

TABLE OF CONTENTS

	Page
LIST OF FIGURES	viii
Chapter	
1. Introduction.....	1
1.1. Introduction.....	1
1.2. Review of Previous Work.....	2
1.3. Scope of the Work	8
2. Derivation of State Equations and Parameter Determination of an IPM Machine.	13
2.1. Derivation of Machine Equations	13
2.2. Determination of Parameters of the IPM.....	25
3. Analysis of the Interior Permanent Magnet Machine Feeding an Impedance Load ..	37
3.1. Introduction.....	37
3.2. Mathematical Model for IPM Feeding an RLC Load.....	38
3.3. Mathematical Model of IPM Feeding an R Load with Capacitive Compensation	45
3.4. Mathematical Model of IPM Feeding an R Load	48
3.5 Comparison of Experimental Results with Calculations	51
3.5.1. IPM Feeding an R Load.....	51
3.5.2. IPM Feeding an R Load With Shunt Capacitor Compensation.....	57

Chapter	Page
3.6. Comparison of Measured and Simulated Waveforms of IPM Machine with Shunt Capacitive Compensation Feeding a Resistive Load	62
3.6.1. IPM Generator Feeding a Small Resistive Load	62
3.6.2. IPM Generator Feeding a Large Resistive Load	65
4. Steady State Analysis and Simulation of the IPM Generator Feeding a Rectifier-Resistive Load.....	67
4.1. Introduction.....	67
4.2. Derivation for Rectifier in Steady State	69
4.3. Steady State Performance of an IPM Generator Feeding a Rectifier-Resistive Load	79
4.4. Modeling of the Diode, Capacitor, and Inductor	84
4.5. Simulation Waveforms of Ideal Voltage Source Feeding Full Bridge Rectifier	91
4.6. Comparison of Measured and Simulated Waveforms of IPM Machine with Shunt Capacitive Compensation Feeding a Rectifier-Resistive Load	95
4.6.1. IPM Generator Feeding a Small Resistive Load	95
4.6.2. IPM Generator Feeding a Large Rectifier-Resistive Load	98
4.6.3. IPM Generator Feeding a Large Rectifier-Resistive Load and Undergoing Quasi-Periodic Subharmonic Oscillations	101
5. Steady State Analysis and Simulation of the IPM Generator Feeding a Rectifier-Buck-Resistive Load	106
5.1. Introduction.....	106
5.2. Derivation of a Buck Converter Operating in Steady State.....	110
5.2.1. Examination of Ideal Buck Converter	124

Chapter	Page
5.3. Steady State Performance of an IPM Generator Feeding a Rectifier-Buck-Resistive Load	128
5.3.1. Introduction.....	128
5.3.2. Experimental and Predicted Performance Results.....	129
5.4. Modeling of the Transistor	137
5.5. Comparison of Measured and Simulated Waveforms of IPM Machine Feeding a Rectifier-Buck-Resistive Load.....	140
5.5.1. Buck Converter in Continuous Conduction Mode	140
5.5.2. Buck Converter in Discontinuous Conduction Mode.....	143
6. Steady State Analysis and Simulation of the IPM Generator Feeding a Rectifier-Boost-Resistive Load.....	147
6.1. Introduction.....	147
6.1.1. Derivation of Boost Converter in Steady State.....	148
6.1.2. Examination of Ideal Boost Converter	160
6.2. Steady State Performance of an IPM Generator Feeding a Rectifier-Boost-Resistive Load.....	164
6.2.1. Introduction.....	164
6.2.2. Experimental and Predicted Performance Results.....	165
6.3. Comparison of Measured and Simulated Waveforms of IPM Machine Feeding A Rectifier-Boost-Resistive Load	175
6.3.1. Boost Converter in Continuous Conduction Mode.....	175
6.3.2. Boost Converter in Discontinuous Conduction Mode.....	178

Chapter	Page
7. Analysis and Simulation of IPM Generator Driving an Induction Machine	182
7.1. Introduction.....	182
7.2. Derivation of Dynamic and Steady State Equations of a Squirrel Cage Induction Machine	183
7.3. Induction Motor Parameter Determination.....	190
7.4. Measured and Calculated Steady State Results	197
7.5. Simulation of IPM-IM Scheme.....	204
7.5.1. Simulation of IPM-IM Scheme When the Load is Proportional to the Square of the Motor Speed	200
7.5.2. Simulation of IPM-IM Scheme When the Load is Proportional to the Motor Speed.....	209
7.5.3. Simulation of IPM-IM Scheme When the Load is Proportional to the Square Root of the Motor Speed.....	216
8. Conclusions and Suggestions for Further Work	220
8.1. Conclusions.....	220
8.2. Suggestions for Further Work.....	221
REFERENCES	223
VITA.....	228