CHAPTER 7

CONCLUSION

In the present research work, Neuro-fuzzy control technique is being deployed for the control of Single Phase and Three Phase Matrix Converter fed Induction Heating powered by Single phase and three phase source. For the Induction Heating system, Matrix Converter is selected since it outperforms the same class of AC–AC converter namely cycloconverter and AC–DC–AC converters. The proposed Neuro-Fuzzy controller based Matrix Converters eliminate the bulk capacitors as DC link. The proposed Neuro-Fuzzy controller based Matrix Converters use minimum number of switches. The proposed Neuro-Fuzzy controller based Matrix Converters produce low THD for the Induction Heating load compared to conventional converters. The control algorithm for the conventional converter is complex as it utilizes more number of switches. As a result, the conventional controller’s performance is very poor, so that non-linear controller is being proposed for the control of Matrix Converter.

The Single Phase Matrix Converter powered by single phase source is modeled in MATLAB/SIMULINK and performance analysis of the converter is carried out with linear PID controller and proposed non-linear Neuro-Fuzzy controller. The Single Phase Matrix Converter powered by three phase source and Three Phase Matrix Converter powered by three phase source are modeled with Neuro-Fuzzy Controller and their performances are analyzed. The performance of the proposed Neuro-Fuzzy Controller for Matrix Converter is compared with the conventional PID Controller.
The performance analysis of Single Phase Matrix Converter with single phase voltage source shows that the non-linear Neuro-Fuzzy controller performance is better than the conventional PID Controller. Conventional and Fuzzy controller are implemented in MATLAB. The performance of the controller to the Single Phase to Single Phase Matrix Controller is analysed by Total Harmonic Distortion.

The Neuro-Fuzzy controller based Single Phase to Single Phase Matrix Converter develops line current THD of 6.12% for the input frequency of 25 Hz where as the line current THD of 4.82% is produced for the input frequency of 1 KHz. Total Harmonic Distortion of non-linear Neuro-Fuzzy Controller is found to be less than that of the conventional PID Controller. The Neuro-Fuzzy controller based Three Phase to Single Phase Matrix Converter develops line current THD of 13.42% for the input frequency of 25 Hz where as the line current THD of 9.53% is produced for the input frequency of 1 KHz. The Neuro-Fuzzy controller based Three Phase to Three Phase Matrix Converter develops line current THD of 11.78% for the input frequency of 25 Hz where as the line current THD of 8.48% is produced for the input frequency of 1 KHz. It is observed that when a frequency increases the line current THD decreases. On the other hand, the performance of Neuro-Fuzzy Controller employing the combination of Fuzzy and Neural network are found to be higher than that of its counterpart Fuzzy controller. The THD values obtained from Neuro-Fuzzy Controller are less than that the THD obtained in Fuzzy Controller.

The performance of Single Phase Matrix Converter and Three Phase Matrix Converter controlled by Neuro-Fuzzy controller are analyzed and they exhibit low THD. The proposed Neuro-Fuzzy controller based Matrix Converters demonstrate the robust operation for Induction Heating load.

7.1 FUTURE WORK
A laboratory prototype of the proposed Neuro-Fuzzy controller based Matrix Converter system can be built to verify the dynamism of the developed model. Modeling of the Controller with Matrix Converter for high powered Induction Heating operations can be carried out. A multilevel Matrix Converter system can be developed for higher power ratings and voltage level. Similarly, control of the Matrix Converter can be performed with other algorithm based controllers such as genetic algorithm, particle swarm optimization, etc.