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Feedback Control

Linear, Nonlinear and Robust Techniques and Design with Industrial Applications

Springer This book develops the understanding and skills needed to be able to tackle original control problems. The general approach to a given control problem is to try the simplest tentative solution first and, when this is insufficient, to explain why and use a more sophisticated alternative to remedy the deficiency and achieve satisfactory performance. This pattern of working gives readers a full understanding of different controllers and teaches them to make an informed choice between traditional controllers and more advanced modern alternatives in meeting the needs of a particular plant. Attention is focused on the time domain, covering model-based linear and nonlinear forms of control together with robust control based on sliding modes and the use of state observers such as disturbance estimation. Feedback Control is self-contained, paying much attention to explanations of underlying concepts, with detailed mathematical derivations being employed where necessary. Ample use is made of diagrams to aid these conceptual explanations and the subject matter is enlivened by continual use of examples and problems derived from real control applications. Readers' learning is further enhanced by experimenting with the fully-commented MATLAB®/Simulink® simulation environment made accessible at [insert URL here to produce simulations relevant to all of the topics covered in the text](#). A solutions manual for use by instructors adopting the book can also be downloaded from [insert URL here](#). Feedback Control is suitable as a main textbook for graduate and final-year undergraduate courses containing control modules; knowledge of ordinary linear differential equations, Laplace transforms, transfer functions, poles and zeros, root locus and elementary frequency response analysis, and elementary feedback control is required. It is also a useful reference source on control design methods for engineers practicing in industry and for academic control researchers.

Mathematical Methods for Robust and Nonlinear Control

EPSRC Summer School

Springer Science & Business Media The underlying theory on which much modern robust and nonlinear control is based can be difficult to grasp. This volume is a collection of lecture notes presented by experts in advanced control engineering. The book is designed to provide a better grounding in the theory underlying several important areas of control. It is hoped the book will help the reader to apply otherwise abstruse ideas of nonlinear control in a variety of real systems.

Robust Nonlinear Control Design

State-Space and Lyapunov Techniques

Springer Science & Business Media This softcover book summarizes Lyapunov design techniques for nonlinear systems and raises important issues concerning large-signal robustness and performance. The authors have been the first to address some of these

issues, and they report their findings in this text. The researcher who wishes to enter the field of robust nonlinear control could use this book as a source of new research topics. For those already active in the field, the book may serve as a reference to a recent body of significant work. Finally, the design engineer faced with a nonlinear control problem will benefit from the techniques presented here.

Nonlinear H₂/H-Infinity Constrained Feedback Control A Practical Design Approach Using Neural Networks

Springer Science & Business Media This book provides techniques to produce robust, stable and useable solutions to problems of H-infinity and H₂ control in high-performance, non-linear systems for the first time. The book is of importance to control designers working in a variety of industrial systems. Case studies are given and the design of nonlinear control systems of the same caliber as those obtained in recent years using linear optimal and bounded-norm designs is explained.

8th International Munich Chassis Symposium 2017

chassis.tech plus

Springer You can find in this book the development of highly and fully automatic driving and the increasing electrification of the powertrain now face chassis development with new challenges too. Innovative chassis systems have to provide solutions for automated driving. The efficient chassis of the future also has to keep an eye on CO₂ targets, comfort and customer focus at all times. A modern chassis has to provide for this in the form of innovations while taking the physical and mechanical interdependencies into account. Confronting these new developments is a challenge for simulation and testing.

How Can Robust Control of Nonlinear Systems be Achieved? Examining Optimization Techniques

GRIN Verlag Doctoral Thesis / Dissertation from the year 2019 in the subject Engineering - General, Basics, grade: A.00, , language: English, abstract: The following text examines the questions, how nonlinear system can better be controlled by new optimisation techniques such as feedback linearization. Due to the inevitable nonlinearities in real systems, several nonlinear control methods like feedback linearization, sliding mode control, backstepping approach and further modes are described in detail in the literature. Due to limitations in application of well known classical methods, researchers have struggled for decades to realize robust and practical solutions for nonlinear systems by proposing different approaches or improving classical control methods. The feedback linearization approach is a control method which employs feedback to stabilize systems containing nonlinearities. In order to accomplish this, it assumes perfect knowledge of the system model to linearize the input-output relationship. In the absence of perfect system knowledge, modelling errors inevitably affect the performance of the feedback controller. Many researchers have come up with a new form of feedback linearization, called robust feedback. This method gives a linearizing control law that transforms the nonlinear system into its linear approximation around an operating point. Thus, it causes only a small transformation in the natural behavior of the system, which is desired in order to obtain robustness. The controllers are required to provide various time domain and frequency domain performances while maintaining sufficient stability robustness. In this regard, the evolutionary optimization techniques provide better option as these are probabilistic search procedures and facilitate inclusion of wide variety of time and frequency domain performance functionals in the objective functions. A significant scope of work remains to be done which provides motivation for the research in the design of robust controllers using evolutionary optimization. Also, emerging techniques using LMI also find potential in controller design for feedback linearized systems. The thrust of the study here is to design robust controllers for nonlinear systems using Evolutionary optimization and LMI. Furthermore, latest control methods for nonlinear system have been studied, deeply, in this thesis. Combining feedback linearization with non linear disturbance observer based control (NDOBC) obtains promising disturbance rejection and reference tracking performance as compared to other robust control methods.

Quantitative Feedback Design of Linear and Nonlinear Control Systems

Springer Science & Business Media Quantitative Feedback Design of Linear and Nonlinear Control Systems is a self-contained book dealing with the theory and practice of Quantitative Feedback Theory (QFT). The author presents feedback synthesis techniques for single-input single-output, multi-input multi-output linear time-invariant and nonlinear plants based on the QFT method. Included are design details and graphs which do not appear in the literature, which will enable engineers and researchers to understand QFT in greater depth. Engineers will be able to apply QFT and the design techniques to many applications, such as flight and chemical plant control, robotics, space, vehicle and military industries, and numerous other uses. All of the examples were implemented using Matlab® Version 5.3; the script file can be found at the author's Web site. QFT results in efficient designs because it synthesizes a controller for the exact amount of plant uncertainty, disturbances and required specifications. Quantitative Feedback Design of Linear and Nonlinear Control Systems is a pioneering work that illuminates QFT, making the theory - and practice - come alive.

Linear Feedback Control

Analysis and Design with MATLAB

SIAM This book discusses analysis and design techniques for linear feedback control systems using MATLAB® software. By reducing the mathematics, increasing MATLAB working examples, and inserting short scripts and plots within the text, the authors have created a resource suitable for almost any type of user. The book begins with a summary of the properties of linear systems and addresses modeling and model reduction issues. In the subsequent chapters on analysis, the authors introduce time domain, complex plane, and frequency domain techniques. Their coverage of design includes discussions on model-based controller designs, PID controllers, and robust control designs. A unique aspect of the book is its inclusion of a chapter on fractional-order controllers, which are useful in control engineering practice.

Robust Control System Design

Advanced State Space Techniques

CRC Press Robust Control System Design: Advanced State Space Techniques, Second Edition expands upon a groundbreaking and combinatorial approach to state space control system design that fully realizes the critical loop transfer function and robustness properties of state/generalized state feedback control. This edition offers many new examples and exercises

Control and Dynamic Systems V50: Robust Control System Techniques and Applications

Advances in Theory and Applications

Elsevier Control and Dynamic Systems: Advances in Theory and Applications, Volume 50: Robust Control System Techniques and Applications, Part 1 of 2 is a two-volume sequence devoted to the issues and application of robust control systems techniques. This volume is composed of 10 chapters and begins with a presentation of the important techniques for dealing with conflicting design objectives in control systems. The subsequent chapters describe the robustness techniques of systems using differential-difference equations; the design of a wide class of robust nonlinear systems, the techniques for dealing with the problems resulting from the use of observers in robust systems design, and the effective techniques for the robust control on non-linear time varying of tracking control systems with uncertainties. These topics are followed by discussions of the effective techniques for the robust control on non-linear time varying of tracking control systems with uncertainties and for incorporating adaptive control techniques into a (non-adaptive) robust control design. Other chapters present techniques for achieving exponential and robust stability for a rather general class of nonlinear systems, techniques in modeling uncertain dynamics for robust control systems design, and techniques for the optimal synthesis of these systems. The last chapters provide a generalized eigenproblem solution for both singular and nonsingular system cases. These chapters also look into the stability robustness design for discrete-time systems. This book will be of value to process and systems engineers, designers, and researchers.

Robust Control of Linear Systems and Nonlinear Control

Proceedings of the International Symposium MTNS-89, Volume II

Springer Science & Business Media This volume is the second of the three volume publication containing the proceedings of the 1989 International Symposium on the Mathematical Theory of Networks and Systems (MTNS-89), which was held in Amsterdam, The Netherlands, June 19-23, 1989. The International Symposia MTNS focus attention on problems from system and control theory, circuit theory and signal processing, which, in general, require application of sophisticated mathematical tools, such as from function and operator theory, linear algebra and matrix theory, differential and algebraic geometry. The interaction between advanced mathematical methods and practical engineering problems of circuits, systems and control, which is typical for MTNS, turns out to be most effective and is, as these proceedings show, a continuing source of exciting advances. The second volume contains invited papers and a large selection of other symposium presentations in the vast area of robust and nonlinear control. Modern developments in robust control and H-infinity theory, for finite as well as for infinite dimensional systems, are presented. A large part of the volume is devoted to nonlinear control. Special attention is paid to problems in robotics. Also the general theory of nonlinear and infinite dimensional systems is discussed. A couple of papers deal with problems of stochastic control and filtering. vi Preface The titles of the two other volumes are: Realization and Modelling in System Theory (volume 1) and Signal Processing, Scattering and Operator Theory, and Numerical Methods (volume 3).

Feedback Control Theory

Courier Corporation An excellent introduction to feedback control system design, this book offers a theoretical approach that captures the essential issues and can be applied to a wide range of practical problems. Its explorations of recent developments in the field emphasize the relationship of new procedures to classical control theory, with a focus on single input and output systems that keeps concepts accessible to students with limited backgrounds. The text is geared toward a single-semester senior course or a graduate-level class for students of electrical engineering. The opening chapters constitute a basic treatment of feedback design. Topics include a detailed formulation of the control design program, the fundamental issue of performance/stability robustness tradeoff, and the graphical design technique of loopshaping. Subsequent chapters extend the discussion of the loopshaping technique and connect it with notions of optimality. Concluding chapters examine controller design via optimization, offering a mathematical approach that is useful for multivariable systems.

Nonlinear and Robust Control of PDE Systems

Methods and Applications to Transport-Reaction Processes

Springer Science & Business Media The interest in control of nonlinear partial differential equation (PDE) systems has been triggered by the need to achieve tight distributed control of transport-reaction processes that exhibit highly nonlinear behavior and strong spatial variations. Drawing from recent advances in dynamics of PDE systems and nonlinear control theory, control of nonlinear PDEs has evolved into a very active research area of systems and control. This book the first of its kind- presents general methods for the synthesis of nonlinear and robust feedback controllers for broad classes of nonlinear PDE systems and illustrates their applications to transport-reaction processes of industrial interest. Specifically, our attention focuses on quasi-linear hyperbolic and parabolic PDE systems for which the manipulated inputs and measured and controlled outputs are distributed in space and bounded. We use geometric and Lyapunov-based control techniques to synthesize nonlinear and robust controllers that use a finite number of measurement sensors and control actuators to achieve stabilization of the closed-loop system, output tracking, and attenuation of the effect of model uncertainty. The controllers are successfully applied to numerous convection-reaction and diffusion-reaction processes, including a rapid thermal chemical vapor deposition reactor and a Czochralski crystal growth process. The book includes comparisons of the proposed nonlinear and robust control methods with other approaches and discussions of practical implementation issues.

Nonlinear Dynamical Systems and Control

A Lyapunov-Based Approach

Princeton University Press Nonlinear Dynamical Systems and Control presents and develops an extensive treatment of stability analysis and control design of nonlinear dynamical systems, with an emphasis on Lyapunov-based methods. Dynamical system theory lies at the heart of mathematical sciences and engineering. The application of dynamical systems has crossed interdisciplinary boundaries from chemistry to biochemistry to chemical kinetics, from medicine to biology to population genetics, from economics to sociology to psychology, and from physics to mechanics to engineering. The increasingly complex nature of engineering systems requiring feedback control to obtain a desired system behavior also gives rise to dynamical systems. Wassim Haddad and VijaySekhar Chellaboina provide an exhaustive treatment of nonlinear systems theory and control using the highest standards of exposition and rigor. This graduate-level textbook goes well beyond standard treatments by developing Lyapunov stability theory, partial stability, boundedness, input-to-state stability, input-output stability, finite-time stability, semistability, stability of sets and periodic orbits, and stability theorems via vector Lyapunov functions. A complete and thorough treatment of dissipativity theory, absolute stability theory, stability of feedback systems, optimal control, disturbance rejection control, and robust control for nonlinear dynamical systems is also given. This book is an indispensable resource for applied mathematicians, dynamical systems theorists, control theorists, and engineers.

Applied Mechanics Reviews

Non-linear Control for Underactuated Mechanical Systems

Springer Science & Business Media This book deals with the application of modern control theory to some important underactuated mechanical systems, from the inverted pendulum to the helicopter model. It will help readers gain experience in the modelling of mechanical systems and familiarize with new control methods for non-linear systems.

Stochastic Game Strategies and their Applications

CRC Press Game theory involves multi-person decision making and differential dynamic game theory has been widely applied to n-person decision making problems, which are stimulated by a vast number of applications. This book addresses the gap to discuss general stochastic n-person noncooperative and cooperative game theory with wide applications to control systems, signal processing systems, communication systems, managements, financial systems, and biological systems. H_∞ game strategy, n-person cooperative and noncooperative game strategy are discussed for linear and nonlinear stochastic systems along with some computational algorithms developed to efficiently solve these game strategies.

Reset Control Systems

Springer Science & Business Media Reset Control Systems addresses the analysis for reset control treating both its basic form, and some useful variations of the reset action and reset condition. The issues regarding reset control – concepts and motivation; analysis tools; and the application of design methodologies to real-world examples – are given thorough coverage. The text opens with a historical perspective which moves from the seminal work of the Clegg integrator and Horowitz FORE to more recent approaches based on impulsive/hybrid control systems and explains the motivation for reset compensation. Preliminary material is also included. The focus then turns to stability analysis for systems using techniques which account for various time- and frequency-domain criteria. The final section of the book is centered on control systems design and application. The PI+CI compensator is detailed as are a proposed frequency domain approach using quantitative feedback theory and ideas for design improvement. Design examples are given.

Robust Motion Control of Oscillatory-Base Manipulators

H_∞ -Control and Sliding-Mode-Control-Based Approaches

Springer This book provides readers with alternative robust approaches to control design for an important class of systems characteristically associated with ocean-going vessels and structures. These systems, which include crane vessels, on-board cranes, radar gimbals and a conductivity temperature and depth winch, are modelled as manipulators with oscillating bases. One design approach is based on the H-infinity control framework exploiting an effective combination of PD control, an extended matrix polytope and a robust stability analysis method with a state-dependent coefficient form. The other is based on sliding-mode control using some novel nonlinear sliding surfaces. The model demonstrates how successful motion control can be achieved by suppressing base oscillations and in the presence of uncertainties. This is important not only for ocean engineering systems in which the problems addressed here originate but more generally as a benchmark platform for robust motion control with disturbance rejection. Researchers interested in the robust control of mechanical systems operating on unstable bases will find this monograph valuable. MATLAB® and Simulink® programs are available for download to make the methods described in the text easier to understand and to allow readers to experience practical procedures at first hand.

Control Applications of Nonlinear Programming and Optimization 1989

Elsevier These Proceedings provide valuable information on the exchange of ideas between scientists who apply nonlinear programming and optimization to real world control problems and those who develop new methods, algorithms and software. The papers deal with windshear problems, optimization of aircraft and spacecraft trajectories, optimal control for robots, the optimization of urban traffic control, general mechanical systems, multilevel inventory systems and robust control.

Adaptive Systems in Control and Signal Processing 1992

Selected Papers from the 4th IFAC Symposium Grenoble, France, 1 - 3 July 1992

Elsevier Adaptive Systems remain a very interesting field of theoretical research, extended by methodological studies and an increasing number of applications. The plenary papers, invited sessions and contributed sessions focused on many aspects of adaptive systems, such as systems identification and modelling, adaptive control of nonlinear systems and theoretical issues in adaptive control. Also covered were methodological aspects and applications of adaptive control, intelligent tuning and adaptive signal processing.

Nonlinear Control Techniques for Electro-Hydraulic

Actuators in Robotics Engineering

CRC Press Nonlinear Control Techniques for Electro-Hydraulic Actuators in Robotics Engineering meets the needs of those working in advanced electro-hydraulic controls for modern mechatronic and robotic systems. The non-linear EHS control methods covered are proving to be more effective than traditional controllers, such as PIDs. The control strategies given address parametric uncertainty, unknown external load disturbance, single-rod actuator characteristics, and control saturation. Theoretical and experimental validations are explained, and examples provided. Based on the authors' cutting-edge research, this work is an important resource for engineers, researchers, and students working in EHS.

Fundamentals of Linear Control

A Concise Approach

Cambridge University Press Taking a different approach from standard thousand-page reference-style control textbooks, Fundamentals of Linear Control provides a concise yet comprehensive introduction to the analysis and design of feedback control systems in fewer than 400 pages. The text focuses on classical methods for dynamic linear systems in the frequency domain. The treatment is, however, modern and the reader is kept aware of contemporary tools and techniques, such as state space methods and robust and nonlinear control. Featuring fully worked design examples, richly illustrated chapters, and an extensive set of homework problems and examples spanning across the text for gradual challenge and perspective, this textbook is an excellent choice for senior-level courses in systems and control or as a complementary reference in introductory graduate level courses. The text is designed to appeal to a broad audience of engineers and scientists interested in learning the main ideas behind feedback control theory.

Robust Discrete Time State Feedback Control of Nonlinear Systems with Parametric Uncertainties

Nonlinear Output Regulation

Theory and Applications

SIAM This book provides a comprehensive and in-depth treatment of the nonlinear output regulation problem.

Control Systems, Robotics and Automation - Volume XII

Nonlinear, Distributed, and Time Delay Systems-I

EOLSS Publications This Encyclopedia of Control Systems, Robotics, and Automation is a component of the global Encyclopedia of Life Support Systems EOLSS, which is an integrated compendium of twenty one Encyclopedias. This 22-volume set contains 240 chapters, each of size 5000-30000 words, with perspectives, applications and extensive illustrations. It is the only publication of its kind carrying state-of-the-art knowledge in the fields of Control Systems, Robotics, and Automation and is aimed, by virtue of the several applications, at the following five major target audiences: University and College Students, Educators, Professional Practitioners, Research Personnel and Policy Analysts, Managers, and Decision Makers and NGOs.

Robust, Nonlinear Feedback Control

This project has encompassed research in four areas of control theory, namely robust, fixed structure control, identification, adaptive cancellation, and nonlinear control. The robust, fixed structure control techniques have been implemented in a mat lab tool box for control design. The identification techniques include recursive methods with guaranteed convergence for high order linear systems. The adaptive cancellation methods provide disturbance rejection for systems with uncertain or time varying disturbance spectra with minimal system modeling. Nonlinear techniques for stabilizing unbalanced rotors and for finite time stabilization have been developed. Experimental implementation and validation of the control methods developed under this project was performed on several laboratory scale testbeds, including an acoustic noise experiment and an unbalanced rotating shaft experiment.

Robust Control Via Variable Structure and Lyapunov Techniques

Springer A large part of today's fervour on robust control research is focused on those techniques which utilise the Variable Structure Control Method and Lyapunov's Second Method, and which constitute the backbone of the so-called "deterministic" control of uncertain systems. The chapters of this book cover a large spectrum of the recent research and introduce the most innovative ideas in

the field. Contained within the volume the reader will find: a survey of control Lyapunov functions; new structures of sliding mode controllers with discussion on higher order sliding modes; new techniques for the design of direct and indirect adaptive controllers; an introduction to the geometric theory of "flat" systems; controllers for plants with component-wise bounded inputs; robust design via linear matrix inequalities and polytopic covering; and some issues on the dissipativity and absolute stability of nonlinear systems.

Nonlinear Control Systems

Springer Science & Business Media The purpose of this book is to present a self-contained description of the fundamentals of the theory of nonlinear control systems, with special emphasis on the differential geometric approach. The book is intended as a graduate text as well as a reference to scientists and engineers involved in the analysis and design of feedback systems. The first version of this book was written in 1983, while I was teaching at the Department of Systems Science and Mathematics at Washington University in St. Louis. This new edition integrates my subsequent teaching experience gained at the University of Illinois in Urbana-Champaign in 1987, at the Carl-Cranz Gesellschaft in Oberpfaffenhofen in 1987, at the University of California in Berkeley in 1988. In addition to a major rearrangement of the last two Chapters of the first version, this new edition incorporates two additional Chapters at a more elementary level and an exposition of some relevant research findings which have occurred since 1985.

Neural Network Systems Techniques and Applications

Advances in Theory and Applications

Academic Press The book emphasizes neural network structures for achieving practical and effective systems, and provides many examples. Practitioners, researchers, and students in industrial, manufacturing, electrical, mechanical, and production engineering will find this volume a unique and comprehensive reference source for diverse application methodologies. Control and Dynamic Systems covers the important topics of highly effective Orthogonal Activation Function Based Neural Network System Architecture, multi-layer recurrent neural networks for synthesizing and implementing real-time linear control, adaptive control of unknown nonlinear dynamical systems, Optimal Tracking Neural Controller techniques, a consideration of unified approximation theory and applications, techniques for the determination of multi-variable nonlinear model structures for dynamic systems with a detailed treatment of relevant system model input determination, High Order Neural Networks and Recurrent High Order Neural Networks, High Order Moment Neural Array Systems, Online Learning Neural Network controllers, and Radial Bias Function techniques. Coverage includes: Orthogonal Activation Function Based Neural Network System Architecture (OAFNN) Multilayer recurrent neural networks for synthesizing and implementing real-time linear control Adaptive control of unknown nonlinear dynamical systems Optimal Tracking Neural Controller techniques Consideration of unified approximation theory and applications Techniques for determining multivariable nonlinear model structures for dynamic systems, with a detailed treatment of relevant system model input determination

Unmanned Aircraft Design

A Review of Fundamentals

Springer Nature This book provides fundamental principles, design procedures, and design tools for unmanned aerial vehicles (UAVs) with three sections focusing on vehicle design, autopilot design, and ground system design. The design of manned aircraft and the design of UAVs have some similarities and some differences. They include the design process, constraints (e.g., g-load, pressurization), and UAV main components (autopilot, ground station, communication, sensors, and payload). A UAV designer must be aware of the latest UAV developments; current technologies; know lessons learned from past failures; and they should appreciate the breadth of UAV design options. The contribution of unmanned aircraft continues to expand every day and over 20 countries are developing and employing UAVs for both military and scientific purposes. A UAV system is much more than a reusable air vehicle or vehicles. UAVs are air vehicles, they fly like airplanes and operate in an airplane environment. They are designed like air vehicles; they have to meet flight critical air vehicle requirements. A designer needs to know how to integrate complex, multi-disciplinary systems, and to understand the environment, the requirements and the design challenges and this book is an excellent overview of the fundamentals from an engineering perspective. This book is meant to meet the needs of newcomers into the world of UAVs. The materials are intended to provide enough information in each area and illustrate how they all play together to support the design of a complete UAV. Therefore, this book can be used both as a reference for engineers entering the field or as a supplementary text for a UAV design course to provide system-level context for each specialized topic.

High-Gain Observers in Nonlinear Feedback Control

SIAM For over a quarter of a century, high-gain observers have been used extensively in the design of output feedback control of nonlinear systems. This book presents a clear, unified treatment of the theory of high-gain observers and their use in feedback control. Also provided is a discussion of the separation principle for nonlinear systems; this differs from other separation results in the literature in that recovery of stability as well as performance of state feedback controllers is given. The author provides a detailed discussion of applications of high-gain observers to adaptive control and regulation problems and recent results on the extended high-gain observers. In addition, the author addresses two challenges that face the implementation of high-gain observers: high dimension and measurement noise. Low-power observers are presented for high-dimensional systems. The effect of measurement noise is characterized and techniques to reduce that effect are presented. The book ends with discussion of digital implementation of the observers. Readers will find comprehensive coverage of the main results on high-gain observers; rigorous, self-contained proofs of all

results; and numerous examples that illustrate and provide motivation for the results. The book is intended for engineers and applied mathematicians who design or research feedback control systems.

Control and Dynamic Systems

Advances in Theory and Applications. Robust control system techniques and applications

Control of Uncertain Dynamic Systems

CRC Press This book is a collection of 34 papers presented by leading researchers at the International Workshop on Robust Control held in San Antonio, Texas in March 1991. The common theme tying these papers together is the analysis, synthesis, and design of control systems subject to various uncertainties. The papers describe the latest results in parametric uncertainty, H_∞ uncertainty, L₁ optimal control, and Quantitative Feedback Theory (QFT). The book is the first to bring together all the diverse points of view addressing the robust control problem and should strongly influence development in the robust control field for years to come. For this reason, control theorists, engineers, and applied mathematicians should consider it a crucial acquisition for their libraries.

Hybrid Artificial Intelligent Systems

7th International Conference, HAIS 2012, Salamanca, Spain, March 28-30th, 2012, Proceedings, Part I

Springer The two LNAI volumes 7208 and 7209 constitute the proceedings of the 7th International Conference on Hybrid Artificial Intelligent Systems, HAIS 2012, held in Salamanca, Spain, in March 2012. The 118 papers published in these proceedings were carefully reviewed and selected from 293 submissions. They are organized in topical sessions on agents and multi agents systems, HAIS applications, cluster analysis, data mining and knowledge discovery, evolutionary computation, learning algorithms, systems, man, and cybernetics by HAIS workshop, methods of classifier fusion, HAIS for computer security (HAISFCS), data mining: data preparation and analysis, hybrid artificial intelligence systems in management of production systems, hybrid artificial intelligent systems for ordinal regression, hybrid metaheuristics for combinatorial optimization and modelling complex systems, hybrid computational intelligence and lattice computing for image and signal processing and nonstationary models of pattern recognition and classifier combinations.

Scientific and Technical Aerospace Reports

Attractive Ellipsoids in Robust Control

Springer This monograph introduces a newly developed robust-control design technique for a wide class of continuous-time dynamical systems called the "attractive ellipsoid method." Along with a coherent introduction to the proposed control design and related topics, the monograph studies nonlinear affine control systems in the presence of uncertainty and presents a constructive and easily implementable control strategy that guarantees certain stability properties. The authors discuss linear-style feedback control synthesis in the context of the above-mentioned systems. The development and physical implementation of high-performance robust-feedback controllers that work in the absence of complete information is addressed, with numerous examples to illustrate how to apply the attractive ellipsoid method to mechanical and electromechanical systems. While theorems are proved systematically, the emphasis is on understanding and applying the theory to real-world situations. *Attractive Ellipsoids in Robust Control* will appeal to undergraduate and graduate students with a background in modern systems theory as well as researchers in the fields of control engineering and applied mathematics.

Nonlinear Control Systems and Power System Dynamics

Springer Science & Business Media *Nonlinear Control Systems and Power System Dynamics* presents a comprehensive description of nonlinear control of electric power systems using nonlinear control theory, which is developed by the differential geometric approach and nonlinear robust control method. This book explains in detail the concepts, theorems and algorithms in nonlinear control theory, illustrated by step-by-step examples. In addition, all the mathematical formulation involved in deriving the nonlinear control laws of power systems are sufficiently presented. Considerations and cautions involved in applying nonlinear control theory to practical engineering control designs are discussed and special attention is given to the implementation of nonlinear control laws using microprocessors. *Nonlinear Control Systems and Power System Dynamics* serves as a text for advanced level courses and is an excellent reference for engineers and researchers who are interested in the application of modern nonlinear control theory to practical engineering control designs.

Feedback Systems

Princeton University Press The essential introduction to the principles and applications of feedback systems—now fully revised and expanded This textbook covers the mathematics needed to model, analyze, and design feedback systems. Now more user-friendly than ever, this revised and expanded edition of Feedback Systems is a one-volume resource for students and researchers in mathematics and engineering. It has applications across a range of disciplines that utilize feedback in physical, biological, information, and economic systems. Karl Åström and Richard Murray use techniques from physics, computer science, and operations research to introduce control-oriented modeling. They begin with state space tools for analysis and design, including stability of solutions, Lyapunov functions, reachability, state feedback observability, and estimators. The matrix exponential plays a central role in the analysis of linear control systems, allowing a concise development of many of the key concepts for this class of models. Åström and Murray then develop and explain tools in the frequency domain, including transfer functions, Nyquist analysis, PID control, frequency domain design, and robustness. Features a new chapter on design principles and tools, illustrating the types of problems that can be solved using feedback Includes a new chapter on fundamental limits and new material on the Routh-Hurwitz criterion and root locus plots Provides exercises at the end of every chapter Comes with an electronic solutions manual An ideal textbook for undergraduate and graduate students Indispensable for researchers seeking a self-contained resource on control theory

Introduction to Feedback Control Theory

Routledge There are many feedback control books out there, but none of them capture the essence of robust control as well as Introduction to Feedback Control Theory. Written by Hitay Özbay, one of the top researchers in robust control in the world, this book fills the gap between introductory feedback control texts and advanced robust control texts. Introduction to Feedback Control Theory covers basic concepts such as dynamical systems modeling, performance objectives, the Routh-Hurwitz test, root locus, Nyquist criterion, and lead-lag controllers. It introduces more advanced topics including Kharitanov's stability test, basic loopshaping, stability robustness, sensitivity minimization, time delay systems, H-infinity control, and parameterization of all stabilizing controllers for single input single output stable plants. This range of topics gives students insight into the key issues involved in designing a controller. Occupying an important place in the field of control theory, Introduction to Feedback Control Theory covers the basics of robust control and incorporates new techniques for time delay systems, as well as classical and modern control. Students can use this as a text for building a foundation of knowledge and as a reference for advanced information and up-to-date techniques