Control and Observer Design for Nonlinear Finite and Infinite Dimensional Systems

With 150 Figures
Contents

Part I Nonlinear Observer Design – from Theory to Industrial Applications

Observers as Internal Models for Remote Tracking via Encoded Information
Alberto Isidori, Lorenzo Marconi, Claudio De Persis......................... 3

Extended Luenberger Observer for Nonuniformly Observable Nonlinear Systems
Klaus Röbenack................................................................. 19

Approximate Observer Error Linearization by Dissipativity Methods
Jaime A. Moreno ................................................................. 35

On Invariant Observers
Silvère Bonnabel, Pierre Rouchon ............................................. 53

Remarks on Moving Horizon State Estimation with Guaranteed Convergence
Tobias Raff, Christian Ebenbauer, Rolf Findeisen, Frank Allgöwer........ 67

Least Squares Smoothing of Nonlinear Systems
Arthur J. Krener ................................................................. 81

State Estimation of a Molten Carbonate Fuel Cell by an Extended Kalman Filter
Michael Mangold, Markus Grötsch, Min Sheng, Achim Kienle ............ 93

Bioprocess State Estimation: Some Classical and Less Classical Approaches
Guillaume Gaffaux, Alain Vande Wouwer .................................. 111
Part II Nonlinear Control of Finite-Dimensional Systems —
Geometric Methods, Differential Flatness, Optimal Control and
their Applications

Convergent Systems: Analysis and Synthesis
Alexey Pavlov, Nathan van de Wouw, Henk Nijmeijer .............. 131

Smooth and Analytic Normal Forms: A Special Class of Strict
Feedforward Forms
Issa A. Tafli, Witold Respondek .................................. 147

Constructive Nonlinear Dynamics — Foundations and
Application to Robust Nonlinear Control
Johannes Gerhard, Martin Mönnigmann, Wolfgang Marquardt ...... 165

Optimal Control of Piecewise Affine Systems: A Dynamic
Programming Approach
Frank J. Christophersen, Mato Baotic, Manfred Morari ............ 183

Hierarchical Hybrid Control Synthesis and its Application to
a Multiproduct Batch Plant
Jörg Raisch, Thomas Moor ........................................ 199

Closed-Loop Fault-Tolerant Control for Uncertain Nonlinear
Systems
Michel Fliess, Cédric Join, Hebertt Sira-Ramírez ................... 217

Feedforward Control Design for Nonlinear Systems under
Input Constraints
Knut Graichen, Michael Zeitz .................................... 235

System Inversion and Feedforward Control via Formal Power
Series and Summation Methods
Marc Oliver Wagner, Thomas Meurer, Michael Zeitz ............... 253

Flatness-Based Improved Relative Guidance Maneuvers for
Commercial Aircraft
Thierry Miquel, Jean Lévine, Félix Mora-Camino .................. 271

Vehicle Path-Following with a GPS-aided Inertial Navigation
System
Steffen Kehl, Wolf-Dieter Pölsler, Michael Zeitz ................. 285

Control of Switched Reluctance Servo-Drives
Achim A.R. Fehn, Ralf Rothfuß .................................... 301
Flatness-Based Two-Degree-of-Freedom Control of Industrial Semi-Batch Reactors
Veit Hagenmeyer, Marcus Nohr ............................................... 315

Part III Nonlinear Control of Infinite-Dimensional Systems – Applications in Mechatronics, Fluid Flow and Chemical Engineering

Controlled Friction Damping using Optimally Located Structural Joints
Lothar Gaul, Stefan Hurlebaus, Hans Albrecht, Jan Wirnitzer .......... 335

Infinite-Dimensional Decoupling Control of the Tip Position and the Tip Angle of a Composite Piezoelectric Beam with Tip Mass
Andreas Kugi, Daniel Thull ................................................... 351

Nonlinear Flow Control Based on a Low Dimensional Model of Fluid Flow
Rudibert King, Melïne Seibold, Oliver Lehmann, Bernd. R. Noack, Marek Morzyński, Gilead Tadmor ........................................ 369

Flatness Based Approach to a Heat Conduction Problem in a Crystal Growth Process
Joachim Rudolph, Jan Winkler, Frank Woittennek ...................... 387

Model–based Nonlinear Tracking Control of Pressure Swing Adsorption Plants
Matthias Bitzer ................................................................. 403

Index ................................................................. 419