

## CONTENTS

PREFACE		iii
ABBREVIATIONS AND NOTATION		vii
CHAPTER 1	INTERNAL SYSTEM DESCRIPTION: THE STATE VECTOR EQUATION	1
1.1	The Discrete-Time State Vector Equation	1
1.2	Discrete-Time State Variable Diagrams	6
1.3	The Continuous-Time State Vector Equation	11
1.4	Continuous-Time State Variable Diagrams	15
1.5	Change of Variables	18
1.6	Distinct Eigenvalue Diagonal Form	19
1.7	Discrete-Time State Vector Equation Solution	21
1.8	Continuous-Time State Vector Equation Solution	24
	Problems	33
	Remarks and References	36
CHAPTER 2	COMPLETE REACHABILITY AND COMPLETE OBSERVABILITY	39
2.1	Complete Reachability in the Continuous-Time Case	39
2.2	Complete Observability in the Continuous-Time Case	43
2.3	Complete Reachability in the Discrete-Time Case	46
2.4	Complete Observability in the Discrete-Time Case	48
2.5	Reachability and Observability Canonical Forms	49
	Problems	54
	Remarks and References	56

CHAPTER 3	EXTERNAL SYSTEM DESCRIPTION: INPUT/OUTPUT MAPS	59
3.1	The Unit Pulse Response	59
3.2	The z-Transform	60
3.3	State Vector Equations and z-Transforms	71
3.4	The Transfer Function	74
3.5	The Block Diagram	77
3.6	The Unit Impulse Response	80
3.7	The s-Transform	81
3.8	State Vector Equations and s-Transforms	87
3.9	Transfer Functions and Block Diagrams	89
	Problems	91
	Remarks and References	93
CHAPTER 4	COMPLETE REALIZATION	99
4.1	Examples of Complete Realizations	99
4.2	Minimal Complete Realizations	103
	Problems	109
	Remarks and References	111
CHAPTER 5	STABILITY	113
5.1	Asymptotic Stability	113
5.2	Uniform Bounded Input Bounded Output Stability	114
5.3	Equivalence of AS and UBIBOS	116
5.4	Routh-Hurwitz Criterion	120
5.5	The Discrete-Time Case	121
	Problems	124
	Remarks and References	126
CHAPTER 6	COMPLETE IDENTIFICATION	129
6.1	Complete Identification from the Unit Pulse Response	130
6.2	Other Approaches to Complete Identification	131
6.3	Complete Identification in the Continuous-Time Case	138

6.4	Comments on Partial Identification	140
	Problems	142
	Remarks and References	143
CHAPTER 7	THREE SPECIAL TOPICS	147
7.1	Time Delay Systems	147
7.2	Sampled Data Systems	156
7.3	Linearization	162
	Problems	168
	Remarks and References	171
INDEX		175