



DEVELOPMENT PLATFORM FOR MOTOR CONTROLS

A dissertation submitted to the
Department of Electrical Engineering, University of Moratuwa
in partial fulfillment of the requirements for the
degree of Master of Science in Industrial Automation

by

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Abstract

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Speed control of induction motor has become a famous topic in the industrial automation field during the past decade. Due to the rapid growth in power electronics, this field has been grown for a great extent. There are many algorithms currently available for speed control of induction motors, while every algorithm has its relative merits over other. In different situations, it's desirable to use different algorithms. In normal inverters available in the market, most of the time one algorithm is implemented, which is hard-coded in the circuit. This project is about design of a programmable induction motor drive which is capable of implementing different algorithms in one system. Currently it has been developed as a test bench for machines laboratory where different algorithms such as Six Step, Sinusoidal PWM and Constant V/f control are available in the same system with user selectable mode. The system is reprogrammable, so it's possible to include some new algorithms such as trapezoidal PWM in future as further development of this project.

Two types of microcontrollers are used in order to produce the control signals for the inverter. One is Object Oriented PIC (OOPic) and other is PIC16F767, in which there are 3 inbuilt hardware PWM modules with 10-bit resolution available. Six step algorithm is implemented using the OOPic & the sinusoidal PWM with V/f control in implemented using PIC16F767. There is a new speed sensor designed using Hall IC which is very cheap & accurate in operation. This is designed as a low cost alternate method of speed sensing instead of 'Using high cost encoder or photo electric sensors. The sensor feedback signal processing & display of speed also implemented in OOPic.



A driver circuit was very much needed in between the controller and the inverter for several reasons. One is to provide optical isolation from logical ground and the power ground. Other one is to provide a sufficient dead time in upper & lower switch signals. Also a voltage which is capable of switching on an IGBT was needed from the driver circuit. An IGBT module-which consists of converter & inverter circuit is used as the main switching device to produce variable frequency, variable voltage sinusoidal output.

Many challenges were faced while carrying on the project, which gave us a valuable experience by having hands on experience with different ICs, power electronic devices & microcontroller programming. The major issues and challenges faced and the solutions are included in this report. Also a detailed discussion about various components & functionalities is included with the test results. This project report will be a very useful document to anybody interested in designing control systems and power electronic circuit design.

DECLARATION

The work submitted in this dissertation is the result of my own investigation, except where otherwise stated. It has not already been accepted for any degree, and is also not being concurrently submitted for any other degree.

UOM Verified Signature

P. R. D. Dayananda

I endorse the declaration by the candidate.

UOM Verified Signature 

Dr. Sisil Kumarawadu

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Many challenges were faced while designing the power electronic circuits and the controllers. Finding solutions to the many issues, which were encountered, really built a strong link between the power electronics and Electrical drives principles, which we learnt especially in throughout the course.

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