ABSTRACT

Power electronics is the application of solid state electronics, associated with conversion, conditioning and controlling of electric power with high efficiency, from one form to another form of output for convenient usage. Due to the rapid development of modern technology, the use of power semiconductor devices is greatly increased. Thereby, the power electronics finds extensive use in wide range of applications such as commercial, domestic, aerospace, industrial, etc., and hence it is used in almost all electrical and electro-mechanical equipments.

The existence of non-linear loads draw the sinusoidal currents from the supply and results in high harmonic distortion and low power factor. These harmonics results in the reduction of gain and efficiency of the power system. Hence, it is essential to improve the power factor and to reduce the harmonics in the power electronic systems. In order to solve these issues, several topologies were introduced. These topologies adapt several converters and inverter circuits for obtaining the unity power factor and less total harmonic distortion. But these topologies have high conduction loss and hence do not generate sustainable power factor. Also, the non-linearities present in the DC-DC converter is a challenging aspect in control system design. The presence of non-linearites produces oscillations, create disturbances and degrade the performance of the system.

Thus this research work is focused in the improvement of power quality with sustainable power factor, less total harmonic reduction, elimination of oscillations, reduction of undesirable sensitivity to parametric variations in DC-DC converters and multi-level inverters.

A novel bridgeless boost converter fed Reverse Voltage (RV) Multi-level Inverter is proposed to generate electrical power for high power applications with improved power factor and less total harmonic reduction. The concept of Hybrid Posicast control technique is introduced in the feedback path of Buck-Boost converter. It ensures steady state stability by eliminating the parametric sensitivity of DC-DC converters. It also eliminates the system overshoot. The performance of the novel reverse voltage Multi-level inverter with various Pulse width Modulation control techniques is proposed for effective harmonic reduction.

The performance analysis of the proposed topologies of converter and inverter has been carried out in MATLAB / SIMULINK and the results so obtained are analyzed and discussed.