

Discrete Time Control Systems 2nd Ogata Manual

This introductory text assists students in developing the ability to understand and analyze both continuous and discrete-time systems. The authors present the most widely used techniques of signal and system analysis in a highly readable and understandable fashion. *Covers the most widely used techniques of signal and system analysis. *Separate treatment of continuous-time and discrete-time signals and systems. *Extensive treatment of Fourier analysis. *A flexible structure making the text accessible to a variety of courses. *Makes extensive use of mathematics in an engineering context. *Uses an abundance of examples to illustrate ideas and apply the theoretical results.

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.

This volume brings about the contemporary results in the field of discrete-time systems. It covers papers written on the topics of robust control, nonlinear systems and recent applications. Although the technical views are different, they all geared towards focusing on the up-to-date knowledge gain by the researchers and providing effective developments along the systems and control arena. Each topic has a detailed discussions and suggestions for future perusal by interested investigators.

Using the power of MATLAB® and its Control System Toolbox, this book is the ideal supplement for a digital control systems course. Students are able to use a digital computer to rapidly work a wide range of numerical problems and gain deeper insight in control design. The book is built around illustrative examples that demonstrate the steps involved in the analysis and design process. The examples are followed by a variety of problems that span the spectrum from follow-up what-if problems, to simple textbook-type reinforcement problems, to open-ended exploratory problems, and to realistic comprehensive problems. This book is part of the Brooks/Cole Bookware Companion Series.

Sliding mode control is a simple and yet robust control technique, where the system states are made to confine to a selected subset. With the increasing use of computers and discrete-time samplers in controller implementation in the recent past, discrete-time systems and computer based control have become important topics. This monograph presents an output feedback sliding mode control philosophy which can be applied to almost all controllable and observable systems, while at the same time being simple enough as not to tax the computer too much. It is shown that the solution can be found in the synergy of the multirate output sampling concept and the concept of discrete-time sliding mode control.

Intelligent systems are a hallmark of modern feedback control systems. But as these systems mature, we have come to expect higher levels of performance in speed and accuracy in the face of severe nonlinearities, disturbances, unforeseen dynamics, and unstructured uncertainties. Artificial neural networks offer a combination of adaptability, parallel processing, and learning capabilities that outperform other intelligent control methods in more complex systems. Borrowing from Biology Examining neurocontroller design in discrete-time for the first time, Neural Network Control of Nonlinear Discrete-Time Systems presents powerful modern control techniques based on the parallelism and adaptive capabilities of biological nervous systems. At every step, the author derives rigorous stability proofs and presents simulation examples to demonstrate the concepts. Progressive Development After an introduction to neural networks, dynamical systems, control of nonlinear systems, and feedback linearization, the book builds systematically from actuator nonlinearities and strict feedback in nonlinear systems to nonstrict feedback, system identification, model reference adaptive control, and novel optimal control using the Hamilton-Jacobi-Bellman formulation. The author concludes by developing a framework for implementing intelligent control in actual industrial systems using embedded hardware. Neural Network Control of Nonlinear Discrete-Time Systems fosters an understanding of neural network controllers and explains how to build them using detailed derivations, stability analysis, and computer simulations.

This unique book provides a bridge between digital control theory and vehicle guidance and control practice. It presents practical techniques of digital redesign and direct discrete-time design suitable for a real-time implementation of controllers and guidance laws at multiple rates and with and computational techniques. The theory of digital control is given as theorems, lemmas, and propositions. The design of the digital guidance and control systems is illustrated by means of step-by-step procedures, algorithms, and case studies. The systems proposed are applied to realistic models of unmanned systems and missiles, and digital implementation.

Written as a companion volume to the author's Solving Control Engineering Problems with MATLAB, this indispensable guide illustrates the power of MATLAB as a tool for synthesizing control systems, emphasizing pole placement, and optimal systems design.

New edition of a text for senior undergraduate and first-year graduate level engineering students. Prerequisites are a course on introductory control systems, a course on ordinary differential equations, and familiarity with MATLAB computations (or MATLAB can be studied concurrently). Annotation copyright by Book News, Inc., Portland, OR This book covers the theory and mathematics needed to understand the concepts in control system design. Chapter 1 deals with compensation network design. Nonlinear control systems, including phase-plane analysis and the Delta method are presented in chapter 2. The analysis and design aspects based on the state variable approach are presented in Chapter 3. The discrete time control systems form the basis for the study of digital control systems in Chapter 4, covering the frequency response, root locus analysis, and stability considerations for discrete-time control systems. The stability analysis based on the Lyapunov method is given in chapter 5. The appendices include two US government articles on industrial control systems (NIST) and the control system design for a solar energy storage system (U.S. Dept. of Energy). Concepts in the text are supported by numerical examples. Features: • Covers the theory and mathematics needed to understand the concepts in control system design • Includes two U.S. government articles on industrial control systems (NIST) and the control system design for a solar energy storage system (U.S. Department of Energy)

Discrete-time Control Systems Pearson

This book contains an introduction to three topics in stochastic control: discrete time stochastic control, i. e. , stochastic dynamic programming (Chapter 1), piecewise - deterministic control problems (Chapter 3), and control of Ito diffusions (Chapter 4). The chapters include treatments of optimal stopping problems. An Appendix - calls material from elementary probability theory and gives heuristic explanations of certain more advanced tools in probability theory. The book will hopefully be of interest to students in several fields: economics, engineering, operations research, finance, business, mathematics. In economics and business administration, graduate students should readily be able to read it, and the mathematical level can be suitable for advanced undergraduates in mathematics and science. The prerequisites for reading the book are only a calculus course and a course in elementary probability. (Certain technical comments may demand a slightly better background.) As this book perhaps (and hopefully) will be read by readers with widely differing backgrounds, some general advice may be useful: Don't be put off if paragraphs, comments, or remarks contain material of a seemingly more technical nature that you don't understand. Just skip such material and continue reading, it will surely not be needed in order to understand the main ideas and results. The presentation avoids the use of measure theory.

This comprehensive introduction to the estimation and control of dynamic stochastic systems provides complete derivations of key results. The second edition includes improved and updated material, and a new presentation of polynomial control and new derivation of linear-quadratic-Gaussian control.

This book covers a wide spectrum of systems such as linear and nonlinear multivariable systems as well as control problems such as disturbance, uncertainty and time-delays. The purpose of this book is to provide researchers and practitioners a manual for the design and application of advanced discrete-time controllers. The book presents six different control approaches depending on the type of system and control problem. The first and second approaches are based on Sliding Mode control (SMC) theory and are intended for linear systems with exogenous disturbances. The third and fourth approaches are based on adaptive control theory and are aimed at linear/nonlinear systems with periodically varying parametric uncertainty or systems with input delay. The fifth approach is based on Iterative learning control (ILC) theory and is aimed at uncertain linear/nonlinear systems with repeatable tasks and the final approach is based on fuzzy logic control (FLC) and is intended for highly uncertain systems with heuristic control knowledge. Detailed numerical examples are provided in each chapter to illustrate the design procedure for each control method. A number of practical control applications are also presented to show the problem solving process and effectiveness with the advanced discrete-time control approaches introduced in this book.

The focus of this book is on the design of a specific control strategy using digital computers. This control strategy referred to as Sliding Mode Control (SMC), has its roots in (continuous-time) relay control. This book aims to explain recent investigations' output in the field of discrete-time sliding mode control (DSMC). The book starts by explaining a new robust LMI-based (state-feedback and observer-based output-feedback) DSMC including a new scheme for sparsely distributed control. It includes a novel event-driven control mechanism, called actuator-based event-driven scheme, using a synchronized-rate biofeedback system for heart rate regulation during cycle-ergometer. Key Features: Focuses on LMI-based SMC (sliding mode control) for uncertain discrete-time system using novel nonlinear components in the control law Makes reader understand the techniques of designing a discrete controller based on the flexible sliding functions Proposes new algorithms for sparsifying control and observer network through multi-objective optimization frameworks Discusses a framework for the design of SMC for two-dimensional systems along with analyzing the controllability of two-dimensional systems Discusses novel schemes for sparsifying the control network

Tough Test Questions? Missed Lectures? Not Enough Time? Fortunately for you, there's Schaum's. This all-in-one-package includes more than 700 fully solved problems, examples, and practice exercises to sharpen your problem-solving skills. Plus, you will have access to 20 detailed videos featuring instructors who explain the most commonly tested problems--it's just like having your own virtual tutor! You'll find everything you need to build confidence, skills, and knowledge for the highest score possible. More than 40 million students have trusted Schaum's to help them succeed in the classroom and on exams. Schaum's is the key to faster learning and higher grades in every subject. Each Outline presents all the essential course information in an easy-to-follow, topic-by-topic format. You also get hundreds of examples, solved problems, and practice exercises to test your skills. This Schaum's Outline gives you 700 fully solved problems Extra practice on topics such as differential equations and linear systems, transfer functions, block diagram algebra, and more Support for all major textbooks for feedback and control systems courses Fully compatible with your classroom text, Schaum's highlights all the important facts you need to know. Use Schaum's to shorten your study time--and get your best test scores! Schaum's Outlines--Problem Solved.

This monograph deals with control problems of discrete-time dynamical systems which include linear and nonlinear input/output relations In its present second enlarged edition the control problems of linear and non-linear dynamical systems will be solved as algebraically as possible. Adaptive control problems are newly proposed and solved for dynamical systems which satisfy the time-invariant condition. The monograph provides new results and their extensions which can also be more applicable for nonlinear dynamical systems. A new method which produces manipulated inputs is presented in the sense of state control and output control. To present the effectiveness of the method, many numerical examples of control problems are provided as well.

Discrete Networked Dynamic Systems: Analysis and Performance provides a high-level treatment of a general class of linear discrete-time dynamic systems interconnected over an information network, exchanging relative state measurements or output measurements. It presents a systematic analysis of the material and provides an account to the math development in a unified way. The topics in this book are structured along four dimensions: Agent, Environment, Interaction, and Organization, while keeping global (system-centered) and local (agent-centered) viewpoints. The focus is on the wide-sense consensus problem in discrete networked dynamic systems. The authors rely heavily on algebraic graph theory and topology to derive their results. It is known that graphs play an important role in the analysis of interactions between multiagent/distributed systems. Graph-theoretic analysis provides insight into how topological interactions play a role in achieving coordination among agents. Numerous types of graphs exist in the literature, depending on the edge set of G . A simple graph has no self-loop or edges. Complete graphs are simple graphs with an edge connecting any pair of vertices. The vertex set in a bipartite graph can be partitioned into disjoint non-

empty vertex sets, whereby there is an edge connecting every vertex in one set to every vertex in the other set. Random graphs have fixed vertex sets, but the edge set exhibits stochastic behavior modeled by probability functions. Much of the studies in coordination control are based on deterministic/fixed graphs, switching graphs, and random graphs. This book addresses advanced analytical tools for characterization control, estimation and design of networked dynamic systems over fixed, probabilistic and time-varying graphs Provides coherent results on adopting a set-theoretic framework for critically examining problems of the analysis, performance and design of discrete distributed systems over graphs Deals with both homogeneous and heterogeneous systems to guarantee the generality of design results

Discrete-Time and Discrete-Space Dynamical Systems provides a systematic characterization of the similarities and differences of several types of discrete-time and discrete-space dynamical systems, including: Boolean control networks; nondeterministic finite-transition systems; finite automata; labelled Petri nets; and cellular automata. The book's perspective is primarily based on topological properties though it also employs semitensor-product and graph-theoretic methods where appropriate. It presents a series of fundamental results: invertibility, observability, detectability, reversibility, etc., with applications to systems biology. Academic researchers with backgrounds in applied mathematics, engineering or computer science and practising engineers working with discrete-time and discrete-space systems will find this book a helpful source of new understanding for this increasingly important class of systems. The basic results to be found within are of fundamental importance for further study of related problems such as automated synthesis and safety control in cyber-physical systems using formal methods.

Analysis and Synthesis of Polynomial Discrete-time Systems: An SOS Approach addresses the analysis and design of polynomial discrete-time control systems. The book deals with the application of Sum of Squares techniques in solving specific control and filtering problems that can be useful to solve advanced control problems, both on the theoretical side and on the practical side. Two types of controllers, state feedback controller and output feedback controller, along with topics surrounding the nonlinear filter and the H-infinity performance criteria are explored. The book also proposes a solution to global stabilization of discrete-time systems. Presents recent developments of the Sum of Squares approach in control of Polynomial Discrete-time Systems Includes numerical and practical examples to illustrate how design methodologies can be applied Provides a methodology for robust output controller design with an H-infinity performance index for polynomial discrete-time systems Offers tools for the analysis and design of control processes where the process can be represented in polynomial form Uses the Sum of Squares method for solving controller and filter design problems Provides MATLAB® code and simulation files of all illustrated example

A comprehensive treatment of the analysis and design of discrete-time control systems which provides a gradual development of the theory by emphasizing basic concepts and avoiding highly mathematical arguments. The text features comprehensive treatment of pole placement, state observer design, and quadratic optimal control.

This book helps students, researchers, and practicing engineers to understand the theoretical framework of control and system theory for discrete-time stochastic systems so that they can then apply its principles to their own stochastic control systems and to the solution of control, filtering, and realization problems for such systems. Applications of the theory in the book include the control of ships, shock absorbers, traffic and communications networks, and power systems with fluctuating power flows. The focus of the book is a stochastic control system defined for a spectrum of probability distributions including Bernoulli, finite, Poisson, beta, gamma, and Gaussian distributions. The concepts of observability and controllability of a stochastic control system are defined and characterized. Each output process considered is, with respect to conditions, represented by a stochastic system called a stochastic realization. The existence of a control law is related to stochastic controllability while the existence of a filter system is related to stochastic observability. Stochastic control with partial observations is based on the existence of a stochastic realization of the filtration of the observed process.

Digital controllers are part of nearly all modern personal, industrial, and transportation systems. Every senior or graduate student of electrical, chemical or mechanical engineering should therefore be familiar with the basic theory of digital controllers. This new text covers the fundamental principles and applications of digital control engineering, with emphasis on engineering design. Fadali and Visioli cover analysis and design of digitally controlled systems and describe applications of digital controls in a wide range of fields. With worked examples and Matlab applications in every chapter and many end-of-chapter assignments, this text provides both theory and practice for those coming to digital control engineering for the first time, whether as a student or practicing engineer. Extensive Use of computational tools: Matlab sections at end of each chapter show how to implement concepts from the chapter Frees the student from the drudgery of mundane calculations and allows him to consider more subtle aspects of control system analysis and design An engineering approach to digital controls: emphasis throughout the book is on design of control systems. Mathematics is used to help explain concepts, but throughout the text discussion is tied to design and implementation. For example coverage of analog controls in chapter 5 is not simply a review, but is used to show how analog control systems map to digital control systems Review of Background Material: contains review material to aid understanding of digital control analysis and design. Examples include discussion of discrete-time systems in time domain and frequency domain (reviewed from linear systems course) and root locus design in s-domain and z-domain (reviewed from feedback control course) Inclusion of Advanced Topics In addition to the basic topics required for a one semester senior/graduate class, the text includes some advanced material to make it suitable for an introductory graduate level class or for two quarters at the senior/graduate level. Examples of optional topics are state-space methods, which may receive brief coverage in a one semester course, and nonlinear discrete-time systems Minimal Mathematics Prerequisites The mathematics background required for understanding most of the book is based on what can be reasonably expected from the average electrical, chemical or mechanical engineering senior. This background includes three semesters of calculus, differential equations and basic linear algebra. Some texts on digital control require more

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.

These papers cover the recent advances in the field of control theory and are designed for electrical engineers in digital signal processing.

The book presents recent advances in the theory of neural control for discrete-time nonlinear systems with multiple inputs and multiple outputs. The simulation results that appear in each chapter include rigorous mathematical analyses, based on the Lyapunov approach, to establish its properties. The book contains two sections: the first focuses on the analyses of control techniques; the second is dedicated to illustrating results of real-time applications. It also provides solutions for the output trajectory tracking problem of unknown nonlinear systems based on sliding modes and inverse optimal control scheme. "This book on Discrete-time Recurrent Neural Control is unique in the literature, with new knowledge and information about the new technique of recurrent neural control especially for discrete-time systems. The book is well organized and clearly presented. It will be welcome by a wide range of researchers in science and engineering, especially graduate students and junior researchers who want to learn the new notion of recurrent neural control. I believe it will have a good market. It is an excellent book after all." — Guanrong Chen, City University of Hong Kong "This book includes very relevant topics, about neural control. In these days, Artificial Neural Networks have been recovering their relevance and well-established importance, this due to its great capacity to process big amounts of data. Artificial Neural Networks development always is related to technological advancements; therefore, it is not a surprise that now we are being witnesses of this new era in Artificial Neural Networks, however most of the developments in this research area only focuses on applicability of the proposed schemes. However, Edgar N. Sanchez author of this book does not lose focus and include both important applications as well as a deep theoretical analysis of Artificial Neural Networks to control discrete-time nonlinear systems. It is important to remark that first, the considered Artificial Neural Networks are development in discrete-time this simplify its implementation in real-time; secondly, the proposed applications ranging from modelling of unknown discrete-time on linear systems to control electrical machines with an emphasize to renewable energy systems. However, its applications are not limited to these kind of systems, due to their theoretical foundation it can be applicable to a large class of nonlinear systems. All of these is supported by the solid research done by the author." — Alma Y. Alanis, University of Guadalajara, Mexico "This book discusses in detail; how neural networks can be used for optimal as well as robust control design. Design of neural network controllers for real time applications such as induction motors, boost converters, inverted pendulum and doubly fed induction generators has also been carried out which gives the book an edge over other similar titles. This book will be an asset for the novice to the experienced ones." — Rajesh Joseph Abraham, Indian Institute of Space Science & Technology, Thiruvananthapuram, India

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.

Among the many techniques for designing linear multivariable analogue controllers, the two most popular optimal ones are H₂ and H-infinity 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.

This book covers crucial lacunae of the linear discrete-time time-invariant dynamical systems and introduces the reader to their treatment, while functioning under real, natural conditions, in forced regimes with arbitrary initial conditions. It provides novel theoretical tools necessary for the analysis and design of the systems operating in stated conditions. The text completely covers two well-known systems, IO and ISO, along with a new system, IIO. It discovers the concept of the full transfer function matrix $F(z)$ in the z -complex domain, which incorporates the Z -transform of the system, input and another variable, vectors, all with arbitrary initial conditions. Consequently, it addresses the full system matrix $P(z)$ and the full block diagram technique based on the use of $F(z)$, which incorporates the Z -transform of the system, input and

