AN ABSTRACT OF A THESIS

ANALYSIS OF AN INTERIOR PERMANENT MAGNET MACHINE OPERATING IN GENERATOR MODE

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A two horsepower interior permanent magnet (IPM) machine operating in generator mode was tested and analyzed. The modeling of the IPM machine includes the effects caused by the changing saturation and armature reaction dependent axes inductances and magnet flux linkage. Experimental data were recorded for the following types of loads presented to the IPM machine: an impedance load, a rectifier load, a rectifier-PWM-buck load, a rectifier-PWM-boost load, and a one horsepower induction motor.

A closed form solution, which avoids iterative techniques, was developed to model the impedance load for the cases when there is and is not capacitive shunt compensation. The experimental data for the impedance load strongly corroborate the results obtained from the closed form model.

The simulation of the IPM machine feeding the rectifier, rectifier-buck, and rectifier-boost loads included the effects due to commutation overlap. Matlab's Simulink was found to be an excellent tool to model the passive switches of the rectifier and the externally controlled switches of the buck and boost converters. The steady state models developed for the rectifier, rectifier-buck, rectifier-boost loads made use of switching function theory to model these loads as an effective resistance at the terminals of the IPM machine.

Experimental data were obtained for the case when the IPM machine, with shunt capacitive compensation, supplied power to the induction motor for various shaft speeds of the IPM machine, and under varying induction motor torque load. The results obtained are corroborated by the mathematical model. The results of the simulation of the IPM-IM for three different types of torque load are also presented.