DESIGN AND IMPLEMENT OF INTELLIGENT VARIABLE FREQUENCY DRIVE

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C degree of Master of Engineering

by

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Abstract

Variable voltage variable frequency (VVYF) or V/*f* is the most common method of speed control of three phase induction motors. Majority of those operate in applications not requiring high accuracy position control or high accuracy speed control. A variety of v/f drives are available in market and the speed, acceleration time ,deceleration time are set manually .The key feature of the proposed *v/f* drive is it's ability to sense the external environment and take decisions intelligently. This is ideal when considering a production line. Automation of an induction motor for a particular production line can be done easily with this *v/f* drive. The brain of this drive is a Peripheral Interface Controller (PIC). It has 3 PWM outputs. PIC was programmed in assembly language .MPLAB software compiles assembly to hex codes. Three PWM signals generated from PIC are sent to three IGBT drivers which are capable of introducing interlock in order to drive one IGBT on the same leg. The signals are sent through four opto couplers to isolate the controller from disturbances from power side. A speed reference is provided by a potentiometer connected to analog channel. When a speed is input by potentiometer, interrupt service routine activates and the motor could be run at that speed. Numerous other applications are possible with this drive in industry, One is dispenser controller. Another application is flow contr Her and many more. However further research could develop the features of this controller particularly the closed loop feature.

CONTENTS

DECLARATION

The work submitted in this thesis 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.

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W C C Sumathiratna

I endorse the declaration by the candidate.

UOM Verified Signature

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Dr. J P Karunadasa

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NOMENCLATURE

C_{GATE}	gate charge
C_{gc}	gate to collector capacitance
C_{ge}	gate to emitter capacitance
E_{OFF}	turn off energy
E_{ON}	turn on energy
F_S	switching frequency
I_{ave}	collector-to-emitter average current
Ic	collecter current
I_{rms}	drain-to-source rms current
P_{DFD}	forward power dissipation of diode
P_{GATE}	power dissipation at gate
P_{SW}	switching losses
P_{TDF}	forward power dissipation of IGBT
P_{TOT}	total losses in IGBT
R_{CE}	$\Delta V_{CE}/\Delta I_C$
$R_{DS\text{-}ON}$	drain-to-source on-state resistance

R_{THJC}	junction to case thermal resistance
T_C	case temperature
T_{JMAX}	maximum junction temperature
T_{on}	turn on delay time
T_{off}	turn off delay time
$V_{CE(SAT,MAX)}$	collector to emitter saturation voltage-maximum value
$V_{CE(SAT,TYP)}$	collector to emitter saturation voltage-typical value
$V_{TO(MAX)}$	maximum collector emitter voltage at zero current
V_{CE0}	collector emitter voltage at zero current
VCE-SAT	collector-to-emitter saturation voltage
V_{F0}	diode forward voltage at zero current
V_{GATE}	gate voltage

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