EOLSS

Encyclopedia of Life Support Systems

Contributions

6.43. Control Systems, Robotics and Automation

Part A: Fundamentals of Control Systems

6.43.1	Elements of Control Systems	(G. P. Rao)
1.1	Basic Elements of Control Systems	(G. P. Rao)
1.2	General Models of Dynamical Systems	(G. P. Rao)
1.3	Description of Continuous Linear Time-invariant Systems i	n Time Domain (H. Unbehauen)
1.4	Description of Continuous Linear Time-invariant Systems i	n Frequency Domain (H. Unbehauen)
1.5	Closed-loop Behaviour of Continuous Linear Time-invarian	nt Systems
		(H. Unbehauen)
6.43.2	Stability Concepts (A.B. Ku	rzhanski / I.F. Sivergina)
6.43.3	Classic Design Methods for Continuous LTI- System	ms (R. T. Stefani)
3.1	Controller-Design in Time-domain	(H. Unbehauen)
3.2	Design in Frequency-domain	(R. T. Stefani)
3.3	PID-control	(M. Araki)
3.4	Internal Model Control (D. Rivera / M. E. Flores)
3.5	Smith Predictor and its Modifications	(C. C. Hang)
6.43.4	Digital Control Systems	(P. N. Paraskevopoulos)
4.1	Discrete-time, Sampled data, Digital Control Systems, Quar	ntization Effects (P. N. Paraskevopoulos)
4.2	Discrete-time Equivalents to Continuous-time Systems	Santina / A.R. Stubberud)
4.3	Design Methods for Digital Controllers, Sample-rate	(P. N. Paraskevopoulos)
4.4	Real-time Implementation	(U. Kiffmeier)
7,7	real time implementation	(O. Killillelei)

6.43.5	Design of State Space Controllers (Pole Placen	nent) for SISO Systems (B. Lohmann)
5.1	Description and Analysis of Dynamic Systems in State	
5.2	Controller Design	(B. Lohmann)
5.3	Observer Design	(B. Lohmann)
5.4	Extended Control Structures	(B. Lohmann)
6.43.6	Basic Nonlinear Control Systems	(D. P. Atherton)
6.1	Describing Function Method	(D. P. Atherton)
6.2	Second Order Systems	(D. P. Atherton)
6.3	Stability Theory	(P. C. Müller)
6.4	Popov and Circle Criterion	(P. C. Müller)
6.5	Control by Compensation of Nonlinearities	(G. Tao / A. Taware)
6.6	Estimation and Compensation of Nonlinear Pertubation	ons by Disturbance
	Observers	(P. C. Müller)
6.7	Anti Wind-up and Override Control (A.H. G	lattfelder / W. Schaufelberger)
6.8	Gain Scheduling	(D.J. Leith / W.E. Leithead)
Part B:	Modeling, Identification and Parameter Estimation	
6.43.7	Modeling and Simulation	(I. Troch / F. Breitenecker)
7.1	Modeling and Simulation of Distributed Systems	(A. Kugi)
7.2	Modeling and Simulation of Distributed Parameter Sy	` - ′
7.3	Modeling and Simulation of Large-Scale Hybrid Syste	
5 4	· ·	A. Pereira Remelho / S. Engell)
7.4	Modeling and Simulation of Dynamic Systems using Bond Graphs (P. Breedveld)	
7.5	Rapid Prototyping for Modell and Controller Implement	
7.6	Mixed Mode Modelling and Simulation for Continuou	s and Diskret Systems (P. Schwarz)
7.7	Software – Developments and Trends	(F. Breitenecker / I. Troch)
6.43.8	Frequency Domain System Identification	(J. Schoukens / R. Pintelon)
8.1	Measurements of Frequency Response Functions	(J. Schoukens / R. Pintelon)
8.2	Estimation with Known Noise Model	(R. Pintelon / J. Schoukens)
8.3	Frequency Domain Subspace algorithms	(R. Pintelon / J. Schoukens)
8.4	Estimation with unknown Noise Models	(R. Pintelon / J. Schoukens)
8.5	Modal Analysis	(P. Guillaume)
6.43.9	Identification of Linear Systems in Time Doma	nin (T. Söderström)
9.1	Least Squares and Instrumental Variable Methods	(T. McKelvey)

9.2	Prediction Error Methods	(T. Söderström)
9.3	Subspace Identification Methods	(K. de Cook / B. de Moor)
9.4	Recursive Algorithms	(HF. Chen)
9.5	Identification for Control (P.M.J. van	n den Hof / R.A. de Callafon)
9.6	Continuous-Time Identification	(R. Johansson)
9.7	Identifiability	(G. Bretthauer)
9.8	Relations between time domain and frequency domain	(T. McKelvey)
9.9	Identification of Time Varying Systems	(P. Young)
6.43.10	Identification of Nonlinear Systems	(H. Unbehauen)
10.1	Nonparametric System Identification	(H. Kashiwagi)
10.2	Identification of block-oriented models	(R. K. Pearson)
10.3	Identification of NARMAX and related models	(S. A. Billings / D. Coca)
10.4	System Identification using Neural Networks	(A. Ali / C. Schmid)
10.5	System Identification using Fuzzy Models	(R. Babuška)
10.6	System Identification using Wavelets	(D. Coca / S. A. Billings)
10.7	Parameter Estimation for Differential Equations	(A. Patra)
10.8	Parameter Estimation for Nonlinear Continuous-Time Sampled Data	State-Space Models from (C. Bohn)
10.9	Identification in the Frequency Domain	(J. S. Bendat)
10.10	Parametric Identification using Sliding Modes (F. Floret-Pont	et / F. Lamnabhi-Lagarrigue)
6.43.11	Bound-based Identification	(E. Walter)
11.1	Linear-model Case	(J. P. Norton)
11.2	Nonlinear-model Case	(K. J. Keesman)
6.43.12	Practical Issues of System Identification	(L. Ljung)
Part C:	Analysis and Design Methods for Control	Systems
6.43.13	Control of Linear Multivariable Systems	(K. Furuta)
13.1	Description and Classification in MIMO Design	(D. H. Owens / J. Hätönen)
13.2	Canonical Forms for State Space Descriptions	N. Karcanias / D. Vafiadis)
13.3	Multivariable Poles and Zero	(N. Karcanias)
13.4	Frequency Domain Representation and Singular Value	` '
	<u>.</u>	(A. C.Antoulas)
13.5	Polynomial and Matrix Fraction Description	(D. Henrion / M. Šebek)
13.6	System Characteristics: Stability, Controllability, Obser	rvability (J. Klamka)
13.7	Model Reduction (R	. E. Skelton / M. de Oliveira)

13.8	Full Order State-Observers	(B. Friedland)
13.9	Reduced Order State-Observers	(B. Friedland)
13.10	Kalman Filters	(M. S. Grewal)
13.11	Pole Placement Control	(J. E. Ackermann)
13.12	Eigenstructure Assignment for Control	(G. P. Liu / R. J. Patton)
13.13	Optimal LinearQquadratic Control	(J. M. Lemos)
13.14	Pontryagin's Maximum Principle	(A. B. Kurzhanski)
13.15	Decoupling Control	(M. Fikar)
13.16	Controller Design using Polynomial Matrix Descr	ription (D. Henrion / M. Šebek)
13.17	Design Techniques in Frequency Domain	(J. M. Edmunds / N. Munro)
13.18	Design Techniques for Time-Varying Systems	(P. A. Iglesias)
13.19	Servo Control Design	(T. Chang)
6.43.14	Robust Control	(S. P. Bhattacharyya)
14.1	Uncertainty Models for Robustness Analysis	(A. Garulli / A. Tesi / A. Vicino)
14.2	Robustness under Real Parameter Uncertainty	(L. H. Keel)
14.3	$oldsymbol{H}_{\scriptscriptstyle \infty}$ -optimal Control	(H. Kwakernaak)
14.4	L_{I} robust Control	(M. Khammash)
14.5	μ -Synthesis	(G. J. Balas)
14.6	Controller Design using Linear Matrix Inequalitie	es (H. Werner)
14.7	Robust Control of Nonlinear Systems: A Control	Lyapunow Function Approacch (P. Kokotović / M. Arcak)
14.8	Fundamentals of the Quantitative Feedback Theo	,
6.43.15	Adaptive Control	(K. S. Narendra)
15.1	Relay Autotuning of PID-Controllers	(D. P. Atherton)
15.2	Self-tuning Control	(P. J. Gawthrop)
15.3	Model Reference Adaptive Control	(A. M. Annaswamy)
15.4	Adaptive Predictive Control	(D. W. Clarke / U. R. Halldorsson)
15.5	Stochastic Adaptive Control	(T. E. Duncan)
15.6	Adaptive Dual Control	(B. Wittenmark)
15.7	Adaptive Nonlinear Control	(P. V. Kokotović / M. Krstić)
15.8	Control of Intermittent Processes	(M. Pandit / H. Hengen)
6.43.16	Model-based Predictive Control	(E. Mosca)
16.1	Model-based Predictive Control for Linear System	ns (R. De Keyser)
16.2		göwer; R: Findeisen, C: Ebenbauer)

6.43.17	Controls of Large Scale Systems	(M. Jamshidi)
6.43.18	Control of Stochastic Systems	(P. R. Kumar)
18.1	Models of Stochastic Systems	(A. W. Ordys / J. Bentsman)
18.2	Stochastic Stability	(H. J. Kushner)
18.3	Minimum Variance Control	(P. J. Gawthrop)
18.4	LQ-Stochastic Control	(J. M. Lemos)
18.5	Dynamic Programming	(P. R. Kumar)
6.43.19	Distributed Parameter Systems; an Overview	(D. L. Russell)
19.1	Controllability and Observability of Distributed Para	ameter Systems (J. Klamka)
19.2	Controller Design for Distributed Parameter Systems	s (Y. Touré / J. Rudolph)
19.3	State Estimation in Distributed Parameter Systems	- ·
19.4	Time Delay Systems	(H. Mounier / J. Rudolph)
6.43.20	Control of 2D Systems	(T Kaczorek)
20.1	Generalised Multidimensional Discrete, Continuous-	Discrete and Positive Systems (T. Kaczorek)
20.2	Controllability and Observability of 2D Systems	(J. Klamka)
20.3	Industrial Applications of 2D Control Systems	(P E. Wellstead)
20.4	Stability of 2D Systems	(P. A. Cook)
6.43.21	Control of Nonlinear Systems	(H. K. Khalil)
21.1	Analysis of Nonlinear Control Systems	(H. K. Khalil)
21.2	Lie Bracket	(K. Schlacher)
21.3	Differential Geometric Approach and Application of Computer Algebra (K. Schlacher	
21.4	Volterra and Fliess Series Expansion	(F. Lamnabhi-Lagarrigue)
21.5	Lyapunov Stability	(H. K. Khalil)
21.6	Input-output Stability	(S. P. Banks)
21.7	Controllability and Observability of Nonlinear System	ms (H. Huiberts / H. Nijmeijer)
21.8	Design for Nonlinear Control Systems	(A. Isidori)
21.9	Feedback Linearization of Nonlinear Systems	(A. Isidori)
21.10	Nonlinear Output Regulation	(A. Isidori)
21.11	Nonlinear Zero-Dynamics in Control Systems	(P. Sarma / B. Bandyopadhyay)
21.12	Flatness-Based Design (P. M.	Martin /R. Murray / P. Rouchon)
21.13	Lyapunov Design	(S. S. Ge)
21.14	Sliding Mode Control	(V. Utkin)
21.15	Nonlinear Observers	(A. J. Krener)
21.16	State Reconstruction by Extended Kalman Filter	(R. Unbehauen)

21.17	Passivity Based Control	(A. Loría / H. Nijmeijer)
6.43.22	Control of Chaos and Bifurcation	(A. L. Fradkov, G. Chen)
22.1	Control of Bifurcations	(G. Chen)
22.2	Modeling and Analysis of Chaotic Systems	(A. L. Fradkov)
22.3	Control of Chaotic Systems	(A. L. Fradkov)
Part D:	Non-standard Types of Control System	ms
6.43.23	Fuzzy Control Systems	(J. Jäkel / R. Mikut / G. Bretthauer)
23.1	Data-Based Fuzzy Modeling	(T. Slawinski / H. Kiendl)
23.2	Optimization of Fuzzy Controllers	(J. Wernstedt)
23.3	Analysis and Stability of Fuzzy Systems	(R. Mikut/G. Bretthauer)
23.4	Fuzzy System Applications	(J. Jäkel/G. Bretthauer)
6.43.24	Neural Control Systems	(J. Campos / F. L. Lewis)
6.43.25	Expert Control Systems	(S. G. Tzafestas)
25.1	Expert Control Systems: An Introduction with Ca	se Studies (S. G. Tzafestas)
25.2	Knowledge-Based and Learning Control Systems	(Z. Bubnicki)
25.3	Fuzzy Expert Control Systems: Knowledge Base V	,
25.4	Blackboard Architecture for Intelligent Control	(G. K. H. Pang)
6.43.26	Genetic Algorithms in Control Systems Eng	gineering (P. J. Fleming / R. C. Purshouse)
6.43.27	Discrete Event Systems	(C. G. Cassandras)
27.1	Modeling of Discrete Event Systems	(S. Lafortune)
27.2	Supervisory Control of Discrete Event Systems	(S. Lafortune)
27.3	Sample Path Analysis of Discrete Event Dynamic S	Systems (Y. C. Ho / X. R. Cao)
6.43.28	Hybrid Control Systems	(K. H. Johansson)
28.1	Modeling of Hybrid Systems (K. H	H. Johansson, J. Lygeros, S. Sastry)
28.2	Well-posedness of Hybrid Systems (M. K. Çamlıbel / W. P. M. H. Heemels / A. J.	van der Schaft / J. M. Schumacher)
28.3	Stability of Hybrid Systems	(M. S. Branicky)
28.4	Abstractions of Discrete, Continuous and Hybrid	Systems (G. J. Pappas)
28.5	Optimal Control of Hybrid Systems	(S. Hedlund / A. Rantzer)

28.6	Verification of Hybrid Systems (C. J. To	omlin / I. Mitchell / A. M. Bayen)	
28.7	Stabilization through Hybrid Control	(J. P. Hespanha)	
28.8	Case Study - Air Traffic Management Systems	(A. M. Bayen / C. J. Tomlin)	
Part E:	Automation and Control Application3		
6.43.29	Architectures and Methods for Computer-ba	ased Automation (P. Göhner)	
6.43.30	Supervisory Distributed Computer Control S	Systems U. Epple)	
6.43.31	Fault Diagnosis and Fault-tolerant Control	(P. M. Frank / M. Blanke)	
31.1	Fault Diagnosis for Linear Systems	(P. M. Frank)	
31.2	Fault Diagnosis for Nonlinear Systems	(M. Kinnaert / J. J. Yamé)	
31.3	Design Methods for Robust Fault Diagnosis	(R. J. Patton / J. Chen)	
31.4	Qualitative Methods in Fault Diagnosis	(J. Lunze)	
31.5	Statistical Methods for Change Detection	(M. Basseville)	
31.6	Industrial Applications of Fault Diagnosis (R.	Isermann / D. Füssel / H. Straky)	
31.7	Off-line Methods for Fault Diagnosis and Inspection	(D. Filbert)	
31.8	Experience with Knowledge Based Systems for Main	ntenance Diagnosis (D. Wach)	
31.9	Fault-tolerant Systems	(M. Staroswiecki)	
31.10	Fault-tolerant Control using LMI-Design	(J. Chen / R. J. Patton)	
31.11	Structural Analysis for Fault Detection and Isolation and for Fault Tolerant Control (M. Staroswiecki)		
31.12	Fault Accomodation Using Model Predictive Method	ds (J. D. Bošković / R. K. Mehra)	
31.13	Control Reconfiguration	(J. Lunze)	
31.14	Adaptive and Neural Approaches to Fault Tolerant (A. P	Control atra / S. Mukhopadhyay / S. Sen)	
6.43.32	Automation and Control of Thermal Process	es (R. Leithner)	
32.1	Steam Generators and Steam Distribution Networks	(R.Leithner)	
32.2	Automation and Control of HVAC Systems	(A. T. P. So)	
6.43.33	Automation and Control of Electrical Power Generation and		
	Transmission Systems	(H. Glavitsch)	
33.1	Control of Synchronous Generators	(J. Hugel)	
33.2	Gas Turbines (HK. Sche	rrer / C. Ganz / W. Weisenstein))	
33.3	Automation and Control of Electrical Power General Steam Turbines (M. Bennauer / EG. Egener / R. Schle	•	

33.4	Automatic Control for Hydroelectric Power Plants (A. H. Glattfelder / L. Huser / P. Dörfler / J. Steinbach	
33.5	Electrical Network Control	(E. Handschin)
33.6	Combined Cycle and Combined Heat and Power Proc	,
33.0		vs / M. Grimble / İ. Koccarslan)
33.7	Control of Large Nuclear Reactors by State and Outp	ut Feedback Techniques
		P. Tiwari / B. Bandyopadhyay)
6.43.34	Automation and Control in Process Industries	(J. Mikleš)
34.1	Automation and Control in Iron and Steel Industries	(J. Heidepriem)
34.2	Automation and Control of Chemical and Petrochemi	cal Plants (D. E. Seborg)
34.3	Automation and Control in Cement Industries	(L. Keviczky)
34.4	Automation and Control of Pulp and Paper Processes	(H. N, Koivo)
34.5	Automation and Control in Wastewater Treatment	(G. Olsson / C. Rosen)
34.6	Modelling and Control of Complex River Water Rese	rvoir Systems (J. Wernstedt)
6.43.35	Automation and Control in Production Proces	ses (D. Popovic)
35.1	Automation and Control in Food Production	(A. Delgado)
35.2	Machine Tool and Welding	(D. Popovic / S. Nordbruch)
35.3	Automation and Control in Electronic Industries	(D. Popovic)
35.4	Automation in Agriculture	(A. Munack)
35.5	Automation in Fisheries and Aquaculture Technology	
6.43.36	Automation and Control in Traffic Systems	(E. D. Dickmanns)
36.1	Automotive Control Systems	(U. Kiencke)
36.2	Intelligent Control of Road Vehicles for Automated D	,
	for Automated Highway Systems and Lateral Guidan	8
	(M. Tomizuka / P.	Hingwe / JY. Wang / M. Tai)
36.3	Ship Steering	(J. van Amerongen)
36.4	Control for Railway Vehicles	(T. X. Mei / R. M. Goodall)
36.5	Train and Railway Operations Control	(E. Schnieder)
36.6	Aerospace	(D. McLean)
6.43.37	Elements in Automation	(T. Samad)
37.1	Sensors in Control Systems (I	D. Zook / U. Bonne / T. Samad)
37.2	Self-Sensing Solid-State Actuators	(K. Kuhnen, H. Janocha)
37.3	Bus Systems (K. Bender / R. Birkhofer / M. Bregulla / P. Wenzel	
37.4	Programmable Logic Controllers (G. Thiele / L. Renner / R. Neimeier	
37.5	Computer-aided Control System Engineering Tools	(C. Schmid)
37.6	Human-Machine Interaction	(G. Johannsen)
37.7	Control of Electrical Machines for Drives	(J. Hugel)

6.43.38	Robotics	(T. Fukuda / N. Kubota)
38.1	Robot Kinematics and Dynamics	(H. Kawasaki)
38.2	Trajectory and Task Planning	(T. Fukuda / N. Kubota)
38.3	Robot Control and Programming	(H. Kawasaki)
38.4	Intelligent Robots	(N. Kubota / T. Fukuda)
38.5	Robotic Applications to Life Support Systems	(A. Gräser)

Note: If necessary, a subject of this list on the Article-level can be also dealt within two or more separate articles.