SEPIC DC – AC Converter Design and Operation

Shweta Hegde[1], Afshin Izadian[1]
[1]Department of Engineering and Technology, Purdue School of Science

This paper focuses on the design and study of operation of the SEPIC converter which is modified to function as an inverter i.e. converts DC input to AC output. The modified converter consists of reduced number of switches which increases the efficiency and also improves the quality of the waveforms generated.

The conventional SEPIC converter consists of two inductors, two capacitors, one transistor switching at high frequency and a diode. The modified SEPIC replaces the diode with a polarity reversing switch component. This component contains two reverse connected transistors T_1 and T_2 which are synchronized with the polarity of the output waveform. This new inverter is capable of producing pure sinusoidal waveform with only three switches of which only one is switched at high frequency, Q. The new inverter is found to operate in four different modes of operation to produce positive and negative cycles of output voltage. The modes 1 and 2 of operation have the switches Q and T_1 operating and produce positive peak and the modes 3 and 4 of operation have the switches Q and T_2 operating and produce negative peak. The inductor connected in the input side of the inverter is chosen to be large enough to maintain continuous conduction.

State Space Averaging technique is used to model the system where the currents through the inductors and voltages across the capacitors are considered to be the state variables. The state space representation of each mode of operation is obtained and the system is averaged over the positive peak and negative peak separately. The state space model of the inverter is validated using MATLAB/SIMULINK. The inverter model was simulated using SimPowerSystems tool box of MATLAB and found to produce pure sinusoidal waveform. The harmonics were found to be reduced to a great extent.

Mentor: Afshin Izadian, Department of Engineering and Technology, Purdue School of Science, IUPUI