ABSTRACT

Induction Heating has a wide range of application in industrial and domestic sectors due to efficient heating and higher reproducibility. As an outcome, it is used in Bulk Heating Processes, Food Processing and Chemical Industries. Now a days, most of the Converters for Induction Heating applications are based on semi-conductor technology which is widely using IGBT and MOSFET devices in the medium-power and high-frequency applications.

Several Converter topologies have been proposed over the past few decades for energizing the Induction Heating process such as Half-Bridge Resonant Inverter, Full-Bridge Resonant Inverter, High Frequency Quasi Resonant Inverter, LLC Resonant Converter, LCL Resonant Converter, Cycloconverter and AC – DC – DC Converters such as Voltage Source Converter and Current Source Converter. Nevertheless, the Induction Heating process involves various operating frequency range based on application. Hence the necessity of converter with a wide range of output frequency is essential for Induction Heating process for which Matrix Converter is a suitable one, since the Matrix Converter is capable of producing an output with wide range of output frequency which is lower or higher than that of the input frequency, also it can produce an output with required amplitude and nearly unity power factor. Moreover, Matrix Converter involves less number of switches and eliminates reactive elements for the conversion process which makes it a suitable one for the process. However, the control of Matrix Converter becomes complex due to the switching process with less number of
switches. To enhance the productivity and control, an efficient controlling is essential for the Inducting Heating.

In this thesis, an Induction Heating with Matrix Converter controlled by Neuro-Fuzzy Controller is being proposed. Neuro-Fuzzy Controller is proposed for three types of Matrix Converter namely Single Phase to Single Phase Matrix Converter, Three Phase to Single Phase Matrix Converter and Three Phase to Three Phase Matrix Converter. The Neuro-Fuzzy Controller will have the benefit of both Neural network and Fuzzy logic system and used various Matrix Converters. The Single Phase Matrix Converter, an AC–AC single stage conversion system with variable range of output frequency, phase angle variation and variable voltage magnitude irrespective of input source is used to energize an Induction Heating with single phase and three phase source of constant frequency and constant voltage. Correspondingly, a Three Phase to Three Phase Matrix Converter control system is being deployed with non-linear controlling technique namely Neuro-Fuzzy Controller. The output performance of Neuro-Fuzzy controller based AC-AC Matrix Converter with single phase and three phase input power supply is analysed. The overall system is modelled and simulated in MATLAB / SIMULINK environment and Total Harmonic Distortion of the generated system is quite reasonable.