
Contents

Part I System Analysis

Smooth Distributions Are Globally Finitely Spanned

Hector J. Sussmann 3

Uniformly Universal Inputs

Eduardo D. Sontag, Yuan Wang 9

System Interconnection

Jan C. Willems 25

Reduced Order Modeling of Nonlinear Control Systems

Arthur J. Krener 41

Part II Optimization Methods

Nonholonomic Trajectory Optimization and the Existence of Twisted Matrix Logarithms

Roger W. Brockett 65

The Hamilton-Jacobi Type Equations for Nonlinear Target Control and Their Approximation

Alexander B. Kurzhanski, Pravin Varaiya 77

Causal Coding of Markov Sources with Continuous Alphabets

Serdar Yüksel, Tamer Başar 91

Pseudospectral Optimal Control and Its Convergence Theorems

Wei Kang, I. Michael Ross, Qi Gong 109

Part III Feedback Design

Event Based Control

Karl J. Åström 127

Zero Dynamics and Tracking Performance Limits in Nonlinear Feedback Systems

A. Pedro Aguiar, João P. Hespanha, Petar V. Kokotović 149

A Nonlinear Model for Combustion Instability: Analysis and Quenching of the Oscillations

Ioan D. Landau, Fethi Bouziani, Robert R. Bitmead 161

Convexification of the Range-Only Station Keeping Problem

Ming Cao, A. Stephen Morse 183

Control of Hydraulic Devices, an Internal Model Approach

Kurt Schlacher, Kurt Zehetleitner 207

Hybrid Zero Dynamics of Planar Bipedal Walking

Jessy W. Grizzle, Eric R. Westervelt 223

Part IV Regulation

Hybrid Systems: Limit Sets and Zero Dynamics with a View Toward Output Regulation

Chaohong Cai, Rafal Goebel, Ricardo G. Sanfelice, Andrew R. Teel 241

Essential and Redundant Internal Models in Nonlinear Output Regulation

Lorenzo Marconi, Laurent Praly 263

Two Global Regulators for Systems with Measurable Nonlinearities and Unknown Sinusoidal Disturbances

Riccardo Marino, Giovanni L. Santosuosso, Patrizio Tomei 285

A Taxonomy for Time-Varying Immersions in Periodic Internal-Model Control

Andrea Serrani 303

Paving the Way Towards the Control of Wireless Telecommunication Networks

Francesco Delli Priscoli, Antonio Pietrabissa 319

**Nonlinear Synchronization of Coupled Oscillators:
The Polynomial Case**
Jung-Su Kim, Frank Allgöwer 339

Part V Geometric Methods

**Disturbance Decoupling for Open Quantum Systems:
Quantum Internal Model Principle**
Narayan Ganesan, Tzyh-Jong Tarn 355

Controller and Observer Normal Forms in Discrete-Time
Salvatore Monaco, Dorothee Normand-Cyrot 377

A Geometric Approach to Dynamic Feedback Linearization
Stefano Battilotti, Claudia Califano 397

Part VI Asymptotic Analysis

**The Steady-State Response of a Nonlinear Control System,
Lyapunov Stable Attractors, and Forced Oscillations**
Chris I. Byrnes, David S. Gilliam 415

**Model Reduction by Moment Matching for Linear
and Nonlinear Systems**
Alessandro Astolfi..... 429

**Adaptive Control of Nonlinear Systems with Unknown
Parameters by Output Feedback:
A Non-Identifier-Based Method**
Hao Lei, Wei Lin 445

**Hybrid Feedback Stabilization of Nonlinear Systems
with Quantization Noise and Large Delays**
Claudio De Persis..... 465