Prefac	ce - Datis and P. Research - From Control of the 1664 Automorphic Computation (1884) (1887) when the Control of	xiii
Part	1: Theory	
Sectio	n 1: Adaptive Control—The Ideal Case	1
1.1	Towards a Unified Theory of Parameter Adaptive Control: Tunability A. S. Morse (<i>IEEE Transactions on Automatic Control</i> , September 1990; first appeared in <i>Proceedings of the 27th IEEE Conference on Decision and Control</i> , December, 1988)	3
1.2	On Necessary Assumptions in Continuous Time Model Reference Adaptive Control D. E. Miller and E. J. Davison (<i>Proceedings of the 28th IEEE Conference on Decision and Control</i> , December 1989)	14
1.3	An Adaptive Controller Which Provides Lyapunov Stability D. E. Miller and E. J. Davison (<i>IEEE Transactions on Automatic Control</i> , June 1989; first appeared in <i>Proceedings of the 27th IEEE Conference on Decision and Control</i> , December 1988)	20
1.4	Richness and Excitation on an Interval—with Applications to Continuous-Time Adaptive Control G. Kreisselmeier and G. Rietze-Augst (IEEE Transactions on Automatic Control, February 1990; first appeared in Proceedings of the 27th IEEE Conference on Decision and Control, December 1988)	31
1.5	Model Reference Adaptive Control for Plants with Unknown Relative Degree G. Tao and P. A. Ioannou (<i>Proceedings of the 1989 Automatic Control Conference</i> , June 1989)	38
1.6	A Smooth High-Gain Adaptive Stabilizer for Linear Systems with Known Relative Degree D. R. Mudgett and A. S. Morse (<i>Proceedings of the 1989 Automatic Control Conference</i> , June 1989)	44
1.7	The Closed-Loop Identification Problem in Indirect Adaptive Control J. W. Polderman and C. Praagman (<i>Proceedings of the 28th IEEE Conference on Decision and Control</i> , December 1989)	50
1.8	Parameter Convergence Conditions Independent of Plant Order D. S. Rhode and P. V. Kokotovic (<i>Proceedings of the 1989 Automatic Control Conference</i> , June 1989)	55
1.9	Global Stability for an MIT Rule Based Adaptive Control Algorithm I. M. Y. Mareels and B. E. Ydstie (<i>Proceedings of the 28th IEEE Conference on Decision and Control</i> , December 1989)	61
Sectio	on 2: Time-Varying and Nonlinear Systems	67
2.1	Adaptive Control of a First Order Plant with a Time-varying Parameter A. M. Annaswamy and K. S. Narendra (<i>Proceedings of the 1989 Automatic Control Conference</i> , June 1989)	69
2.2	A New Indirect Adaptive Control Scheme for Time-Varying Plants K. S. Tsakalis and P. A. Ioannou (<i>IEEE Transactions on Automatic Control</i> , June 1990; first appeared in <i>Proceedings of the 27th IEEE Conference on Decision and Control</i> , December 1988)	75
2.3	Adaptive Tracking for Feedback Linearizable SISO Systems R. Marino, I. Kanellakopoulos, and P. Kokotovic (<i>Proceedings of the 28th IEEE Conference on Decision and Control</i> , December 1989)	84
2.4	Indirect Techniques for Adaptive Input Output Linearization of Nonlinear Systems A. Teel, R. Kadiyala, P. Kokotovic, and S. Sastry (<i>Proceedings of the 1990 Automatic Control Conference</i> , May 1990)	90

2.5	Observer-Based Adaptive Control of Nonlinear Systems under Matching Conditions I. Kanellakopoulos, P. V. Kokotovic, and R. H. Middleton (<i>Proceedings of the 1990 Automatic Control Conference</i> , May 1990)	92
2.6	Indirect Adaptive Nonlinear Control JB. Pomet and L. Praly (<i>Proceedings of the 27th IEEE Conference on Decision and Control</i> , December 1988)	99
2.7	Adaptive Nonlinear Regulation: Equation Error from the Lyapunov Equation JB. Pomet and L. Praly (<i>Proceedings of the 28th IEEE Conference on Decision and Control</i> , December 1989)	101
2.8	Variable Structure Model-Reference Adaptive Control (VS-MRAC) Using Only Input and Output Measurements: Part II L. Hsu (Proceedings of the 27th IEEE Conference on Decision and Control, December 1988)	107
2.9	A New Robust Model Reference Adaptive Control Using Variable Structure Adaptation for Plants with Relative Degree Two LC. Fu (<i>Proceedings of the 1990 Automatic Control Conference</i> , May 1990)	113
2.10	A New Approach for Solving Model Reference Adaptive Control Problem for Fast Time-Varying Unknown Plants with Relative Degree One LC. Fu, and CJ. Chien (<i>Proceedings of the 1990 Automatic Control Conference</i> , May 1990)	119
Section	3: Robust Adaptive Control	125
3.1	Toward Practical Adaptive Control J. M. Krause, G. Stein, and P. P. Khargonekar (<i>Proceedings of the 1989 Automatic Control Conference</i> , June 1989)	127
3.2	Robust Adaptive Regulation without Persistent Excitation R. Lozano-Leal (<i>IEEE Transactions on Automatic Control</i> , December 1989; first appeared in Proceedings of the 1989 Automatic Control Conference, June 1989)	133
3.3	Robust Adaptive LQ Control Schemes J. Sun and P. Ioannou (<i>Proceedings of the 1989 Automatic Control Conference</i> , June 1989)	141
3.4	Indirect Adaptive Feed-Forward Tracking Controllers TC. Tsao and M. Tomizuka (<i>Proceedings of the 1989 Automatic Control Conference</i> , June 1989)	147
3.5	A Combined Direct, Indirect, and Variable Structure Method for Robust Adaptive Control K. S. Narendra and J. D. Bŏsković (<i>Proceedings of the 1990 Automatic Control Conference</i> , May 1990)	153
3.6	Disturbance-Generated Bifurcation in a Prototype Adaptive System with e_1 -Modification Law S. Bai and F. M. A. Salam (<i>IEEE Transactions on Automatic Control</i> , October 1988; first	159
	appeared in Proceedings of the 27th IEEE Conference on Decision and Control, December 1988)	310-10
3.7	Nonlinear Interactions between Signals and Parameters in Robust Adaptive Control G. J. Rey, C. R. Johnson, Jr., and R. R. Bitmead (<i>Proceedings of the 1990 Automatic Control Conference</i> , May 1990)	165
3.8	Adaptive Robust Pole Placement—An Alternative Approach M. Das, P. Kokate, and N. K. Loh (<i>Proceedings of the 1990 Automatic Control Conference</i> , May 1990)	171
3.9	Multiple Model Adaptive Controller for the STOL F-15 with Sensor/Actuator Failures P. S. Maybeck and D. L. Pogoda (<i>Proceedings of the 28th IEEE Conference on Decision and Control</i> , December 1989)	177
3.10	Stability Analysis of Decentralised Robust Adaptive Control D. J. Hill, C. Wen, and G. C. Goodwin (Proceedings of the 27th IEEE Conference on Decision and Control, December 1988)	184

3.11	Decentralized Indirect Adaptive Control of Interconnected Systems	189
	A. Datta and P. Ioannou (Proceedings of the 1990 Automatic Control Conference, May 1990)	
Section	n 4: Stochastic Adaptive Control	195
4.1	Escape Time Formulation of Robust Stochastic Adaptive Control R. R. Bitmead and P. E. Caines (<i>Proceedings of the 27th IEEE Conference on Decision and Control</i> , December 1988)	197
4.2	Parameter Convergence in the Stochastic Gradient Adaptive Control Law SF. Lin, and P. R. Kumar (<i>Proceedings of the 27th IEEE Conference on Decision and Control</i> , December 1988)	203
4.3	A Parameter Estimation Algorithm for Continuous Time Stochastic Adaptive Control M. Gevers, V. Wertz, and G. C. Goodwin (<i>Proceedings of the 27th IEEE Conference on Decision and Control</i> , December 1988)	205
4.4	Convergence of Adaptive Control Schemes Using Least-Squares Parameter Estimates P. R. Kumar (<i>IEEE Transactions on Automatic Control</i> , April 1990; first appeared in <i>Proceedings of the 28th IEEE Conference on Decision and Control</i> , December 1989	207
4.5	Mean Square Convergence of an Adaptive RLS Algorithm with Stochastic Excitation S. Bittanti and M. Campi (<i>Proceedings of the 28th IEEE Conference on Decision and Control</i> , December 1989)	216
4.6	Some Aspects of the Adaptive Control of Stochastic Evolution Systems T. E. Duncan and B. Pasik-Duncan (<i>Proceedings of the 28th IEEE Conference on Decision and Control</i> , December 1989)	222
4.7	Asymptotically Efficient Adaptive Allocation Schemes for Controlled Markov Chains: Finite Parameter Space R. Agrawal, D. Teneketzis, and V. Anantharam (<i>IEEE Transactions on Automatic Control</i> , December 1989, first appeared in <i>Proceedings of the 27th IEEE Conference on Decision and Control</i> , December 1988)	226
4.8	On the Adaptive Stabilization of Linear Stochastic Systems with Jump Process Parameters H. F. Chen and P. E. Caines (<i>Proceedings of the 28th IEEE Conference on Decision and Control</i> , December 1989)	237
Part	2: Applications	
Section	n 5: Applications of Adaptive Control	241
5.1	Practical Experiences of Adaptive Techniques K. J. Astrom and T. Hagglund (Proceedings of the 1990 Automatic Control Conference, May 1990)	243
5.2	Supervision and Coordination of Parameter-Adaptive Controllers T. Knapp and R. Isermann (<i>Proceedings of the 1990 Automatic Control Conference</i> , May 1990)	251
5.3	An Application of Adaptive Scheme to Fluid Level Control J. M. Fernandes, C. E. de Souza, and G. C. Goodwin (<i>Proceedings of the 1989 Automatic Control Conference</i> , June 1989)	257
5.4	Adaptive Regulation of Arterial Gas Pressures by Using Robust Adaptive Control Scheme A. Sano, K. Ohkubo, H. Ohmori, and M. Kikuchi (<i>Proceedings of the 27th IEEE Conference on Decision and Control</i> , December 1988)	263
5.5	Adaptive Robust Control Scheme Applied to a Single-Zone HVAC System Y. H. Chen, K. M. Lee, and W. J. Wepfer (<i>Proceedings of the 1990 Automatic Control Conference</i> , May 1990)	270

5.6	Self-Tuning Load Frequency Controller for Interconnected Power Systems Including Effects of Nonlinearities K. A. Lee and H. Yee (<i>Proceedings of the 1990 Automatic Control Conference</i> , May 1990	276
5.7	Application of Self-Tuning to Automotive Cruise Control M. Tsujii, H. Takeuchi, K. Oda, and M. Ohba (<i>Proceedings of the 1990 Automatic Control Conference</i> , May 1990)	282
5.8	An Adaptive Sliding Mode Vehicle Traction Controller Design HS. Tan and M. Tomizuka (<i>Proceedings of the 1990 Automatic Control Conference</i> , May 1990)	288
5.9	Adaptive Control of Automotive Transmissions K. Glitzenstein and J. K. Hedrick (<i>Proceedings of the 1990 Automatic Control Conference</i> , May 1990)	294
5.10	The Application of a Class of Adaptive Control Algorithms to Hydraulic Servosystems S. Ananthakrishnan and R. Fullmer (<i>Proceedings of the 1990 Automatic Control Conference</i> , May 1990)	301
5.11	Experimental Results in Adaptive Control of Biotechnological Processes M. Samaan, T. Dahhou, I. Queinnec, and M. M'Saad (<i>Proceedings of the 1990 Automatic Control Conference</i> , May 1990	303
5.12	Multivariable Adaptive Control of Nonlinear Completely Mixed Bioreactors D. Dochain (<i>Proceedings of the 1990 Automatic Control Conference</i> , May 1990)	308
5.13	Nonlinear Adaptive Control of a Twin Lift Helicopter System M. Mittal, J. V. R. Prasad, and D. P. Schrage (<i>Proceedings of the 1990 Automatic Control Conference</i> , May 1990)	314
5.14	Adaptive Time-Optimal Control of Flexible Structures A. M. Pascoal, R. L. Kosut, G. F. Franklin, D. R. Meldrum, and M. L. Workman (<i>Proceedings of the 1989 Automatic Control Conference</i> , June 1989)	320
5.15	An Averaging Approach to Optimal Adaptive Control of Large Space Structures D. S. Bayard (<i>Proceedings of the 1990 Automatic Control Conference</i> , May 1990)	326
Section	n 6: Applications of Adaptive Control to Robotics	333
6.1	Adaptive Motion Control of Rigid Robots: A Tutorial R. Ortega and M. W. Spong (<i>Proceedings of the 27th IEEE Conference on Decision and Control</i> , December 1988)	335
6.2	Future Trends in Adaptive Control of Robot Manipulators I. D. Landau (<i>Proceedings of the 27th IEEE Conference on Decision and Control</i> , December 1988)	345
6.3	Issues in Robot Adaptive Control H. M. Schwartz, G. Warshaw, and T. Janabi (<i>Proceedings of the 1990 Automatic Control Conference</i> , May 1990)	348
6.4	An Exponentially Stable Adaptive Control Law for Robot Manipulators N. Sadegh and R. Horowitz (<i>Proceedings of the 1990 Automatic Control Conference</i> , May 1990)	357
6.5	Instability Analysis and Robust Adaptive Control of Robotic Manipulators J. S. Reed and P. A. Ioannou (<i>Proceedings of the 27th IEEE Conference on Decision and Control</i> , December 1988)	364
6.6	Performance in Adaptive Manipulator Control G. Niemeyer and JJ. E. Slotine (<i>Proceedings of the 27th IEEE Conference on Decision and Control</i> , December 1988)	370

6.7	Repetitive Control of a Two Degree of Freedom SCARA Manipulator WW. Kao, R. Horowitz, M. Tomizuka, and M. Boals (<i>Proceedings of the 1989 Automatic Control Conference</i> , June 1989)	377
6.8	A New Learning Controller for Mechanical Manipulators N. Sadegh and K. Guglielmo (<i>Proceedings of the 1989 Automatic Control Conference</i> , June 1989)	384
6.9	Stable Adaptive Teleoperation G. Niemeyer and JJ. E. Slotine (<i>Proceedings of the 1990 Automatic Control Conference</i> , May 1990)	391
6.10	Adaptive CSI Compensation for Reduced-Order-Model-Based Control of A Flexible Robot Manipulator R. A. Davidson, M. J. Balas, and B. T. Reisenauer (<i>Proceedings of the 1990 Automatic Control Conference</i> , May 1990)	397
Author	Author Index	
Subject	t Index	405
Editors	s' Biographies	400