

INDEX.

Abstract	AB.1
Index	IN.1
Acknowledgements	AC.1
Symbols	S.1

Introduction

I.1 - Historical review	I.1
I.2 - Structure of the thesis	I.6
I.3 - Aims of the thesis	I.8

Chapter 1 - Induction Motor Model. Generalities.

1.1 - Equations of the induction motor model	1.1
1.1.1 - Introduction	1.1
1.1.2 - Voltage equations	1.2
1.1.3 - Applying Park's transform	1.4
1.1.4 - Voltage matrix equations	1.5
1.1.4.1 - Fixed to the stator	1.5
1.1.4.2 - Fixed to the rotor	1.5
1.1.4.3 - Fixed to the synchronism	1.5
1.2 - Space phasor notation	1.6
1.2.1 - Introduction	1.6
1.2.2 - Current space phasors	1.7
1.2.3 - Flux linkage space phasor	1.9
1.2.3.1 - Stator flux-linkage space phasor in the stationary reference frame fixed to the stator	1.9
1.2.3.2 - Rotor flux-linkage space phasor in the rotating reference frame fixed to the rotor	1.10
1.2.3.3 - Rotor flux-linkage space phasor in the stationary reference frame fixed to the stator	1.11
1.2.3.4 - Stator flux-linkage space phasor in the rotating reference frame fixed to the rotor	1.12
1.2.4 - The space phasors of stator and rotor voltages	1.12
1.2.5 - Space-phasor form of the motor equations	1.13
1.2.5.1 - Space-phasor voltage equations in the general reference frame	1.13
1.2.5.2 - Space-phasor voltage equations in the stationary reference frame fixed to the stator	1.14
1.2.5.3 - Space-phasor voltage equations in the rotating reference frame fixed to the rotor	1.15
1.2.5.4 - Space-phasor voltage equations in the rotating reference frame at synchronous speed	1.15
1.3 - Torque expressions	1.17

Index.

1.3.1 - Introduction	1.17
1.3.2 - Deduction of the torque expression by means of energy considerations	1.17
1.3.3 - Torque constant	1.18
1.4 - Simulink model	1.19
1.4.1 - Equations used in the model	1.19
1.4.1.1 - Stator reference	1.19
1.4.1.2 - Rotor reference	1.19
1.4.1.3 - Synchronous reference	1.20
1.4.1.4 - Motion equation	1.20
1.4.2 - Simulated results	1.21
1.5 - Steady state analysis	1.23
1.5.1 - Steady state conditions	1.23
1.5.2 - Steady state equations	1.23
1.5.3 - Steady state equivalent circuit	1.24
1.6 - Interim conclusions	1.25

Chapter 2 - Direct Torque Control. Principles and Generalities.

2.1 - Induction motor controllers	2.1
2.1.1 - Voltage/frequency	2.1
2.1.2 - Vector controls	2.2
2.1.3 - Field Acceleration method	2.2
2.1.4 - Direct Torque Control	2.2
2.2 - Principles of Direct Torque Control	2.4
2.2.1 - Introduction	2.4
2.2.2 - DTC Controller	2.4
2.2.3 - DTC Schematic	2.7
2.2.3.1 - Stator flux and torque estimator using w_m , i_{sA} and i_{sB} magnitudes	2.8
2.2.3.2 - Stator flux and torque estimator using V_{dc} , i_{sA} and i_{sB} magnitudes	2.9
2.2.4 - Parameter detuning effects	2.10
2.3 - Improvements in Direct Torque Control	2.11
2.3.1 - Introduction	2.11
2.3.2 - Different tables	2.11
2.3.2.1 - First approach	2.11
2.3.2.1.1 - Six sector table but different zones	2.11
2.3.2.1.2 - Twelve sector table	2.13
2.3.2.1.3 - Simulations, results and conclusions	2.15
2.3.2.2 - Second approach	2.18
2.3.2.3 - Third approach	2.19
2.3.2.4 - Conclusions	2.20
2.3.3 - Predictive methods	2.21
2.3.4 - Fuzzy logic based systems	2.22
2.3.5 - Regulating the flux	2.23
2.4 - Interim conclusions	2.25

Chapter 3 - Fuzzy Logic Direct Torque Control.

3.1 - Introduction	3.1
3.2 - Fuzzy Logic Direct Torque Control	3.3
3.2.1 - Fuzzy Logic controller 1	3.3
3.2.1.1 - Objectives	3.3
3.2.1.2 - Inputs and output membership functions.	3.3
3.2.1.3 - Rules	3.5
3.2.2 - Fuzzy Logic controller 2	3.6
3.2.2.1 - Objectives	3.6
3.2.2.2 - Inputs and output membership functions.	3.6
3.2.2.3 - Rules	3.7
3.2.3 - Fuzzy Logic DTC schema	3.8
3.2.4 - Stator Flux Reference Optimum Controller	3.9
3.3 - Simulated results	3.10
3.4 - Interim conclusions	3.15

Chapter 4 - Design of Experimental Induction Motor Drive System.

4.1 - Introduction	4.1
4.2 - Induction motor drive architecture	4.3
4.3 - Implementing DTC and FLDT	4.8
4.3.1 - Task distribution	4.8
4.3.2 - Programming the system	4.8
4.3.3 - Timing of the real implementation	4.9
4.4 - Simulation of the real plant	4.11
4.5 - Interim conclusions	4.14

Chapter 5 - Experimental Results.

5.1 - Corroborating the real implementation	5.1
5.1.1 - Classical DTC	5.1
5.1.2 - Fuzzy Logic DTC	5.8
5.2 - FLDT and DTC comparison	5.10
5.3 - Interim conclusions	5.16

Chapter 6 - Conclusions. Further work.

6.1 - Conclusions	6.1
6.1.1 - Direct Torque Control	6.1
6.1.2 - Fuzzy Logic Direct Torque Control	6.2
6.1.3 - Experimental motor drive system	6.3
6.1.4 - Real implementation	6.4
6.2 - Further work	6.5

Index.

References. R.1

Appendices.

A.1 - Programs	A.1
A.1.1 - TH1_5c.c	A.2
A.1.2 - PCTH1_5c.c	A.22
A.1.3 - TH1_9.c	A.29
A.1.4 - PCTH1_9.c	A.55
A.2 - Fuzzy rules	A.65
A.2.1 - FLC 1	A.65
A.2.1.1 - Flux increase, $Wpc < Tpc$	A.66
A.2.1.2 - Flux increase, $Wpc > Tpc$	A.67
A.2.1.3 - Flux decrease, $Wpc < Tpc$	A.68
A.2.1.4 - Flux decrease, $Wpc > Tpc$	A.69
A.2.2 - FLC 2	A.70
A.3 - Experimental motor drive pictures	A.71
A.3.1 - Workbench. Induction motor_1.5kW. DC motor	A.71
A.3.2 - Resistors	A.73
A.3.3 - Voltage Source Inverter	A.75
A.3.4 - Workstation	A.75