6 Conclusion and Scope for Future Work

6.1 Conclusions

This thesis is devoted to the design, analysis and simulation of composite filter for power quality issues of electric arc furnace distribution network. The main contributions of the thesis include:

- Novel EAF model is proposed to demonstrate typical PQ issues of EAF connected distribution network such as voltage harmonics, current harmonics, voltage flicker and voltage unbalance behavior together.
- Performance characteristics of the proposed EAF model are compared with that of existing Cassie-Mayr EAF Model and with real field data available for various operating cycles of an EAF to validate the same.
- Typical EAF connected distribution network along with other auxiliaries is demonstrated and simulated to analyze the distribution network from power quality point of view keeping IEEE 519-92 Standards in view.
- Design of the passive filter is carried out for PQ improvement of EAF connected distribution network.
- Series active filter with control strategy based on the dual formulation of the electric power vectorial theory for non-sinusoidal and unbalanced voltage is implemented improving the passive filter compensation characteristics. Main task is to combine and to simulate both the filters and thus to form composite filter to solve PQ issues of the distribution network.
- State-space averaging model of proposed composite filter is constructed to analyze system stability by proposed control strategy.
- Simulation of the distribution network with the composite power filter is carried out to validate its performance. The simulations are carried out in MATLAB environment using SIMULINK and power system block set toolboxes.

- Performance of the composite filter with that of the passive filter is compared and analyzed for various operating cycles of EAF.
- Composite filter performance is investigated and evaluated in 3-Φ, 3-wire distribution network under various load conditions-refining cycle, melting cycle considering sinusoidal flicker, melting cycle considering random flicker and unbalance load voltages.
- It is found that the proposed composite filter performs satisfactorily and performs better than the passive filter alone.
- The present work is likely to contribute significantly to the area of power quality enhancement. The control techniques developed will be particularly useful for designing composite/hybrid filter in 3-Ø, 3-wire and 3-Ø, 4-wire distribution system for balanced/unbalanced linear and non-linear load connected in star/delta configuration.

6.2 Scope for Future Work

It is almost impossible to cover all aspects of power quality improvement of EAF connected distribution network using composite filter. Therefore, suggested below are the few areas which can be further explored to improve the power quality in distribution system using CF:

- Instead of using DC battery as the source of energy of the composite filter, the use of other form of energy sources such as renewable energy can be studied.
- The magnetizing effects of transformer connected in the distribution network on the performance of the composite filter can be studied.
- To evaluate the practicality of the proposed control scheme, number of pragmatic issues such as field data test and hardware aspects can be taken into consideration for the power quality improvement of EAF connected distribution network and explored further.
- In this study, supply frequency is assumed to be constant. Hence, the performance of composite filter under the condition of frequency variation can be further evaluated.

- A voltage regulation capability of the composite filter is need to be evaluated under ideal as well as non-ideal source voltage conditions.