

LABVIEW PID SPEED CONTROLLER FOR DC MOTOR

EFFIZUL SYAFRIN BIN ABU BAKAR

This project is submitted as partial fulfillment of the requirements for the award of the  
Degree of Bachelor of Electrical Engineering (Electronics)

Faculty of Electrical & Electronics Engineering  
Universiti Malaysia Pahang

17 NOVEMBER 2008

## TABLE OF CONTENTS

CHAPTER	TITLE	PAGE
	TITLE PAGE	i
	DECLARATION	ii
	DEDICATION	iii
	ACKNOWLEDGEMENT	iv
	ABSTRACT	v
	ABSTRAK	vi
	TABLE OF CONTENTS	vii
	LIST OF TABLES	x
	LIST OF FIGURES	xi
	LIST OF GRAPH	xii
	LIST OF SYMBOLS	xiii
	LIST OF ABBREVIATION	xiv
	LIST OF APPENDICES	xv
<b>1</b>	<b>INTRODUCTION</b>	<b>1</b>
	1.1 Background	1
	1.2 Problem Statement	3
	1.3 Objective	4
	1.4 Scope of project	4
	1.5 Thesis Organization	5
<b>2</b>	<b>LITERATURE REVIEW</b>	<b>7</b>
	2.1 Proportional-Integration-Derivation Controller (PID Controller)	7
	2.2 Ziegler-Nichols Method	11

	2.3 DC Motor	15
	2.4 Data Acquisition (DAQ) Card	15
	2.5 Laboratory Virtual Instrumentation Engineering Workbench (LabVIEW)	17
<b>3</b>	<b>METHODOLOGY</b>	<b>21</b>
	3.1 Introduction	21
	3.2 System Flowchart	22
	3.3 Software Development	24
	3.3.1 DC Motor Modeling	24
	3.3.2 Ziegler-Nichols Closed Loop Method	27
	3.3.3 Simulation	30
	3.3.4 LabVIEW Programming	32
	3.4 Hardware Development	34
	3.4.1 DC Motor	35
	3.4.2 DAQ Card	36
	3.4.3 Motor Driver G340	37
<b>4</b>	<b>RESULTS AND ANALYSIS</b>	<b>40</b>
	4.1 Introduction	40
	4.2 Simulation	40
	4.2.1 Result and Analysis of Uncontrolled System	41
	4.2.2 Result and Analysis of Proportional Mode System	43
	4.2.3 Result and Analysis of Proportional-Integration Mode System	45
	4.2.4 Result and Analysis of Proportional-Integration-Derivation Mode System	47
	4.3 Summary	49
<b>5</b>	<b>CONCLUSION AND RECOMMENDATION</b>	<b>50</b>
	5.1 Introduction	50
	5.2 Recommendations	51

5.3 Cost and Commercialization	52
--------------------------------	----

<b>REFERENCES</b>	<b>53</b>
-------------------	-----------

Appendices A – C	55-84
------------------	-------

## LIST OF TABLES

<b>TABLE NO.</b>	<b>TITLE</b>	<b>PAGE</b>
2.1	Closed-Loop Calculation of $K_c$ , $T_i$ and $T_d$	13
2.2	Open-Loop Calculation of $K_c$ , $T_i$ and $T_d$	14
3.1	Physical Parameter of DC Motor	24
3.2	General Ziegler-Nichols Closed-Loop Table	28
3.3	Tuned PID Controller Value	29
4.1	Analysis of the Response	49

## LIST OF FIGURE

<b>FIGURE NO.</b>	<b>TITLE</b>	<b>PAGE</b>
2.1	A Block Diagram of a PID Controller	7
2.2	Block Diagram and Front Panel of LabVIEW	18
3.1	Basic Block Diagram of the Project	21
3.2	Flowchart of System Development	23
3.3	DC Motor Model System	24
3.4	LabVIEW Simulation Block Diagram Window	30
3.5	LabVIEW PID Controller Block Diagram Window	32
3.6	Servo Motor	35
3.7	USB DAQ Card	37
3.8	Motor Driver G340	37

## LIST OF GRAPH

<b>GRAPH NO.</b>	<b>TITLE</b>	<b>PAGE</b>
2.1	System Tuned Using the Ziegler-Nichols Closed-Loop Tuning Method	13
3.1	Sustain Oscillation Response	27
4.1	Graph Response without Controller	41
4.2	Graph Response with P Mode	43
4.3	Graph Response with PI Mode	45
4.4	Graph Response with PID Mode	47

## LIST OF SYMBOLS

$K_u$	-	Gain Value
$P_u$	-	Period of Oscillation
$T_i, K_i$	-	Integral Time
$T_d, K_d$	-	Derivative Controller
$K_p$	-	Proportional Gain
$K_{cr}$	-	Critical Gain
$P_{cr}$	-	Critical Period



## LIST OF ABBREVIATION

PID	-	proportional-integration-derivation
DAQ	-	data acquisition card
USB	-	universal serial bus
DC	-	direct current
EMF	-	electromagnetic force

## LIST OF APPENDICES

<b>APPENDIX</b>	<b>TITLE</b>	<b>PAGE</b>
A	DAQ Card Manual	55
B	Servo Motor Manual Installation	76
C	PID.vi Block Diagram	84