CHAPTER 7

CONCLUSION

7.1 CONCLUSION

Though the concept of switched reluctance motor was established in 1838, it attracted researchers only after the modern era of power electronics and computer aided electromagnetic design. It combines many of the desirable qualities of induction-motor drives and DC commutator motor drive, as well as PM brushless DC systems. Switched reluctance motors are rugged and simple in construction and economical compared with the synchronous motor and the induction motor.

But SRM could not reach its popularity in spite of its wide application due to the non uniform torque characteristics of the motor. A novel control methodology is derived in this work for the SRM based on DTC. In this method, torque and torque ripple is directly controlled through the control of the magnitude of the flux linkage and the change in speed of the stator flux vector. Also the method does not require the nonlinear magnetization characteristics to be used in the real-time torque control. Furthermore, the scheme is not dependent on the accuracy of the estimated model parameters, as no model calculation is required during operation.

Initially, a comparison of the various direct torque control methodologies (Classical DTC, DSVM-DTC and SVM-DTC) is done in order to evaluate the influence of the motor operating condition on steady state
performance. A particular emphasis on stator current distortion and on torque ripple has been made. It can be noted that SVM-DTC has the best performances, but it requires more complex control scheme and the knowledge of some motor parameters. DSVM-DTC is a good compromise between classical and SVM DTC schemes. It shows small torque ripple and requires only the knowledge of stator resistance.

So, a modified DTC algorithm is proposed which is based on the discrete space vector modulation theory. In DSVM voltage vectors are increased by dividing the sampling time into \( N \) equal intervals and applying various voltage vectors in each of them. Having a large number of voltage space vectors, smaller torque ripple with constant switching frequency is attained. The use of this technique is very useful in application where the maximum sampling frequency is limited by large computational time.

Further, a novel DTC method for 5Φ SRM is carried to provide multiple space vectors. The five-phase inverter provides \( 3^5 \) voltage space vectors with regard to \( 3^3 \) (27) voltage vectors generated by a three phase inverter. Five phase DTC strategy realized almost ripple free operation for the entire speed range. Consequently, the flux, torque and speed estimation is improved. The fast response and robustness merits of three-phase DTC are entirely preserved. The simulation results clearly demonstrate that DTC for 5Φ SRM, which can achieve more precise flux and torque control than 3Φ motor for the same commanded inputs. The result suggests that the combination of DTC with multi-phase SRM can realize higher performance. The advantage of higher reliability, higher power density and less torque
ripple outfits the cost drawback of five–phase SRM and has significant use in the areas of aircraft, defense mission, actuators in nuclear power plants and ship propulsion.

7.2 FUTURE SCOPE

The future scope of this thesis involves the implementation of the direct torque control by neural, fuzzy and neuro-fuzzy controllers. Also, optimisation techniques like genetic algorithm can be implemented for accurate and efficient control of motor with fewer ripples extending the area of research. In future, it is scheduled for experimental test using practical SRM drives.