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Generic Electric Propulsion Drive

A thesis in the partial fulfilment of the requirements for the
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ABSTRACT

Considerable resources worldwide are invested in the research and development of future transportation technology. The foreseen direction and therefore research of future personalised transportation is focused on Battery Electric Vehicles (BEV) or hybrid combinations that use hydrogen fuel cells. These new transport energy systems are considered most to replace the current vehicles powered by the internal combustion engine (ICE).

The research work presented in this thesis mainly focuses on the development of a software control system for future BEV prototype vehicles - a generic intelligent control system (GICS). The system design adopts a modular design concept and intelligent control. The whole system consists of four modules being communication, power supply, motor driver and transmission module. Each module uses a microcontroller as the brain and builds an embedded control system within the module. The control and communication between the modules is based on a group of specific parameters and the status of a state machine. In order to effectively implement intelligent control and simplify the system structure and programming, a generic intelligent fuzzy logic model that can be configured to a specific application with a near real-time buffered communication methodology is developed. The tests made on the fuzzy control model and the near real-time buffered communication gave a very positive outcome. The implementation of the fuzzy control and the communication methodology in each of the modules results in a communication between the modules with a steady speed, better reliability and system stability. These modules link together through the communication channels and form a multi-agent collaborative system (MACS). As the controllers are designed based on the parametric concept, the system is able to be implemented to future new modules and therefore allow prototype vehicle control systems to be developed more efficiently. The MACS is based on the core components of the control system - fuzzy logic controller (FLC), Serial Communication and Analogue input control software modules. Further work is carried out as an attempt to integrate the control software with a hardware design for a generic electric propulsion drive (GEPD). This thesis therefore outlines the design and considerations in software and hardware integration in addition to the GICS. The output from this thesis being the construction of soft programming modules for embedded microcontroller based control system has been accepted and presented at two international conferences; one in Wellington, New Zealand[1] the second in Acireale, Italy[2].

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CONTENTS

LIST OF FIGURES.....	VII
LIST OF EQUATIONS.....	XII
LIST OF TABLES.....	XIII
LIST OF INSTRUCTIONS.....	XIV
LIST OF ABBREVIATIONS.....	XV
CHAPTER 1 INTRODUCTION	1
1.1 THE RESEARCH TOPIC.....	1
1.2 THE SCOPE OF RESEARCH	1
1.3 ORGANISATION OF DISSERTATION	2
CHAPTER 2 LIATURE REVIEW	5
2.1 BACKGROUND.....	5
2.2 INVESTIGATION	6
2.3 AUTOMOTIVE CONTROL SYSTEMS.....	7
2.3.1 Antiblockier System (ABS).....	9
2.3.2 Traction Control System (TCS).....	9
2.3.3 Electronic Stability Control	10
2.4 RESEARCH OF FUZZY LOGIC CONTROL SYSTEMS FOR AUTOMOBILES	12
2.5 AUTOMOTIVE CONTROL SYSTEM COMMUNICATIONS	14
2.5.1 CAN (Control Area Network).....	14
2.5.2 LIN (Local Interconnect Network)	16
2.5.3 MOST(Media-Orientated Systems Transport)	16
2.5.4 Battery Electric Vehicle Applications.....	17
2.6 HISTORY OF BATTERY DRIVEN VEHICLES.....	17
2.6.1 Hybrid Vehicles.....	19
2.7 POWER ELECTRONICS	23
2.7.1 DC-DC Converters.....	23
2.7.2 Inverter	26
2.8 MECHANICAL TRANSMISSION	29
2.8.1 Automated Manuals.....	30

2.8.2	Clutchless Manuals	30
2.8.3	Standard automated manual transmissions.....	30
2.8.4	Dual clutch transmissions	31
2.8.5	Seamless shift	31
2.8.6	Automatic Transmissions	32
2.8.7	Continuously Variable Transmissions (CVT)	32
2.8.8	Commercial Directions	33
2.8.9	Research Directions	33
CHAPTER 3 GENERIC INTELLIGENT CONTROL SYSTEM		
DEVELOPMENT.....		34
3.1	PURPOSE.....	34
3.2	ADC CONVERSION	38
3.2.1	ADC Investigation	38
3.2.2	Software Development.....	43
3.2.3	Software Testing	45
3.2.4	Software Redevelopment.....	49
3.3	COMMUNICATION.....	54
3.3.1	Communication requirements.....	55
3.3.2	Simple Communication.....	57
3.3.3	Software Development.....	58
3.4	FUZZY LOGIC	66
3.4.1	Difficulties.....	66
3.4.2	Fuzzy Logic Controller Development.....	73
3.4.3	Fuzzy Logic Control Demonstration	92
CHAPTER 4 ELECTRIC PROPULSION DRIVE SYSTEM OUTLINE.....		94
CHAPTER 5 POWER SUPPLY MODULE.		98
5.1	POWER SUPPLY INVESTIGATIONS	98
5.1.1	Boost Converter.....	98
5.1.2	Isolated Boost Converter	101
5.1.3	Non Isolated vs. Isolated Boost Converter	103
5.2	DESIGN CONSIDERATIONS.....	106

5.2.1	States of operation.....	106
5.2.2	Hazard Identifications	107
5.3	SMPS CONTROL DESIGN INVESTIGATION	111
5.3.1	Direct Microcontroller Control	111
5.3.2	Microcontroller and Hardware Combination	112
5.3.3	Microcontroller and Firmware.....	112
5.3.4	Firmware Application	113
5.3.5	Control Development Investigations Findings.....	114
5.4	CONTROL SYSTEM DESIGN	122
5.4.1	Control Inputs.....	123
5.5	MICROCONTROLLER DETAILS	127
5.5.1	Control Algorithm.....	127
5.5.2	Mixed Signal Microcontroller Requirements.....	128
CHAPTER 6 MOTOR DRIVER MODULE		131
6.1	INVESTIGATION INTO POSSIBLE CONTROL METHODOLOGIES FOR INDUCTION MOTORS	131
6.1.1	Control methods.....	131
6.1.2	Control Approaches.....	132
6.1.3	Electric Drive Control Investigation	132
6.2	MOTOR DRIVER MODULE DESIGN	134
6.2.1	Equal Pulse PWM	136
6.2.2	Sinusoidal Generated PWM	139
6.2.3	IGBT Hardware.....	141
6.2.4	Microcontroller Inputs	142
6.3	MICROCONTROLLER DETAILS	145
6.3.1	Control Algorithm.....	145
6.3.2	Mixed Signal Microcontroller Requirements.....	146
CHAPTER 7 TRANSMISSION MODULE		149
7.1	MECHANICAL DESIGN INVESTIGATION AND OPTIONS	150
7.1.1	Automated manual transmissions	150
7.1.2	Continuously Variable Transmission.....	155

7.1.3	Identified Solution.....	161
7.2	CONTROL TASK	162
7.2.1	Governed Pulley Movement	163
7.2.2	Variable AC Torque Production	164
7.2.3	Control Variables.....	164
7.3	MICROCONTROLLER DETAILS	165
7.3.1	Control Algorithm.....	165
7.3.2	Mixed Signal Microcontroller Requirements.....	166
CHAPTER 8 DISCUSSION AND CONCLUSION		168
8.1	DISCUSSION	168
8.1.1	Generic Intelligent Control System.....	168
8.1.2	Hardware.....	170
8.1.3	Mechanics.....	174
8.2	CONCLUSION	175
REFERENCES		176
APPENDIX A BATTERY TECHNOLOGY.....		A-1
A.1	BATTERIES TECHNOLOGIES.....	A-1
A.2	CURRENT BATTERY TECHNOLOGIES AND HISTORY	A-1
A.3	PROMISING POSSIBLE TRACTION BATTERIES.....	A-3
APPENDIX B SOFTWARE TEST METHODS.....		B-1
B.1	ANALOGUE TO DIGITAL CONVERSION COMMUNICATION TESTING	B-1
B.2	SERIAL COMMUNICATION TESTING	B-2
B.3	FLC AND GICS TESTING	B-6
APPENDIX C SOFT MODULE TEST RESULTS		C-1
C.1	ADC SOFT MODULE OSCILLOSCOPE TRACES.....	C-1
C.2	FUZZY LOGIC CONTROLLER OSCILLOSCOPE TRACES	C-6
APPENDIX D POWER SUPPLY MODULE HARDWARE DESIGN		D-1
APPENDIX E MOTOR DRIVE MODULE HARDWARE DESIGN		E-1
APPENDIX F TRANSMISSION MODULE HARDWARE DESIGN		F-1

LIST OF FIGURES

Figure 2-1 The ECU from a late model Nissan vehicle[5].	8
Figure 2-2 A typical CAN low priority sub system found in current production vehicles[36].	17
Figure 2-3 Buck converter layout.	25
Figure 2-4 Boost converter layout.	25
Figure 2-5 Buck-Boost converter layout.	26
Figure 2-6 Delta phase configuration.	27
Figure 2-7 Wye phase configuration.	27
Figure 3-1 General model of a closed loop control system.	34
Figure 3-2 Microcontroller CLCS layout.	35
Figure 3-3 GICS software operational flow.	36
Figure 3-4 Internal ADC layout using embedded components.	39
Figure 3-5 External ADC layout using parallel data transfer over a standard port I/O.	40
Figure 3-6 External ADC layout using synchronous serial communication.	40
Figure 3-7 Parallel ADC conversion layout.	41
Figure 3-8 Flow chart of timer interrupt routine responsible for the ADC sampling rate.	44
Figure 3-9 Flowchart of ADC interrupt routine.	45
Figure 3-10 Voltage pulses demonstrating the ADC interrupt time requirement with no delay.	46
Figure 3-11 Voltage pulses demonstrating the ADC interrupt time requirement with a delay statement.	47
Figure 3-12 Effect of 1 kHz sampling on the frequency of the control algorithm.	48
Figure 3-13 Effect of 300 Hz sampling on the frequency of the control algorithm.	49
Figure 3-14 Modular view of the ADC software.	51
Figure 3-15 Oscilloscope trace from testing ADC operation with 100Hz square wave input.	52
Figure 3-16 Oscilloscope trace from testing ADC operation with 100Hz ramp wave input.	53
Figure 3-17 Simple receiving communication method using interrupt based communication approach.	57
Figure 3-18 Simple transmission communication method using interrupt based communication approach.	58
Figure 3-19 Interrupt routine for buffered communication.	60
Figure 3-20 Processing input buffer routine.	61
Figure 3-21 Moving datum relative to the communication buffer.	62
Figure 3-22 Latency of receiving commands using interrupt based communication.	62

Figure 3-23 Latency of receiving commands using buffered communication.	63
Figure 3-24 Flow chart of method employed for transmission using buffers.	64
Figure 3-25 Captured waveform showing the execution frequency with the original transmission method.	65
Figure 3-26 Captured waveform showing the execution frequency with the new transmission method.	66
Figure 3-27 Control response mapping of 2D input space.	68
Figure 3-28 Graphical representation of membership needed to be implemented.	69
Figure 3-29 Array representation of mapping a fuzzy set.	70
Figure 3-30 Example of looking up mapping of a fuzzy set.	71
Figure 3-31 Mapping nonlinear membership using reduced memory requirements.	73
Figure 3-32 Microcontroller storage of fuzzy set.	75
Figure 3-33 Method of storing membership in limited microcontroller memory.	75
Figure 3-34 Stage 1 check if fuzzy set constants are valid.	76
Figure 3-35 Stage 2 calculating the points for the centre membership.	77
Figure 3-36 Stage 3 calculating the points for the outer centre memberships.	78
Figure 3-37 Stage 4 calculating the points for the outer memberships.	79
Figure 3-38 Shape of Fuzzy variable for set point moderately close to the limit of possible values.	80
Figure 3-39 Shape of Fuzzy variable for set point very close to the limit of possible values.	80
Figure 3-40 Locating the highest activated membership for single membership.	81
Figure 3-41 Decided upon activation of multiple memberships.	81
Figure 3-42 Locating the highest activated membership for single membership.	82
Figure 3-43 Found to only activate single membership.	82
Figure 3-44 Pictorial view of calculating a rule activation.	84
Figure 3-45 Diagram visualization of calculating output membership function.	85
Figure 3-46 GUI of initialising a new controller using the FLC generator.	88
Figure 3-47 GUI of fuzzy logic control code generator.	89
Figure 3-48 Offsets of membership powers.	90
Figure 3-49 Numerical control value from an output membership is governed by the equation.	91
Figure 3-50 Calculating the FLC output from output memberships.	92
Figure 3-51 Fuzzy logic controller operating a single input single output proportional only control rule base.	93

Figure 3-52 Fuzzy logic controller operating a multiple input single output proportional and proportional rule base.	93
Figure 4-1 Proposed system overview of the EPD.	95
Figure 5-1 Non-isolated Boost Converter.	98
Figure 5-2 Equivalent circuit of non isolated boost converter during the on state.	99
Figure 5-3 Equivalent circuit of non isolated boost converter during the off state.	100
Figure 5-4 Half Bridge Converter.	102
Figure 5-5 Full Bridge Converter.	102
Figure 5-6 Relationship between duty ratio and gain of non isolated boost converter.	104
Figure 5-7 Relationship between duty ratio and gain of isolated boost converter.	104
Figure 5-8 Relationship between duty ratio and gain of non isolated boost converter focused around steady state control point.	105
Figure 5-9 Relationship between duty ratio and gain of isolated boost converter focused around steady state control point.	105
Figure 5-10 State diagram of power supply modes of operation.	106
Figure 5-11 Microcontroller directly controlling the switching of the power electronics.	111
Figure 5-12 Microcontroller combined with fixed hardware to control the switching of the power electronics.	112
Figure 5-13 Microcontroller combined with FPGA to control the switching of the power electronics.	113
Figure 5-14 FPGA only to control the switching of the power electronics.	114
Figure 5-15 Flow chart of operation of single microcontroller the power electronics.	115
Figure 5-16 Adaptation of single microcontroller to switch the hardware by adding extra microcontroller dedicated to high speed switching.	116
Figure 5-17 Flow chart of operation of using multiple microcontrollers the switching of the power electronics.	116
Figure 5-18 Diagram of analogue switching circuit.	120
Figure 5-19 Non linearity of using analogue circuit.	120
Figure 5-20 Increase in linearity using a narrower operation point.	121
Figure 5-21 Diagram of digital switching circuit.	121
Figure 5-22 Diagram of using a combination of digital and analogue techniques in producing a switching circuit.	122
Figure 5-23 Embedded SMPS Control System.	123

Figure 5-24 Example of collecting input variables showing the high and low-resolution voltage output prior to signal conditioning.....	124
Figure 6-1 Embedded Motor Driver Control System.....	135
Figure 6-2 Switching pattern for a six step invert.	136
Figure 6-3 Phase voltages during the different states of the six step inverter.	137
Figure 6-4 Layout of control hardware using discrete logic ICs.	138
Figure 6-5 Logic arrangement to generate the switching logic block shown is Figure 6-4.	138
Figure 6-6 Layout of control hardware using simple programmable logic array.	139
Figure 6-7 Layout of controller using external sine wave generators.....	140
Figure 6-8 Layout of controller using the internal DAC to generate two of the required phase and a third produced by summing circuit.....	140
Figure 6-9 Theoretical resolution of the sinusoidal output from the DAC output and corresponding quantisation error when supplying a motor with a 10Hz modulation at fixed interrupt rate of 1 kHz.	141
Figure 6-10 Theoretical resolution of the sinusoidal output from the DAC output and corresponding quantisation errors when supplying a motor with 60Hz modulation at fixed interrupt rate of 1 kHz.	141
Figure 6-11 Physical configuration for three phase bridge operation.	142
Figure 7-1 Layout of automated manual transmission.....	151
Figure 7-2 Simplified dog clutch.	152
Figure 7-3 Simplified cone clutch.....	153
Figure 7-4 Seamless method of fixing gear sets to shafts	153
Figure 7-5 Seamless shift stage 1.	153
Figure 7-6 Seamless shift state 3.....	153
Figure 7-7 Seamless shift stage 2.	154
Figure 7-8 Seamless shift stage 4.	154
Figure 7-9 Centripetal force driven VDP CVT.....	156
Figure 7-10 Pulley displacement by conical power screws.....	157
Figure 7-11 Pulley displacement by a single central power screw.....	158
Figure 7-12 Pulley displacement with linear bearing support of a single power screw.....	159
Figure 7-13 Pulley displacement with two power screws.	159
Figure 7-14 Pulley Displacement by cantilever.....	160
Figure 7-15 Embedded transmission control system.	163
Figure 8-1 Recommend SMPS control arrangement.	172

Figure 8-2 Proposed FPGA FLC implementation applied to motor control module..... 174

LIST OF EQUATIONS

Equation 2-1 Voltage across an inductor.....	24
Equation 2-2 Voltage output of a buck converter.....	25
Equation 2-3 Voltage output of a boost converter.....	25
Equation 2-4 Voltage output from buck boost converter.....	26
Equation 2-5 Synchronous motor torque output	29
Equation 2-6 Synchronous motor power[48].....	29
Equation 3-1 Memory requirement for mapping controller response.....	68
Equation 3-2 Memory requirement for mapping controller response.....	68
Equation 3-3 Simple fuzzy set mapping memory requirements	72
Equation 3-4 Applied equation for 4 input variable controller	84
Equation 3-5 Applied equation for 3 variable controller.....	84
Equation 3-6 Positive change to control the equation.....	91
Equation 3-7 Negative change to control given by the equation.....	91
Equation 3-8 Numerical control value from an output membership is governed by the equation.....	91
Equation 3-9 Output from the fuzzy logic controller can be given by the equation	92
Equation 5-1 Rate of change of the inductor current during on state.....	99
Equation 5-2 Inductor voltage during the off state.....	100
Equation 5-3 Applied total charge flow for off state	100
Equation 5-4 Charge flow for steady state operation.....	101
Equation 5-5 Voltage gain for non-isolated boost converter.....	101
Equation 5-6 Power through a device	108
Equation 6-1 Mechanical Power	133
Equation 6-2 Net Torque	133
Equation 6-3 Slip Rate.....	134
Equation 6-4 Calculation of the slip rate within the controller	143
Equation 7-1 Mechanical power transfer of transmission.....	149
Equation 7-2 Relation between input and output shaft velocities	149
Equation 7-3 Torque gain through a transmission.....	150

LIST OF TABLES

Table 2-1 Full Electric vehicle produced by major automobile manufactures.....	19
Table 3-1 Relationship between the General CLCS model and CLCS applied with microcontroller Technology.	35
Table 3-2 Error rates from communication testing.....	65
Table 4-1 Modules to be developed.....	96
Table 5-1 Required Variables for SMPS.	125
Table 5-2 Required inputs for the controller.	126
Table 6-1 Control variables for the controller to generate slip frequency.....	143
Table 6-2 Required inputs the controller.....	144

LIST OF INSTRUCTIONS

Instruction 3-1 ADC start-up function (general).....	51
Instruction 3-2 ADC start-up function (example).....	51
Instruction 3-3 ADC ready function.....	51
Instruction 3-4 ADC Value function.....	52
Instruction 3-5 Communication instruction format.....	55
Instruction 3-6 Code required for a single rule.....	85

LIST OF ABBREVIATIONS

BEV: Battery Electric Vehicles
CPLD: Complex Programmable Logic Devices
COG: Centre Of Gravity
COS: Centre Of Sums
CVT: Continuously Variable Transmission
DCT: Dual Clutch Transmissions
EPA: Environmental Protection Agency
FBC: Full Bridge Converter
FLC: Fuzzy Logic Controller
FVC: Frequency to Voltage Converter
GEPD: Generic Electric Propulsion Drive
EPD: Electric Propulsion Drive
CLCS: Close Loop Control System
GICS: Generic Intelligent Control system
HBC: Half Bridge Converter
HEV: Hybrid Electric Vehicles
ICE: Internal Combustion Engine
MACD: Multi Agent Collaborative Design
PCA: Programmable Counter Array
PWM: Pulse Width Modulation
SMPS: Switch Mode Power Supplies
VDP: Variable Diameter Pulley