

**DEVELOPMENT OF FUZZY LOGIC CONTROLLER  
FOR MAGNETIC LEVITATION SYSTEM**

Thesis is presented in partial fulfillment for the award of the  
Bachelor of Electrical Engineering (Hons)  
UNIVERSITI TEKNOLOGI MARA



**HASLINA BT ADNAN  
FACULTY OF ELECTRICAL ENGINEERING  
UNIVERSITI TEKNOLOGI MARA (UiTM)  
13500 PERMATANG PAUH  
PULAU PINANG**

**FACULTY OF ELECTRICAL ENGINEERING  
UNIVERSITI TEKNOLOGI MARA**

**A report submitted to the Faculty of Electrical Engineering, Universiti Teknologi  
MARA in partial fulfillment of the requirement for the Bachelor of Electrical  
Engineering (Hons)**

**This thesis is approved by:**



.....

Pn. Afaf Rozan Mohd. Radzol  
(Project Supervisor)  
Faculty of Electrical Engineering  
Universiti Teknologi MARA  
Pulau Pinang

(Date: 25 April 2008)

## **DECLARATION**

It is hereby declared that all the materials in this thesis entitle “Developed of Fuzzy Logic Controller” are the result of my original research work. All the material not from my own work has been clearly acknowledged in this thesis.

## TABLE OF CONTENTS

<b>DECLARATION</b>	<b>i</b>
<b>ACKNOWLEDGEMENTS</b>	<b>ii</b>
<b>ABSTRACT</b>	<b>iii</b>
<b>TABLE OF CONTENTS</b>	<b>iv</b>
<b>LIST OF FIGURE</b>	<b>vi</b>
<b>LIST OF TABLE</b>	<b>vii</b>
<b>LIST OF EQUATION</b>	<b>ix</b>
<b>ABBREVIATION</b>	<b>x</b>

<b>CHAPTER</b>	<b>TITLE</b>	<b>PAGE</b>
1	INTRODUCTION	
	1.1 AN OVERVIEW	1
	1.2 OBJECTIVES	1
	1.3 SCOPE OF WORK	2
	1.4 DISSERTATION ORGANIZATION	3
2	LITERATURE REVIEW	
	2.1 MAGNETIC LEVITATION SYSTEM	4
	2.2 FUZZY LOGIC	5
	2.2.1 Structure of Fuzzy Controller	5
	2.2.1.1 Preprocessing	7
	2.2.1.2 Fuzzification	8
	2.2.1.3 Rule base	8
	2.2.1.4 Membership function	8
	2.2.1.5 Fuzzy Inference Engine	9
	2.2.1.6 Defuzzification	10
	2.3 SOFTWARE	
	2.3.1 SIMULINK	10

	2.3.2 SIMULINK Block Diagram	11
	2.3.3 Fuzzy Logic Toolbox	11
3	METHODOLOGY	
	3.1 INTRODUCTION	14
	3.2 CONTROLLER	14
	3.2.1 Fuzzy Logic Controller Design Procedure	14
	3.2.2 Fuzzy Logic Controller Design	15
4	PID CONTROLLER	
	4.1 INTRODUCTION	43
	4.2 PID CONTROLLER	43
	4.2.1 Proportional term	45
	4.2.2 Integral term	45
	4.2.3 Derivative term	46
	4.3 PID SIMULINK model	47
5	RESULTS AND DISCUSSION	
	5.1 INTRODUCTION	49
	5.2 RESULTS FOR PID CONTROLLER	50
	5.3 RESULTS FOR FUZZY LOGIC CONTROLLER	52
	5.3.1 Result by using 9 rules (triangular mf)	52
	5.3.2 Result by using 25 rules (triangular mf)	53
	5.3.3 Result by using 25 rules (Gaussian curve mf)	54
	5.3.4 Result by using 25 rules (Z, Pi, and S curve mf)	55
	5.4 DISCUSSIONS	56
6	CONCLUSIONS AND FUTURE DEVELOPMENT	
	6.1 CONCLUSIONS	57
	6.2 FUTURE DEVELOPMENT	57
	REFERENCES	58
	APPENDICES	

## **ABSTRACT**

Magnetic Levitation (Maglev) system is nonlinear and complex system. The purpose of this project was to develop Fuzzy Logic Controller (FLC) to the Maglev system. Fuzzy Logic Controller resemble human decision making. This controller is used to control the tracking performance of the Maglev system. Fuzzy Logic Controller is designed by using MATLAB Fuzzy Toolbox and the Magnetic Levitation control system block diagram environment is designing using SIMULINK. There is several method uses to control the Maglev system such as PID controller. The result was produced after testing was completed and show in the experimental results. The comparison between the both PID and Fuzzy controller performance will be presented in this thesis.