Chapter – VII

CHAPTER 7

CONCLUSIONS AND FUTURE SCOPE

7.1 INTRODUCTION

This chapter concludes the work and comments on results. Summary of results obtained with discussion is presented. At the end future scope is discussed. There has been growing interest in multiphase induction motors as due to their features like reliability, high torque etc. which makes them suitable to be used in Aerospace, hybrid electric vehicles and electric ship propulsion.

7.2 REMARKABLE ACHIEVEMENTS

The innovative and remarkable achievements of this designed and developed six phase induction motor-prototype are summarized below:

3. There is no criterion of maintaining 30 degrees phase shift, i.e. arbitrary phase shift. All control schemes developed till date were for 30 degree phase shift only. [20]-[46]
4. No third harmonic current injection or current sensor required for torque improvement: In this novel prototype six phase induction motor, the torque is found to be 1.6 times that of three phase induction motor torque. This is higher than 1.4 times as described in references [5], [1], [28]. This is achieved without

third harmonic current injection for torque improvement and control with arbitrary phase displacement by small changes in design and dimensions of motor.

The other features of a developed prototype six-phase induction motor are summarized as:

5. Improved reliability, i.e. if one inverter fails, the motor continue to run (though at reduced rating) thus continuity of operation is maintained, this is because the two neutrals are kept open.
6. Harmonic reduction because all the harmonics of the order ($6n \pm 1$) where n = 1, 3, 5, 7------- get cancelled because of 30 degrees phase displacement. Reduced torque pulsations because of harmonic reduction.
7. As losses are reduced efficiency is improved as there are no circulating currents because of harmonic reduction.
8. By using 30 degrees phase displacement, for the same air gap flux, the inverter dc bus voltage is reduced by approximately a half (Because of 30 degrees displacement, voltage relations are like star-delta).
9. Also control is economical as sensor less vector control is implemented.

7.2.1 Limitations of the design and development:

1. For higher rating, the size of the motor and hence inverter size becomes very large, which may increase the overall cost.
2. Although sensor-less vector control is economical, the parameter variation problem particularly near zero speed imposes a challenge in the accuracy of speed estimation.(as seen from figure In Sensor less control there is no feedback so no error correction, Speed is estimated from the readings of output voltage and current.

7.3 FUTURE SCOPE:

1. The same motor can be controlled using direct torque control, DTC which may give better speed control.
2. Six phase motor can be designed with two stator windings with different number of poles so that two different speeds can be obtained as per number of poles.
3. Multi motor operation, i.e. two or more multiphase motors can be supplied from single six phase inverter to get more torque wherever required, e.g. Electric Ship Propulsion.
4. Same design can be extended in multiples of three, i.e. 9 phase, 12 phase, 15 phase motor as per the requirement of torque.