Optimal Control Systems Electrical Engineering Handbook Mal

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Optimal and Robust Scheduling for Networked Control Systems

Text for a first course in control systems, revised (1st ed. was 1970) to include new subjects such as the pole placement approach to the design of control systems, design of observers, and computer simulation of control systems. For senior engineering students. Annotation copyright Book News, Inc.

Optimal Control Systems

More than a decade ago, world-renowned control systems authority Frank L. Lewis introduced what would become a standard textbook on estimation, under the title Optimal Estimation, used in top universities throughout the world. The time has come for a new edition of this classic text, and Lewis enlisted the aid of two accomplished experts to bring the book completely up to date with the estimation methods driving today's high-performance systems. A Classic Revisited Optimal and Robust Estimation: With an Introduction to Stochastic Control Theory, Second Edition reflects new developments in estimation theory and design techniques. As the title suggests, the major feature of this edition is the inclusion of robust methods. Three new chapters cover the robust Kalman filter, H-infinity filtering, and H-infinity filtering of discrete-time systems. Modern Tools for Tomorrow's Engineers This text overflows with examples that highlight practical applications of the theory and concepts. Design algorithms appear conveniently in tables, allowing students quick reference, easy implementation into software, and intuitive comparisons for selecting the best algorithm for a given application. In addition, downloadable MATLAB® code allows students to gain hands-on experience with industry-standard software tools for a wide variety of applications. This cutting-edge and highly interactive text makes teaching, and learning, estimation methods easier and more modern than ever.

Applied Control Theory for Embedded Systems

In its highly organized overview of all areas, the book examines the design of modern optimal controllers requiring the selection of a performance criterion, demonstrates optimization of linear systems with bounded controls and limited control effort, and considers nonlinearities and their effect on various types of signals.

Optimal and Robust Estimation

Many embedded engineers and programmers who need to implement basic process or motion control as part of a product design do not have formal training or experience in control system theory. Although some projects require advanced and very sophisticated control systems expertise, the majority of embedded control problems can be solved without resorting to heavy math and complicated control theory. However, existing texts on the subject are highly mathematical and theoretical and do not offer practical examples for embedded designers. This book is different;it presents mathematical background with sufficient rigor for an engineering text, but it concentrates on providing practical application examples that can be used to design working systems, without needing to fully understand the math and high-level theory operating behind the scenes. The author, an engineer with many years of experience in the application of control system theory to embedded designs, offers a concise presentation of the basics of control theory as it pertains to an embedded environment. Practical, down-to-earth guide teaches engineers to apply practical control theorems without needing to employ rigorous math Covers the latest concepts in control systems with embedded digital controllers

Optimal Control Systems

Designed for one-semester introductory senior-or graduate-level course, the authors provide the student with an introduction of analysis techniques used in the design of nonlinear and optimal feedback control systems. There is special emphasis on the fundamental topics of stability, controllability, and optimality, and on the corresponding geometry associated with these topics. Each chapter contains several examples and a variety of exercises.

Optimal Control of Greenhouse Cultivation

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.

Optimal Control Theory

The theory of optimal control systems has grown and flourished since the 1960's. Many texts, written on varying levels of sophistication, have been published on the subject. Yet even those purportedly designed for beginners in the field are often riddled with complex theorems, and many treatments fail to include topics that are essential to a thorough grounding in the various aspects of and approaches to optimal control. Optimal Control Systems provides a comprehensive but accessible treatment of the subject with just the right degree of mathematical rigor to be complete but practical. It provides a solid bridge between "traditional" optimization using the calculus of variations and what is called "modern" optimal control. It also treats both continuous-time and discrete-time optimal control systems, giving students a firm grasp on both methods. Among this book's most outstanding features is a summary table that accompanies each topic or problem and includes a statement of the problem with a step-by-step solution. Students will also gain valuable experience in using industry-standard MATLAB and SIMULINK software, including the Control System and Symbolic Math Toolboxes. Diverse applications across fields from power engineering to medicine make a foundation in optimal control systems an essential part of an engineer's background. This clear, streamlined presentation is ideal for a graduate level course on control systems and as a quick reference for working engineers.

Control System Design

A rigorous introduction to optimal control theory, which will enable engineers and scientists to put the theory into practice.

Optimal Control of Wind Energy Systems

Geared toward upper-level undergraduates, this text introduces three aspects of optimal control theory: dynamic programming, Pontryagin's minimum principle, and numerical techniques for trajectory optimization. Numerous problems, which introduce additional topics and illustrate basic concepts, appear throughout the text. Solution guide available upon request. 131 figures. 14 tables. 1970 edition.

Optimal Control Theory

MATLAB is an indispensable asset for scientists, researchers, and engineers. The richness of the MATLAB computational environment combined with an integrated development environment (IDE) and straightforward interface, toolkits, and simulation and modeling capabilities, creates a research and development tool that has no equal. From quick code prototyping to full blown deployable applications, MATLAB stands as a de facto development language and environment serving the technical needs of a wide range of users. As a collection of diverse applications, each book chapter presents a novel application and use of MATLAB for a specific result.

MATLAB

This book introduces new approaches to solving optimal control problems in induction heating process applications. Optimal Control of Induction Heating Processes demonstrates how to apply and use new optimization techniques for different types of induction heating installations. Focusing on practical methods for solving real engineering optimization problems, the text features a variety of specific optimization examples for induction heater modes and designs, particularly those used in industrial applications. The book describes basic physical phenomena in induction heating and induction heating process (IHP) optimization problems as well as IHP mathematical models for practical use. It explains the fundamentals of the new exact method and the advantages it offers over other well-known methods. A sound introduction to the broad theory of optimal control, Optimal Control of Induction Heating Processes presents a clear and accessible approach to the modern design and control of practical, cost-effective induction heating processes. This book is ideal for all students, production managers, engineers, designers, scientists, and users of induction heating machinery who would like to study, design, and improve processes of induction mass heating.

Modern Control Engineering

Introduction to state-space methods covers feedback control; state-space representation of dynamic systems and dynamics of linear systems; frequency-domain analysis; controllability and observability; shaping the dynamic response; more. 1986 edition.

Robust and Optimal Control

A rigorous introduction to optimal control theory, with an emphasis on applications in economics. This book bridges optimal control theory and economics, discussing ordinary differential equations, optimal control, game theory, and mechanism design in one volume. Technically rigorous and largely self-contained, it provides an introduction to the use of optimal control theory for deterministic continuous-time systems in economics. The theory of ordinary differential equations (ODEs) is the backbone of the theory developed in the book, and chapter 2 offers a detailed review of basic concepts in the theory of ODEs, including the solution of systems of linear ODEs, state-space analysis, potential functions, and stability analysis. Following this, the book covers the main results of optimal control theory, in particular necessary and sufficient optimality conditions; game theory, with an emphasis on differential games; and the application of control-theoretic concepts to the design of economic mechanisms. Appendixes provide a mathematical review and full solutions to all end-of-chapter problems. The material is presented at three levels: single-person decision making; games, in which a group of decision makers interact strategically; and mechanism design, which is concerned with a designer's creation of an environment in which players interact to maximize the designer's objective. The book focuses on applications; the problems are an integral part of the text. It is intended for use as a textbook or reference for graduate students, teachers, and researchers interested in applications of control theory beyond its classical use in economic growth. The book will also appeal to readers interested in a modeling approach to certain practical problems involving dynamic continuous-time models.

Calculus of Variations and Optimal Control Theory

Advanced Control Engineering provides a complete course in control engineering for undergraduates of all technical disciplines. Included are real-life case studies, numerous problems, and accompanying MatLab programs.

Linear Optimal Control Systems

Nonlinear Optimal Control Theory presents a deep, wide-ranging introduction to the mathematical theory of the optimal control of processes governed by ordinary differential equations and certain types of differential equations with memory. Many examples illustrate the mathematical issues that need to be addressed when using optimal control techniques in diverse areas. Drawing on classroom-tested material from Purdue University and North Carolina State University, the book gives a unified account of bounded state problems governed by ordinary, integrodifferential, and delay systems. It also discusses Hamilton-Jacobi theory. By providing a sufficient and rigorous treatment of finite dimensional control problems, the book equips readers with the foundation to deal with other types of control problems, such as those governed by stochastic differential equations, partial differential equations, and differential games.

Optimal Networked Control Systems with MATLAB

Preface; List of symbols; Introduction; Analysis of control systems; Multivariable systems; Vector random processes; Performance; Robustness; The linear quadratic regulator; The Kalman filter; Linear quadratic Gaussian control; Control; Ful information control estimation; H [infinity symbol] output feedback; Controller order reduction; Appendix: Mathematical notes.

Linear Optimal Control

Greenhouse control system manufacturers produce equipment and software with hundreds of settings and, while they hold training courses on how to adjust these settings, there is as yet no integrated instruction on when or why. Despite rapid growth in the greenhouse industry, growers are still faced with a multitude of variables and no unifying framework from which to choose the best option. Consolidating 30 years of research in greenhouse climate control, Optimal Control of Greenhouse Cultivation utilizes mathmatical models to incorporate the wealth of scientific knowledge into a feasible optimal control methodology for greenhouse crop cultivation. Discussing several different paradigms on greenhouse climate control, it integrates the current research into physical modeling of the greenhouse climate in response to heating, ventilation, and other control variables with the biological modeling of variables such as plant evapo-transpiration and growth. Key topics include state-space greenhouse and crop modeling needed for the design of integrated optimal controllers that exploit rather than mitigate outside weather conditions, especially sunlight, given widely different time scales. The book reviews classical rule-based and multivariable feedback controllers in comparison with the optimal hierarchical control paradigm. It considers real and hypothetical examples including lettuce, tomato, and solar greenhouses and examines experimental results of greenhouse climate control using optimal control software. The book concludes with a discussion of open issues as well as future perspectives and challenges. Providing a tool to automatically determine the most economical controls and settings for their operation, this much-needed book relieves growers of unnecessary control tasks, and allows them to achieve the best possible trade-off between short term savings and optimal harvest yield.

Nonlinear Optimal Control Theory

The lectures gathered in this volume present some of the different aspects of Mathematical Control Theory. Adopting the point of view of Geometric Control Theory and of Nonlinear Control Theory, the lectures focus on some aspects of the Optimization and Control of nonlinear, not necessarily smooth, dynamical systems. Specifically, three of the five lectures discuss respectively: logic-based switching control, sliding mode control and the input to the state stability paradigm for the control and stability of nonlinear systems. The remaining two lectures are devoted to Optimal Control: one investigates the connections between Optimal Control Theory, Dynamical Systems and Differential Geometry, while the second presents a very general version, in a non-smooth context, of the Pontryagin Maximum Principle. The arguments of the whole volume are self-contained and are directed to everyone working in Control Theory. They offer a sound presentation of the methods employed in the control and optimization of nonlinear dynamical systems.

Optimal Control Of Singularly Perturbed Linear Systems And Applications

Among the many techniques for designing linear multivariable analogue controllers, the two most popular optimal ones are H2 and H ¿ optimization. The fact that most new industrial controllers are digital provides strong motivation for adapting or extending these techniques to digital control systems. This book, now available as a corrected reprint, attempts to do so. Part I presents two indirect methods of sampled-data controller design: These approaches include approximations to a real problem, which involves an analogue plant, continuous-time performance specifications, and a sampled-data controller. Part II proposes a direct attack in the continuous-time domain, where sampled-data systems are time-varying. The findings are presented in forms that can readily be programmed in, e.g., MATLAB.

Discrete-Time Inverse Optimal Control for Nonlinear Systems

A NEW EDITION OF THE CLASSIC TEXT ON OPTIMAL CONTROL THEORY As a superb introductory text and an indispensable reference, this new edition of Optimal Control will serve the needs of both the professional engineer and the advanced student in mechanical, electrical, and aerospace engineering. Its coverage encompasses all the fundamental topics as well as the major changes that have occurred in recent years. An abundance of computer simulations using MATLAB and relevant Toolboxes is included to give the reader the actual experience of applying the theory to real-world situations. Major topics covered include: Static

Optimization Optimal Control of Discrete-Time Systems Optimal Control of Continuous-Time Systems The Tracking Problem and Other LQR Extensions Final-Time-Free and Constrained Input Control Dynamic Programming Optimal Control for Polynomial Systems Output Feedback and Structured Control Robustness and Multivariable Frequency-Domain Techniques Differential Games Reinforcement Learning and Optimal Adaptive Control

Optimal Control Applications in Electric Power Systems

A Two-port Framework for Robust and Optimal Control introduces an alternative approach to robust and optimal controller synthesis procedures for linear, time-invariant systems, based on the two-port system widespread in electrical engineering. The novel use of the two-port system in this context allows straightforward engineering-oriented solution-finding procedures to be developed, requiring no mathematics beyond linear algebra. A chain-scattering description provides a unified framework for constructing the stabilizing controller set and for synthesizing H2 optimal and H∞ sub-optimal controllers. Simple yet illustrative examples explain each step. A Two-port Framework for Robust and Optimal Control features: · a hands-on, tutorial-style presentation giving the reader the opportunity to repeat the designs presented and easily to modify them for their own programs; · an abundance of examples illustrating the most important steps in robust and optimal design; and · end-of-chapter exercises. To further demonstrate the proposed approaches, in the last chapter an application case study is presented which demonstrates the use of the framework in a real-world control system design and helps the reader quickly move on with their own challenges. MATLAB® codes used in examples throughout the book and solutions to selected exercise questions are available for download. The text will have particular resonance for researchers in control with an electrical engineering background, who wish to avoid spending excessive time in learning complex mathematical, theoretical developments but need to know how to deal with robust and optimal control synthesis problems. Please see [http://km.emotors.ncku.edu.tw/class/hw1.html] for solutions to the exercises provided in this book.

An Engineering Approach to Optimal Control and Estimation Theory

The theory of optimal control systems has grown and flourished since the 1960's. Many texts, written on varying levels of sophistication, have been published on the subject. Yet even those purportedly designed for beginners in the field are often riddled with complex theorems, and many treatments fail to include topics that are essential to a thorough grounding in the various aspects of and approaches to optimal control. Optimal Control Systems provides a comprehensive but accessible treatment of the subject with just the right degree of mathematical rigor to be complete but practical. It provides a solid bridge between "traditional" optimization using the calculus of variations and what is called "modern" optimal control. It also treats both continuous-time and discrete-time optimal control systems, giving students a firm grasp on both methods. Among this book's most outstanding features is a summary table that accompanies each topic or problem and includes a statement of the problem with a step-by-step solution. Students will also gain valuable experience in using industry-standard MATLAB and SIMULINK software, including the Control System and Symbolic Math Toolboxes. Diverse applications across fields from power engineering to medicine make a foundation in optimal control systems an essential part of an engineer's background. This clear, streamlined presentation is ideal for a graduate level course on control systems and as a quick reference for working engineers.

Advanced Control Engineering

Discrete-Time Inverse Optimal Control for Nonlinear Systems proposes a novel inverse optimal control scheme for stabilization and trajectory tracking of discrete-time nonlinear systems. This avoids the need to solve the associated Hamilton-Jacobi-Bellman equation and minimizes a cost functional, resulting in a more efficient controller. Design More Efficient Controllers for Stabilization and Trajectory Tracking of Discrete-Time Nonlinear Systems The book presents two approaches for controller synthesis: the first based on passivity theory and the second on a control Lyapunov function (CLF). The synthesized discrete-time optimal controller can be directly implemented in real-time systems. The book also proposes the use of recurrent neural networks to model discrete-time nonlinear systems. Combined with the inverse optimal control approach, such models constitute a powerful tool to deal with uncertainties such as unmodeled dynamics and disturbances. Learn from Simulations and an In-Depth Case Study The authors include a variety of simulations to illustrate the effectiveness of the synthesized controllers for stabilization and trajectory tracking of discrete-time nonlinear systems. An in-depth case study applies the control schemes to glycemic control in patients with type 1 diabetes mellitus, to calculate the adequate insulin delivery rate required to prevent hyperglycemia and hypoglycemia levels. The discrete-time optimal and robust control techniques proposed can be used in a range of industrial applications, from aerospace and energy to biomedical and electromechanical systems. Highlighting optimal and efficient control algorithms, this is a valuable resource for researchers, engineers, and students working in nonlinear system control.

Robust Industrial Control Systems

"This book attempts to reconcile modern linear control theory with classical control theory. One of the major concerns of this text is to present design methods, employing modern techniques, for obtaining control systems that stand up to the requirements that have been so well developed in the classical expositions of control theory. Therefore, among other things, an entire chapter is devoted to a description of the analysis of control systems, mostly following the classical lines of thought. In the later chapters of the book, in which modern synthesis methods are developed, the chapter on analysis is recurrently referred to. Furthermore, special attention is paid to subjects that are standard in classical control theory but are frequently overlooked in modern treatments, such as nonzero set point control systems, tracking systems, and control systems that have to cope with constant disturbances. Also, heavy emphasis is placed upon the stochastic nature of control problems because the stochastic aspects are so essential."--Preface.

Optimal Control Systems

The theory of optimal control systems has grown and flourished since the 1960's. Many texts, written on varying levels of sophistication, have been published on the subject. Yet even those purportedly designed for beginners in the field are often riddled with complex theorems, and many treatments fail to include topics that are essential to a thorough grounding in the various aspects of and approaches to optimal control. Optimal Control Systems provides a comprehensive but accessible treatment of the subject with just the right degree of mathematical rigor to be complete but practical. It provides a solid bridge between "traditional" optimization using the calculus of variations and what is called "modern" optimal control. It also treats both continuous-time and discrete-time optimal control systems, giving students a firm grasp on both methods. Among this book's most outstanding features is a summary table that accompanies each topic or problem and includes a statement of the problem with a step-by-step solution. Students will also gain valuable experience in using industry-standard MATLAB and SIMULINK software, including the Control System and Symbolic Math Toolboxes. Diverse applications across fields from power engineering to medicine make a foundation in optimal control systems an essential part of an engineer's background. This clear, streamlined presentation is ideal for a graduate level course on control systems and as a quick reference for working engineers.

Optimal Control of Induction Heating Processes

This textbook offers a concise yet rigorous introduction to calculus of variations and optimal control theory, and is a self-contained resource for graduate students in engineering, applied mathematics, and related subjects. Designed specifically for a one-semester course, the book begins with calculus of variations, preparing the ground for optimal control. It then gives a complete proof of the maximum principle and covers key topics such as the Hamilton-Jacobi-Bellman theory of dynamic programming and linear-quadratic optimal control. Calculus of Variations and Optimal Control Theory also traces the historical development of the subject and features numerous exercises, notes and references at the end of each chapter, and suggestions for further study. Offers a concise yet rigorous introduction Requires limited background in control theory or advanced mathematics Provides a complete proof of the maximum principle Uses consistent notation in the exposition of classical and modern topics Traces the historical development of the subject Solutions manual (available only to teachers) Leading universities that have adopted this book include: University of Illinois at Urbana-Champaign ECE 553: Optimum Control Systems Georgia Institute of Technology ECE 6553: Optimal Control and Optimization University of Pennsylvania ESE 680: Optimal Control Theory University of Notre Dame EE 60565: Optimal Control

Modern Control System Theory

The coverage of the former is quite exhaustive while that of latter is adequate with significant provision of the necessary topics that enables a research student to comprehend various technical papers. The stress is on the interdisciplinary nature of the subject. Practical control problems from various engineering disciplines have been drawn to illustrate the potential concepts.

Solutions Manual for Optimal Control Systems

Covering all aspects of this important topic, this work presents a review of the main control issues in wind power generation, offering a unified picture of the issues surrounding its optimal control. Discussion is focused on a global dynamic optimization approach to wind power systems using a set of optimization criteria which comply with a comprehensive group of requirements including: energy conversion efficiency; mechanical reliability; and quality of the energy provided.

Optimal Control and Estimation

Optimal Networked Control Systems with MATLAB® discusses optimal controller design in discrete time for networked control systems (NCS). The authors apply several powerful modern control techniques in discrete time to the design of intelligent controllers for such NCS. Detailed derivations, rigorous stability proofs, computer simulation examples, and downloadable MATLAB® codes are included for each case. The book begins by providing background on NCS, networked imperfections, dynamical systems, stability theory, and stochastic optimal adaptive controllers in discrete time for linear and nonlinear systems. It lays the foundation for reinforcement learning-based optimal adaptive controller use for finite and infinite horizons. The text then: Introduces quantization effects for linear and nonlinear NCS, describing the design of stochastic adaptive controllers for a class of linear and nonlinear systems Presents two-player zero-sum game-theoretic formulation for linear systems in input–output form enclosed by a communication network Addresses the stochastic optimal control of nonlinear NCS by using neuro dynamic programming Explores stochastic optimal design for nonlinear two-player zero-sum games under communication constraints Treats an event-sampled distributed NCS to minimize transmission of state and control signals within the feedback loop via the communication network Covers distributed joint optimal network scheduling and control design for wireless NCS, as well as the effect of network protocols on the wireless NCS controller design An ideal reference for graduate students, university researchers, and practicing engineers, Optimal Networked Control Systems with MATLAB® instills a solid understanding of neural network controllers and how to build them.

Optimal Control for Mathematical Models of Cancer Therapies

Parallel Algorithms for Optimal Control of Large Scale Linear Systems is a comprehensive presentation for both linear and bilinear systems. The parallel algorithms presented in this book are applicable to a wider class of practical systems than those served by traditional methods for large scale singularly perturbed and weakly coupled systems based on the power-series expansion methods. It is intended for scientists and advance graduate students in electrical engineering and computer science who deal with parallel algorithms and control systems, especially large scale systems. The material presented is both comprehensive and unique.

Parallel Algorithms for Optimal Control of Large Scale Linear Systems

Significant advances in the field of optimal control have been made over the past few decades. These advances have been well documented in numerous fine publications, and have motivated a number of innovations in electric power system engineering, but they have not yet been collected in book form. Our purpose in writing this book is to provide a description of some of the applications of optimal control techniques to practical power system problems. The book is designed for advanced undergraduate courses in electric power systems, as well as graduate courses in electrical engineering, applied mathematics, and industrial engineering. It is also intended as a self-study aid for practicing personnel involved in the planning and operation of electric power systems for utilities, manufacturers, and consulting and government regulatory agencies. The book consists of seven chapters. It begins with an introductory chapter that briefly reviews the history of optimal control and its power system applications and also provides an outline of the text. The second chapter is entitled "Some Optimal Control Techniques"; its intent is to introduce fundamental concepts of optimal control theory that are relevant to the applications treated in the following chapters. Emphasis is given to clear, methodical development rather than rigorous formal proofs. Topics discussed include variational calculus, Pontryagin's maximum principle, and geometric methods employing functional analysis. A number of solved examples are included to illustrate the techniques.

Primer on Optimal Control Theory

Graduate-level text provides introduction to optimal control theory for stochastic systems, emphasizing application of basic concepts to real problems.

Optimal Control Theory with Applications in Economics

A Relaxation Based Approach to Optimal Control of Hybrid and Switched Systems proposes a unified approach to effective and numerically tractable relaxation schemes for optimal control problems of hybrid and switched systems. The book gives an overview of the existing (conventional and newly developed) relaxation techniques associated with the conventional systems described by ordinary differential equations. Next, it constructs a self-contained relaxation theory for optimal control processes governed by various types (sub-classes) of general hybrid and switched systems. It contains all mathematical tools necessary for an adequate understanding and using of the sophisticated relaxation techniques. In addition, readers will find many practically oriented optimal control problems related to the new class of dynamic systems. All in all, the book follows engineering and numerical concepts. However, it can also be considered as a mathematical compendium that contains the necessary formal results and important algorithms related to the modern relaxation theory. Illustrates the use of the relaxation approaches in engineering optimization Presents application of the relaxation methods in computational schemes for a numerical treatment of the sophisticated hybrid/switched optimal control problems Offers a rigorous and self-contained mathematical tool for an adequate understanding and practical use of the relaxation techniques Presents an extension of the relaxation methodology to the new class of applied dynamic systems, namely, to hybrid and switched control systems

Feedback Control Theory

Highlights the Hamiltonian approach to singularly perturbed linear optimal control systems. Develops parallel algorithms in independent slow and fast time scales for solving various optimal linear control and filtering problems in standard and nonstandard singularly perturbed systems, continuous- and discrete-time, deterministic and stochastic, mul

A Relaxation-Based Approach to Optimal Control of Hybrid and Switched Systems

This outstanding reference presents current, state-of-the-art research on importantproblems of finite-dimensional nonlinear optimal control and controllability theory. Itpresents an overview of a broad variety of new techniques useful in solving classicalcontrol theory problems.Written and edited by renowned mathematicians at the forefront of research in thisevolving field, Nonlinear Controllability and Optimal Control providesdetailed coverage of the construction of solutions of differential inclusions by means ofdirectionally continuous sections Lie algebraic conditions for local controllability the use of the Campbell-Hausdorff series to derive properties of optimal trajectories the Fuller phenomenon the theory of orbits and more.Containing more than 1,300 display equations, this exemplary, instructive reference is aninvaluable source for mathematical researchers and applied mathematicians, electrical andelectronics, aerospace, mechanical, control, systems, and computer engineers, and graduatestudents in these disciplines .

Optimal Sampled-Data Control Systems

Optimal and Robust Scheduling for Networked Control Systems tackles the problem of integrating system components—controllers, sensors, and actuators—in a networked control system. It is common practice in industry to solve such problems heuristically, because the few theoretical results available are not comprehensive and cannot be readily applied by practitioners. This book offers a solution to the deterministic scheduling problem that is based on rigorous control theoretical tools but also addresses practical implementation issues. Helping to bridge the gap between control theory and computer science, it suggests that the consideration of communication constraints at the design stage will significantly improve the performance of the control system. Technical Results, Design Techniques, and Practical Applications The book brings together well-known measures for robust performance as well as fast stochastic algorithms to assist designers in selecting the best network configuration and guaranteeing the speed of offline optimization. The authors propose a unifying framework for modelling NCSs with time-triggered communication and present technical results. They also introduce design techniques, including for the codesign of a controller and communication sequence and for the robust design of a communication sequence for a given controller. Case studies explore the use of the FlexRay TDMA and time-triggered control area network (CAN) protocols in an automotive control system. Practical Solutions to Your Time-Triggered Communication Problems This unique book develops ready-to-use engineering tools for large-scale control system integration with a focus on robustness and performance. It emphasizes techniques that are directly applicable to time-triggered communication problems in the automotive industry and in avionics, robotics, and automated manufacturing.

Nonlinear Controllability and Optimal Control

Upper-level undergraduate text introduces aspects of optimal control theory: dynamic programming, Pontryagin's minimum principle, and numerical techniques for trajectory optimization. Numerous figures, tables. Solution guide available upon request. 1970 edition.

Optimal Control

Robust Industrial Control Systems: Optimal Design Approach for Polynomial Systems presents a comprehensive introduction to the use of frequency domain and polynomial system design techniques for a range of industrial control and signal processing applications. The solution of stochastic and robust optimal control problems is considered, building up from single-input problems and gradually developing the results for multivariable design of the later chapters. In addition to cataloguing many of the results in polynomial systems needed to calculate industrial controllers and filters, basic design procedures are also introduced which enable cost functions and system descriptions to be specified in order to satisfy industrial requirements. Providing a range of solutions to control and signal processing problems, this book: * Presents a comprehensive introduction to the polynomial systems approach for the solution of H_2 and H_infinity optimal control problems. * Develops robust control design procedures using frequency domain methods. * Demonstrates design examples for gas turbines, marine systems, metal processing, flight control, wind turbines, process control and manufacturing systems. * Includes the analysis of multi-degrees of freedom controllers and the computation of restricted structure controllers that are simple to implement. * Considers time-varying control and signal processing problems. * Addresses the control of non-linear processes using both multiple model concepts and new optimal control solutions. Robust Industrial Control Systems: Optimal Design Approach for Polynomial Systems is essential reading for professional engineers requiring an introduction to optimal control theory and insights into its use in the design of real industrial processes. Students and researchers in the field will also find it an excellent reference tool.

Nonlinear and Optimal Control Systems

Nonlinear and Optimal Control Theory

This book presents applications of geometric optimal control to real life biomedical problems with an emphasis on cancer treatments. A number of mathematical models for both classical and novel cancer treatments are presented as optimal control problems with the goal of constructing optimal protocols. The power of geometric methods is illustrated with fully worked out complete global solutions to these mathematically challenging problems. Elaborate constructions of optimal controls and corresponding system responses provide great examples of applications of the tools of geometric optimal control and the outcomes aid the design of simpler, practically realizable suboptimal protocols. The book blends mathematical rigor with practically important topics in an easily readable tutorial style. Graduate students and researchers in science and engineering, particularly biomathematics and more mathematical aspects of biomedical engineering, would find this book particularly useful.