## **CHAPTER 9**

## CONCLUSION

Continuous and discontinuous PWM strategies have been developed and laid out in an analytical way. The performances of these strategies, their limitations, and advantages were studied in three different power converters viz. (a) Three Phase VSI, (b) Three Phase CSI, (c) Four legged inverter. Using the PWM strategy developed for four legged converters, the control scheme was designed for the control of a four-legged inverter and four legged active power filter.

## 9.1 PWM Strategies in VSI

In the first section various continuous and discontinuous PWM strategies on three phase VSI were studied. An analytical methodology for the determination of the expressions for the modulation signals required in carrier-based generalized discontinuous PWM modulation schemes in three-phase inverters was developed. The method for evolving modulation strategies using the theory of existence function is applicable for situations where the reference three-phase voltages are either balanced or unbalanced. This development is made possible with the extension of the classical space vector technique and the appropriate definition of the distribution or partition ratio of the times the zero (null) switching modes are used in the synthesis of a reference voltage. Some confirmatory experiments results have been provided to illustrate the various generalized carrier-based modulation signals possible. The methodology set forth is extendable to the determination of discontinuous modulation schemes of other converters such as four-leg, current source inverters multi-level, AC-AC converters, and other topologies.

## 9.2 PWM Strategies from VSI applied to CSI

A simplified and detailed method for VSI to CSI mapping is explicated. The approach for development of logic circuit is explained with utmost simplicity. Various modulating schemes of VSI mapped to CSI are studied. It can be show £2TT2 1 Tf0.002372TT6cffit Tc 0.0

explained in a lucid way. The method shows the limitations and advantages of the possible exploratory parameters  $[\gamma, \kappa]$  to meet application measures such as harmonic content, switching loss requirements.

Using the definitions of the space vector methodology, which includes the zero sequence voltages, the carrier-based discontinuous modulation scheme for the four-leg converter has been developed. The space vector comprising of active and null states is split into two halves (a) positive sequence voltages constituting positive zero sequence voltages and (b) negative sequence voltages constituting negative zero sequence voltages. The remaining set of four modes with zero qd voltages constitutes the null states. Using the positive and negative sequence sets and their combinations, the timings for the adjacent switching modes required to synthesize a reference voltage in all the six sectors are calculated.

From these expressions the modulation functions for the top switching devices are determ

For the case in which the three load voltages are balanced, the period for which the devices are clamped in each load phase are seen to be the same (120 degrees per cycle); however; for the situation in which the load phase voltages are unbalanced, there is a total of 360 degrees clamping for the three-phase but are unevenly distributed in the load phases. simple IP controllers with features of Butterworth polynomials for the source current regulations. Simulation results for the dynamic and steady-state regulation of the load voltages for an unbalanced three-phase impedance load and a balanced three-phase impedance load with a nonlinear rectifier validated the control strategy and modulation scheme proposed.