

## CONTENTS

PERNYATAAN . . . . .	iii
PREFACE . . . . .	v
ABSTRACT . . . . .	vi
INTISARI . . . . .	vii
CONTENTS . . . . .	viii
LIST OF FIGURES . . . . .	x
CHAPTER I INTRODUCTION . . . . .	1
1.1 Research Motivation . . . . .	1
1.2 Problem Statement . . . . .	2
1.3 Research Contribution . . . . .	2
1.4 Research Objective . . . . .	2
1.5 Research Boundaries . . . . .	2
1.6 Research Benefit . . . . .	2
CHAPTER II LITERATURE REVIEW . . . . .	3
CHAPTER III PREREQUISITES ON QUANTUM MECHANICS . . . . .	5
3.1 General Overview . . . . .	5
3.2 Prologue to The Schrödinger Equation . . . . .	5
3.3 One-Dimensional Time-Dependent Schrödinger Equation . . . . .	6
3.4 Mathematical Tools of Quantum Mechanics . . . . .	8
3.4.1 Hilbert Space . . . . .	8
3.4.2 Dirac's Bra-Ket Notation . . . . .	9
3.4.3 General Definition of Operators . . . . .	11
3.4.4 Hermitian Conjugate . . . . .	12
3.4.5 Normalization in Dirac's Bra-Ket Notation . . . . .	12
3.4.6 Commutator Algebra . . . . .	13
3.4.7 Eigenvalues and Eigenvectors of an Operator . . . . .	14
3.4.8 Uncertainty Relation between Two Operators . . . . .	14
3.5 Spin . . . . .	16
CHAPTER IV LYAPUNOV STABILITY THEORY . . . . .	23
CHAPTER V PLANT MODELING AND CONTROL LAW DESIGN . . . . .	29
5.1 Plant Modeling . . . . .	29
5.2 Lyapunov Function . . . . .	30
5.3 Stability Analysis . . . . .	31

5.4	Control Law Design . . . . .	32
CHAPTER VI SIMULATION SETUP, RESULTS, AND ANALYSIS . . . . .		35
6.1	Numerical Simulation Setup . . . . .	35
6.2	Performance Indicators . . . . .	35
6.3	Result with Original Signum Control Law . . . . .	35
6.4	Result with Hyperbolic Tangent Control Law . . . . .	36
6.5	Result with Proportional Control Law . . . . .	36
6.6	Comparison of Control Signals . . . . .	37
6.7	Remark about Stability and Convergence . . . . .	37
6.8	Comparison of The Method in This Study with Methods in Other Studies . . . . .	37
CHAPTER VII CONCLUSION AND FUTURE WORK . . . . .		46
REFERENCES . . . . .		47
APPENDIX . . . . .		A-1
A.1	Origins of Quantum Mechanics . . . . .	A-1
A.2	3-Dimensional Schrödinger Equation . . . . .	A-5
A.3	The Spatial Wave Function of The Hydrogen Atom . . . . .	A-7
A.4	Orbital Angular Momentum . . . . .	A-10
A.5	Applications Using Spin-1/2 System . . . . .	A-11
A.5.1	Quantum Computing . . . . .	A-11
A.5.2	Spintronics . . . . .	A-12