ABSTRACT

Induction motors are extensively used both for industrialized applications and for domestic application, its accurate control is very much essential for specific operation, and also to save electrical power. Earlier whenever accurate control was required DC motors were used, as there is a possibility in it for independent control of flux and torque. However, After the availability of fast acting and high switching frequency solid state electronics devices, it has become possible to control an induction motor like a dc motor by making use of different switching scheme for an inverter fed induction motor. This process has a disadvantage of torque ripple. In this dissertation variations & effect of stator resistance on torque ripple and possible implementation methods to reduce torque ripple has been discussed, and also switching pattern has been analyzed. Some of the reported methods are based on six sectors & are Conventional Direct Torque Control (C_DTC) and Modified DTC (M_DTC) to independently control the torque have analyzed, with which a New Sector direct torque control (N_DTC) work has been carried out with simulation using MATLAB/Simulink. The simulation results were compared with the existing methods and the torque ripple is observed. Further Simulation study was extended to a twelve Sector DTC (12_DTC) and results were compared with the Six Sector method.

From the various literature surveys, it is inferred that the advantage of DTC is its simple control technique and it is less dependent on the machine parameters, the only parameter on which it depends is the stator winding resistance. In almost every work carried out earlier on Direct Torque Control of the machine the variation of the dependent parameter of the machine has been taken as a constant value but, the parameter is not a constant, and has variations with temperature. The work investigated with simulation study on DTC by varying the possible or expected values of stator resistance variations and the dependency of the torque ripple with the dependent parameter is established.

The work is consolidated with an experimental arrangement to see the possible level of rise in the temperature of the stator core of the machine, the first experiment using microcontroller is conducted at different loads on an induction machine and the rise in temperature with time are noted. The experimental result shows that a huge temperature variation has occurred, resulting with change in stator winding resistance. The second part
of the experiment is carried out by measuring the resistance with volt-ampere method, the experiment is conducted at room temperature and at a temperature of 125 degree the resistance variations were seen and concluded that in normal operation of a machine the stator winding resistance changes and it has to be taken into consideration while controlling a machine to reduce torque oscillations.

Finally the switching pattern algorithm is implemented on a FPGA core (using VHDL program) both for six and twelve sector. This implementation makes it useful in real time with respect to concurrent decision making optimal switching resource utilization. A basic hardware model to notice the variations in the speed of an induction motor based on FPGA system has been analyzed, which gives a possible method so that real time control of induction motor can be achieved.