AN ABSTRACT OF A DISSERTATION

NEW SENSORLESS CONTROL OF NINE-PHASE INTERIOR PERMANENT MACHINE USING HIGH FREQUENCY INJECTION IN NON-TORQUE PRODUCING CIRCUIT FOR SINGLE-STAR AND TRIPLE-STAR CONNECTIONS

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Doctor of Philosophy in Electrical Engineering

In this dissertation a sensor-less method to estimate the rotor angle of a nine-phase Interior Permanent Magnet (IPM) machine in different stator connections (single-star and triple-star) is presented. The major contributions of this work includes the injection of a high frequency voltage signals into non-torque producing circuit of the machine in which the rotor angle is estimated without generating any extra high frequency torque ripple. The requirement of only one low pass filter in the angle estimation is another feature of this work. This method can be used for a wide range of the rotor speed including the zero speed. The inductances of the third or fifth sequences of the nine-phase machine are used to modulate the high frequency injected voltage signals from which the third or fifth sequence currents are extracted. Using a heterodyning method and the Luenberger observer, the rotor position is estimated.

The proposed method has been tested using the coupled full order model of the nine-phase IPM machines in different connections, including all the possible higher order MMF harmonics. After getting the position estimation results, the estimated angles are used to control the machine under field oriented control. This method uses minimum copper loss strategy in which the references of different axis currents of the machine are generated such that the machine supplies the load with minimum copper loss.

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DEDICATION

This Dissertation is dedicated to all generous people who shared their knowledge with me and gave me chance to learn.

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