# ABSTRACT

This thesis deals with the modelling and diagnosis of Squirrel Cage Induction Motor (SCIM) faults due to single broken bar and air gap eccentricity under medium and light load conditions.

In the first part of the thesis, a Coupled Circuit Model (CCM) is developed for a SCIM. A discrete space winding function is then proposed for accurate computation of inductances involved in the CCM under air gap eccentricity. The complete model is finally validated experimentally using model parameters determined through experiments as well from design specifications of a laboratory scale 3-phase SCIM.

In the second part, diagnosing of the above faults by Motor Current Signature Analysis (MCSA) using the well known MUltiple SIgnal Classification (MUSIC) algorithm for detection of the fault frequency components is presented. Firstly, a method of preconditioning is proposed to improve the numerical conditioning of MUSIC using a notch filter. Since the faults manifest themselves in frequency components of the current spectrum which change with supply frequency and slip, a method for slip and supply frequency estimation is proposed using Extended Complex Kalman Filter (ECKF). Detection of closely spaced frequency components which arise due to faults under light load need very high resolution spectral methods. Towards this end MUSIC is used with interleaved current signal data to detect these frequency components. Simulation and experimental results are presented to establish the effectiveness of the proposed techniques and algorithms for developing fault models and diagnosing single broken bar and eccentricity faults in SCIM operating under light-load conditions.

*Keywords: Coupled circuit model, winding function method, single broken bar fault, air gap eccentricity, slip frequency estimation, MUSIC, ill-conditioning, notch filter, detection of closely spaced fault frequency*