Contents

Ргета	ace	VII
Chap	oter 1 Introduction, Goal and Outline	1
1.1	Preliminary Comments, 1	
1.2	Purpose and Scope, 3	
1.3	Why Time Domain?, 6	
1.4	Outline, 8	
1.5	References, 12	
Chap	eter 2 Basic Concepts and Definitions in Stochastic Processes	1!
2.1	Introduction, 15	
2.2	Fundamental Definitions in Probability Theory, 15	
2.3	Some Common Distributions, 23	
2.4	Important Concepts in Time Series Analysis, 25	
2.5	Some Basic Properties of Gaussian Processes, 36	
2.6	General Difficulties in Continuous Stochastic Processes Theory, 37	
2.7	The Wiener Process, 38	
2.8	The Role of Stochastic Integration, 39	
2.9	References, 40	
Chap	ter 3 Fundamental Inequalities and Convergence Theorems	41
3.1	Fundamental Inequalities in Stochastic Processes Theory, 41	
3.2	Fundamental Stochastic Convergence Theorems, 43	
3.3	References, 53	

8.2

Cha	oter 4	The Role of the Linear Model	
4.1 4.2 4.3 4.4	Inno ARM	vation for Using White Noise to Drive Linear Models, 55 vations and Pseudo Innovations Sequences, 60 (A Models for Nonstationary Situations, 61 rences, 62	
Char		Least Squares Parameter Identification of	
	-10. 5	Time Series and Systems	63
5.1	Gene	ral, 63	
5.2	Least	Squares Identification, 65	
5.3		ential Least Squares Identification, 70	
5.4		ce Least Squares and Sequential Lattice Least Squares rithms, 73	
5.5		etting Factors in Sequential Identification of Time ing Processes, 85	
5.6		vs. Recursive Processing, 87	
5.7		rences, 89	
Chap	oter 6	Convergence of Least Squares Identifiers	91
6.1		nvergence Proof for Cases of Stable Signal Models, 91	
6.2 6.3	Conv	nvergence Proof for Cases of Unstable Signal Models, 98 ergence Rate of LS Identifiers and Their Maximum ihood Property, 106	
6.4		insour roperty, 106 ssion of Properties of Identifier's Robustness to Round-	
0.4		Firor and Conclusions, 109	
6.5		rences, 110	
Chap	ter 7	Recursive Gadient Identification Methods	111
7.1	Intro	duction, 111	
7.2		lgorithm Description, 112	
7.3		ergence of SA Identifiers, 113	
7.4		t Sequential Lattice Grandient Algorithm, 120	
7.5	A Co	mparison of Gradient Lattice vs. LS Identifiers, 122	
7.6		ences, 124	
Chap		Identification and Order Determination: MA/ARMA, Non-Invertible, Feedback and Partly-Deterministic Structures	125
8.1		vation of ARMA Parameters and Orders Form Pure AR	

Identification for Cases of Non-Invertible Systems, 138

8.3 8.4 8.5 8.6	ARMA Models With Zeros on The Unit Circle, 143 Direct Identification of Pure MA Models, 147 Direct Identification of Mixed ARMA Models, 149 Merits of Pure AR Models vs. Pure MA or Directly-Identified ARMA Models, 150 Identification of Input-Output-Noise Models, 153	
8.8	Identification of Stable and Unstable Closed Loop Structures, 15	55
8.9	Selection of Sampling Interval in System Modeling, 160	
8.10	References, 162	
Chapt	ter 9 Adaptive Decision Theory	163
9.1	Problem Statement, 163	
9.2	Definitions, 164	
9.3	Bayes Decision Rule - Binary Decision, 165	
9.4	Self-Adaptive Decision Algorithm, 168	
9.5	Self-Adaptive Decisions: Multi-Class Situation, 172	
9.6	The Role of Calssification Algorithms in Detection and Pattern	
0.7	Recognition Problems, 172	
9.7	References, 173	
Chapt	ter 10 Optimal Linear Filtering of Noise	175
10.1	Problem Statement, 175	
10.2	The Wiener Filter, 177	
10.3	The Kalman Filter, 180	
10.4	The Augmented Kalman Filter for Colored Measurement Noise, 185	
10.5	Error Properties and Comparisons of Wiener and Kalman Filters,	187
10.6	References, 194	
Chapt	ter 11 Adaptive Filtering	197
11.1	Adaptive Filtering with Partial Knowledge, 197	
11.2	Adaptive Filtering with Unknown Parameters of Signal and of Noise, 201	
11.3	References, 211	
Chapt	ter 12 Adaptive Control	
12.1	General Problem Statement and Certainty Equivalence Considerations, 213	
12.2	Adaptive Control via Separately Designed Identifier-	

Filter-Controller, 214

	nkins-Type Adaptive Control Design, 225 e Adaptive Control, 227 es, 241			
Appendix A Co	mputer Printouts of Programs and Results	243		
Program P-5.1	SLS Algorithm: Evaluation of Effect of P_0 on SLS Identification Error, 243			
Program P-5.2	Evaluation of Effect of Initial Estimate on SLS Identification Error, 250			
Program P-5.3 Program P-5.4	SLS Identification of Unstable Time Series Models, 254 Effect of P_0 on SLS Identification of Unstable Time Series, 256			
Program P-5.5	SLS Identification Process With Poles on Unit Circle of B-Plane, 260			
Program P-5.6	SLS Identification Cases of Pole on Unit Circle With Other Pole Outside/Inside Unit Circle, 269			
Program P-5.7	Sequential Least Squares Lattice Identification—Stable System, 279			
Program P-5.8	Sequential Least Squares Lattice Identification—Unstable System, 290			
Program P-7.1 Program P-7.2 Program P-8.1	Gradient Lattice Identification—Stable System, 292 Gradient Lattice Identification of Unstable Systems, 301 SLS Identification of Non-Invertible Time Series Model, 302			
Program P-9.1 Program P-11.1	Self-Adaptive Classification, 305 Self-Adaptive Filter, 312			
Tir	ltifunctional Prosthesis and Orthosis Control via ne Series Identification and Discrimination of gle-Site Myoelectric Signal Signatures	317		
	nd, 319 ifunctional Controller, 320 edure and Results, 322 ons, 327			
Appendix C Some Fundamental Matrix Relations 331				
C.2 Eigenvalu	n Matrix, 331 es and Spectral Radius, 332 unts and Trace Functions, 333			

C.4	Polynomial Relations and Non-Derogatory Matrices, 334	
C.5	Positive/Negative (Semi) Definiteness, 334	
C.6	Orthogonal and Symmetric Matrices, 335	
C.7	Inverses, 336	
C.8	Diagonalization, 337	
C.9	Companion Form, 339	
C.10	Differentiation, 340	
C.11	Some Other Matrix Properties, 341	
C.12	References, 342	
Apper	ndix D Transfer-Function/State-Space Transformations	343
D.1	Transformation from State Space to Transfer Function, 343	
D.2	Transformation from Transfer Function to State Space, 344	
D.3	References, 346	
Apper	ndix E Some Lemmas on Series Convergences	347
E.1-E	.14 Lemmas, 314	
E.15	References, 354	
Proble	·	355
Authors Index		369
Subjed	et Index	373