driven. For electric vehicular system, there is a need for highly reliable, flexible and fault tolerant electrical power processing system on board to deliver high quality of power, based on the vehicle demands. Because of high efficiency, silent operation, compact form, reliability, and low maintenance BLDC motor gain its importance for EV operation. The BLDC motors eliminate sparking, noise, electro-magnetic interference (EMI) and maintenance problems associated with conventional DC

motors, as these are synchronous motors with stator having three phase windings and a permanent magnets rotor with hall effect for position sensing. This research work focus on the development of new DC-DC converter topology for supply energy to Hybrid Source Electric Vehicle (HSEV) driven by BLDC motor.

The Positive Output Elementary Super lift Luo converter is a new series of DC-DC converter which has high voltage transfer gain, high power density and high efficiency. In this research work, the Positive Output Elementary Super Lift Luo Converter (POESLLC) is designed and simulated with MATLAB/Simulink and developed its prototype model for testing its performance. After verifying its power handling ability, it is connected in parallel with two types of energy sources such as Solar PV and battery. Parallel operation of the converter provides the high power handling ability, stress less operation of the switching devices, fault tolerance operation of the converter etc. A Current Distribution Control principle has implemented with Sliding Mode Control (SMC) methodology. Finally, the parallel operated POESLL converter is connected with a BLDC motor drive with an improved rating. The performance and robustness of the POESLL converter fed BLDC motor-driven electrical vehicle operation is tested with simulation and experimental test and its various stages of the results are reported.

The high gain modified, three port dual boost, Single Ended Primary Inductor Converter (SEPIC) is designed to accept the wide range of inputs and it is used to boost up the DC voltage generated from the solar PV panel. The three winding high frequency transformer is connected in between the DC link and the input sources of DC-DC converter integrates two different input sources. A modified SEPIC converter is used to control the battery from the prime possible power generation, using a solar PV system fixed on the vehicle. The theoretical and experimental analysis of the modified SEPIC converter is presented to validate the power transfer capability and voltage gain of the conversion.

Voltage source inverter converts solar DC power into AC power and ultimately tracks the BLDC motor which controls the vehicle movements. The electronically commutated BLDC motor is used with voltage source inverter operated at fundamental frequency switching thus, avoiding the high frequency switching losses and resulting in high efficiency of the system. The performance of the developed DC-DC converter has been compared with conventional converter topology based on boosting gain and conversion efficiency. The modified SEPIC converter gives better gain values and conversion efficiency compared to other topology and also it has an ability for handling the dual energy source of the Electric Vehicles optimally with respect to available level and vehicle demand.