CHAPTER-VI

CONCLUSION

6.1 CONCLUSION

This chapter consolidates the important findings and brief review of the work performed and reported in the thesis. Further the future scope / investigation in this area is indicated. This is followed by Reference used in the entire development work.

Power quality and reliability are essential for proper operation of industrial processes, which involve critical and sensitive loads. With the growing usage of solid-state converters in application such as adjustable speed drives and computer supplies, there has been a considerable increase in the voltage/current harmonic congestion and distortion on the power network. Short-duration power disturbances, such as voltage sags, swells and short interruptions, are major concern for industrial customer. Due to wide usage of sensitive electronic equipment in process automation, even voltage sags which last for only few tenths of second may cause production stops with considerable associated costs; these costs include production losses, equipment restarting, damaged or lower-quality product and customer satisfaction.

The high costs associated with these disturbances explain the increasing interest towards power quality & reliability problems mitigation techniques. The cost of mitigation intervention has to be compared with the loss of revenue and takes into account all economic factors involved.

Various power-conditioning devices such as series voltage compensator (e.g. DVR), shunt current compensator (e.g. STATCOM, SVC) and hybrid series and shunt filters are widely used to eliminate current harmonics and voltage distortion and thus improve the power quality.

Shunt passive filters (single tuned & double tuned filters) have traditionally been used to absorb the harmonics generated by large harmonics loads and

provide the reactive supports below the tuned frequency. The supply and line impedance however strongly influence the compensation characteristics of the filter. Shunt filters are also highly susceptible to series & parallel resonances. Hence shunt filters are generally off-tuned with respects to dominant harmonics, which defeats their very purpose of installation.

Shunt active filters offer some improvement over passive filtering by way of smooth power factor and harmonic current control and non-susceptibility to resonance at dominant harmonic frequencies. But active current filtering is viable solution only if the peak harmonic distortion is limited. It is difficult to implement a large rated shunt PWM inverter with a high current bandwidth and a high switching frequency would elevate the switching losses.

Series compensators (e.g. DVR) have been effective voltage compensators. However it is difficult for them to control harmonics and zero sequence components in the absence of a passive shunt filter.

In this thesis novel techniques was develop using IARP theory to improve the power quality for sensitive load. Active series filter to eliminate the voltage harmonic for sensitive load was developed which reduced the voltage harmonic from approximately 17 % to 6%.

Similarly, using same IARP theory with slight modification it is possible to compensate negative as well as zero sequence components. Simulation results as well as experimentation results show that this new technique detect online negative & zero sequence component and compensate the same using voltage source inverter whose output changes through PWM techniques. Main advantage of detecting the negative & zero sequence component using instantaneous α-β-0 theory is that this can be easily implemented using DSP or analog circuit and no complex algebra is required which is the case using symmetrical components. Also online instantaneous negative & zero

sequence parameter of the bus voltage can be detected using this method. Negative sequence compensation is shown to be desirable for improved performance of 3-ϕ induction motor.

Also novel control method was introduced which can extract harmonics as well as negative & zero sequence parameter using instantaneous active reactive power theory. Hence extracted signal will be used as reference signals along with PI control to control the voltage source inverter. These extracted signals are instantaneous & online so that harmonics as well as negative & zero sequence in the sensitive bus voltage will be reduced / compensated.

Following are the main benefits of these techniques

- This techniques is very simple & easy to implement
- On line compensation of power quality problem which lead to high productivity, less down time of machine and man power
- Losses in the power system components (i.e. transformer, transmission line, motor, cable etc) reduce.
- Improved Motor performance in terms of torque and efficiency
- Improve the performance of interconnected power system and the quality of the power.
- The techniques developed in this thesis covers to meets the following objectives:
- Compensation of voltage harmonics and negative & zero sequence voltage to the sensitive load bus.

A simple Control scheme to compensate both, voltage harmonics as well as negative & zero sequence voltage using IARP theory was also proposed along with simulation results.

With this it is clear that the hybrid topology (series active + shunt passive) has been shown to provide cost-effective solution to voltage distortion and current harmonics suppression. By extending the functionality of the hybrid compensator a wider range of power quality problems can be tackled.