Generic Electric Propulsion Drive

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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 consider 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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LIST OF ABREVIATIONS

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