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Optimal Control Systems D. Subbaram Naidu 2018-10-03 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.

Discrete-data Control Systems Benjamin C. Kuo 1974

Modern Control Engineering Katsuhiko Ogata 1990 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.

Digital Control Systems Benjamin C. Kuo 1992 In recent years significant progress has been made in the analysis and design of discrete-data and digital control systems. These systems have gained popularity and importance in industry due in part to the advances made in digital computers for controls and, more recently, in microprocessors and digital signal processors. An introductory text for a senior or graduate course on digital control systems, this text covers the theory and applications of digital control systems, assuming a knowledge of matrix algebra, differential equations, Laplace transforms and the basic principles of continuous-data control systems. Many subjects are new to the Second Edition, most importantly design topics such as disturbance rejection, sensitivity considerations, and zero-ripple deadbeat-response design. In addition, Kuo includes separate discussions on controllability, observability, and stability, expands the discussions of sampling period selection, emphasizes computer-aided solutions, and provides a new and simpler approach to the Nyquist criterion of stability. Each chapter begins with keywords and topics that provide students with an overview of the key topics to be covered. Illustrative examples, many derived from practical systems, are included throughout the text. Numerous exercise problems end each chapter.

Digital Skills Alexander J. A. M. van Deursen 2014-07-10 The first book to systematically discuss the skills and literacies needed to use digital media, particularly the Internet, van Dijk and van Deursen's clear and accessible work distinguishes digital skills, analyzes their roles and prevalence, and offers solutions from individual, educational, sociological, and policy perspectives.

Discrete-time Control Systems Katsuhiko Ogata 1995 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.

True Digital Control C. James Taylor 2013-05-29 *True Digital Control: Statistical Modelling and Non-Minimal State Space Design* develops a true digital control design philosophy that encompasses data-based model identification, through to control algorithm design, robustness evaluation and implementation. With a heritage from both classical and modern control system synthesis, this book is supported by detailed practical examples based on the authors' research into environmental, mechatronic and robotics systems. Treatment of both statistical modelling and control design under one cover is unusual and highlights the important connections between these disciplines. Starting from the ubiquitous proportional-integral controller, and with essential concepts such as pole assignment introduced using straightforward algebra and block diagrams, this book addresses the needs of those students, researchers and engineers, who would like to advance their knowledge of control theory and practice into the state space domain; and academics who are interested to learn more about non-minimal state variable feedback control systems. Such non-minimal state feedback is utilised as a unifying framework for generalised digital control system design. This approach provides a gentle learning curve, from which potentially difficult topics, such as optimal, stochastic and multivariable control, can be introduced and assimilated in an interesting and straightforward manner. Key features: Covers both system identification and control system design in a unified manner Includes practical design case studies and simulation examples Considers recent research into time-variable and state-dependent parameter modelling and control, essential elements of adaptive and nonlinear control system design, and the delta-operator (the discrete-time equivalent of the differential operator) systems Accompanied by a website hosting MATLAB examples *True Digital Control: Statistical Modelling and Non-Minimal State Space Design* is a comprehensive and practical guide for students and professionals who wish to further their knowledge in the areas of modern control and system identification.

Principles of Combustion Kenneth K. Kuo 1986-05-08 This comprehensive text covers principles and applications with an emphasis on the theoretical modeling of combustion. Addresses chemical thermodynamics and kinetics, conservation equations for multi-component reacting flows, deflagration and detonation waves, premixed laminar flames, spray combustion of fuel droplets, ignition, and related topics. Many examples are included to demonstrate the application of theory. Emphasizes the use of digital computers for solutions.

Automatic Control Systems Benjamin C. Kuo 1982 Stresses the theory & application of control systems with a focus on conventional analysis & design methods, state variable methods, & digital control systems.

Numerical Algorithms Justin Solomon 2015-06-24 *Numerical Algorithms: Methods for Computer Vision, Machine Learning, and Graphics* presents a new approach to numerical analysis for modern computer scientists. Using examples from a broad base of computational tasks, including data processing, computational photography, and animation, the textbook introduces numerical modeling and algorithmic design

Microcontroller Based Applied Digital Control Dogan Ibrahim 2006-04-14 Combines the theory and the practice of applied digital control This book presents the theory and application of microcontroller based automatic control systems. Microcontrollers are single-chip computers which can be used to control real-time systems. Low-cost, single chip and easy to program, they have traditionally been programmed using the assembly language of the target processor. Recent developments in this field mean that it is now possible to program these devices using high-level languages such as BASIC, PASCAL, or C. As a result, very complex control algorithms can be developed and implemented on the microcontrollers. Presenting a detailed treatment of how microcontrollers can be programmed and used in digital control applications, this book: * Introduces the basic principles of the theory of digital control systems. * Provides several working examples of real working mechanical, electrical and fluid systems. * Covers the implementation of control algorithms using microcontrollers. * Examines the advantages and disadvantages of various realization techniques. * Describes the use of MATLAB in the analysis and design of control systems. * Explains the sampling process, z-transforms, and the time response of discrete-time systems in detail. Practising engineers in industry involved with the design and implementation of computer control systems will find *Microcontroller Based Applied Digital Control* an invaluable resource. In addition, researchers and students in control engineering and electrical engineering will find this book an excellent research tool.

Modern Control Systems Richard C. Dorf 2011 *Modern Control Systems*, 12e, is ideal for an introductory undergraduate course in control systems for

engineering students. Written to be equally useful for all engineering disciplines, this text is organized around the concept of control systems theory as it has been developed in the frequency and time domains. It provides coverage of classical control, employing root locus design, frequency and response design using Bode and Nyquist plots. It also covers modern control methods based on state variable models including pole placement design techniques with full-state feedback controllers and full-state observers. Many examples throughout give students ample opportunity to apply the theory to the design and analysis of control systems. Incorporates computer-aided design and analysis using MATLAB and LabVIEW MathScript.

Modern Control Systems Richard C. Dorf 1980

Automatic Control Systems Benjamin C. Kuo 1995

Instructor's Solutions Manual to Accompany Digital Control Systems Benjamin C. Kuo 1997-06-01

Proceedings 1985

Books in Print 1995

Control System Design Graham Clifford Goodwin 2001 For both undergraduate and graduate courses in Control System Design. Using a "how to do it" approach with a strong emphasis on real-world design, this text provides comprehensive, single-source coverage of the full spectrum of control system design. Each of the text's 8 parts covers an area in control--ranging from signals and systems (Bode Diagrams, Root Locus, etc.), to SISO control (including PID and Fundamental Design Trade-Offs) and MIMO systems (including Constraints, MPC, Decoupling, etc.).

Network Analysis and Synthesis Franklin F. Kuo 1968

Solutions Manual to Accompany Digital Control Systems Benjamin C. Kuo 1992

Mastering Spark with R Javier Luraschi 2019-10-07 If you're like most R users, you have deep knowledge and love for statistics. But as your organization continues to collect huge amounts of data, adding tools such as Apache Spark makes a lot of sense. With this practical book, data scientists and professionals working with large-scale data applications will learn how to use Spark from R to tackle big data and big compute problems. Authors Javier Luraschi, Kevin Kuo, and Edgar Ruiz show you how to use R with Spark to solve different data analysis problems. This book covers relevant data science topics, cluster computing, and issues that should interest even the most advanced users. Analyze, explore, transform, and visualize data in Apache Spark with R Create statistical models to extract information and predict outcomes; automate the process in production-ready workflows Perform analysis and modeling across many machines using distributed computing techniques Use large-scale data from multiple sources and different formats with ease from within Spark Learn about alternative modeling frameworks for graph processing, geospatial analysis, and genomics at scale Dive into advanced topics including custom transformations, real-time data processing, and creating custom Spark extensions

Mechatronics and Automatic Control Systems Wego Wang 2013-11-18 This book examines mechatronics and automatic control systems. The book covers important emerging topics in signal processing, control theory, sensors, mechanic manufacturing systems and automation. The book presents papers from the 2013 International Conference on Mechatronics and Automatic Control Systems in Hangzhou, held in China during August 10-11, 2013.

Digital Communications Bernard Sklar 2016-12-23 The clear, easy-to-understand introduction to digital communications Completely updated coverage of today's most critical technologies Step-by-step implementation coverage Trellis-coded modulation, fading channels, Reed-Solomon codes, encryption, and more Exclusive coverage of maximizing performance with advanced "turbo codes" "This is a remarkably comprehensive treatment of the field, covering in considerable detail modulation, coding (both source and channel), encryption, multiple access and spread spectrum. It can serve both as an excellent introduction for the graduate student with some background in probability theory or as a valuable reference for the practicing communication system engineer. For both communities, the treatment is clear and well presented." - Andrew Viterbi, The Viterbi Group Master every key digital communications technology, concept, and technique. Digital Communications, Second Edition is a thoroughly revised and updated edition of the field's classic, best-selling introduction. With remarkable clarity, Dr. Bernard Sklar introduces every digital communication technology at the heart of today's wireless and Internet revolutions, providing a unified structure and context for understanding them -- all without sacrificing mathematical precision. Sklar begins by introducing the fundamentals of signals, spectra, formatting, and baseband transmission. Next, he presents practical coverage of virtually every contemporary modulation, coding, and signal processing technique, with numeric examples and step-by-step implementation guidance. Coverage includes: Signals and processing steps: from information source through transmitter, channel, receiver, and information sink Key tradeoffs: signal-to-noise ratios, probability of error, and bandwidth expenditure Trellis-coded modulation and Reed-Solomon codes: what's behind the math Synchronization and spread spectrum solutions Fading channels: causes, effects, and techniques for withstanding fading The first complete how-to guide to turbo codes: squeezing maximum performance out of digital connections Implementing encryption with PGP, the de facto industry standard Whether you're building wireless systems, xDSL, fiber or coax-based services, satellite networks, or Internet infrastructure, Sklar presents the theory and the practical implementation details you need. With nearly 500 illustrations and 300 problems and exercises, there's never been a faster way to master advanced digital communications. CD-ROM INCLUDED The CD-ROM contains a complete educational version of Elanix' SystemView DSP design software, as well as detailed notes for getting started, a comprehensive DSP tutorial, and over 50 additional communications exercises.

Advanced Control Engineering Roland Burns 2001-11-07 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.

Advanced Modern Control System Theory and Design Stanley M. Shinnars 1998-09-30 The definitive guide to advanced control system design Advanced Modern Control System Theory and Design offers the most comprehensive treatment of advanced control systems available today. Superbly organized and easy to use, this book is designed for an advanced course and is a companion volume to the introductory text, Modern Control System Theory and Design, Second Edition (or any other introductory book on control systems). In addition, it can serve as an excellent text for practicing control system engineers who need to learn more advanced control systems techniques in order to perform their tasks. Advanced Modern Control Systems Theory and Design briefly reviews introductory control system analysis concepts and then presents the methods for designing linear control systems using single-degree and two-degrees-of-freedom compensation techniques. The very important subjects of modern control system design using state-space, pole placement, Ackermann's formula, estimation, robust control, and H8 techniques are then presented. The following crucial subjects are then covered in the presentation: * Digital Control System Analysis and Design--extends the continuous concepts presented to discrete systems * Nonlinear Control System Design--extends the linear concepts presented to nonlinear systems * Introduction to Optimal Control Theory and Its Applications--presents such key topics as dynamic programming and the maximum principle, as well as applications to the space attitude control problem and the lunar soft-landing problem * Control System Design Examples: Complete Case Studies--presents the complete case studies of five control system design examples that illustrate practical design projects Other notable features of this volume are: * Free MATLAB software containing problem solutions which can be retrieved from the Mathworks, Inc. anonymous FTP server at ftp://ftp.mathworks.com/pub/books/advshinnars * MATLAB programs and a tutorial on the use of MATLAB incorporated directly into the text * An extensive set of worked-out, illustrative solutions added in dedicated sections at the end of chapters * End-of-chapter problems--one-third with answers to facilitate self-study * A solutions manual containing solutions to the remaining two-thirds of the problems available from the Wiley editorial department.

Handbook of Research on Personal Autonomy Technologies and Disability Informatics Pereira, Javier 2010-10-31 "This book offers a comprehensive description of the needs that must be considered by IT engineers when designing technical assistance tools that can be used by disabled persons according to their specific motoric, visual, auditive, or psychic needs"--Provided by publisher.

Digital Control Engineering M. Sami Fadali 2012-08-21 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

Introduction to Control Engineering Ajit K. Mandal 2006-01-01 The Text Is Written From The Engineer'S Point Of View To Explain The Basic Concepts Involved In Feedback Control Theory. The Material In The Text Has Been Organized For Gradual And Sequential Development Of Control Theory Starting With A Statement Of The Task Of A Control Engineer At The Very Outset. The Book Is Tended For An Introductory Undergraduate Course In Control Systems For Engineering Students.This Text Presents A Comprehensive Analysis And Design Of Continuous-Time Control Systems And Includes More Than Introductory Material For Discrete Systems With Adequate Guidelines To Extend The Results Derived In Connection Continuous-Time Systems. The Prerequisite For The Reader Is Some Elementary Knowledge Of Differential Equations, Vector-Matrix Analysis And Mechanics. Transfer Function And State Variable Models Of Typical Components And Subsystems Have Been Derived In The Appendix At The End Of The Book.Most Of The Materials Including Solved And Unsolved Problems Presented In The Book Have Been Class-Tested In Senior Undergraduates And First Year Graduate EI Courses In The Field Of Control Systems At The Electronics And Telecommunication Engineering Department, Jadavpur University. Matlab Is The Most Widely Used CAD Software Package In Universities Throughout The World. Some Representative Matlab Scripts Used For Solving Problems Are Cluded At The End Of Each Chapter. The Detailed Design Steps Of Fuzzy Logic Based Controller Using Simulink And Matlab Has Been Provided In The Book To Give The Student A Head Start In This Emerging Discipline.A Chapter Has Been Included To Deal With Nonlinear Components And Their Analysis G Matlab And Simulink Through User Defined S-Functions. Finally, A Chapter Has Been Included To Deal With The Implementation Of Digital Controllers On Finite Bit Computer, To Bring Out The Problems Associated With Digital Trollers. In View Of Extensive Use Of Matlab For Rapid Verification Of Controller Designs, Some Notes For Using Matlab Script M-Files And Function M-Files Are Included At The End Of The Book.

Vibration with Control Daniel J. Inman 2006-11-02 Engineers are becoming increasingly aware of the problems caused by vibration in engineering design, particularly in the areas of structural health monitoring and smart structures. Vibration is a constant problem as it can impair performance and lead to fatigue, damage and the failure of a structure. Control of vibration is a key factor in preventing such detrimental results. This book presents a homogenous treatment of vibration by including those factors from control that are relevant to modern vibration analysis, design and measurement. Vibration and control are established on a firm mathematical basis and the disciplines of vibration, control, linear algebra, matrix computations, and applied functional analysis are connected. Key Features: Assimilates the discipline of contemporary structural vibration with active control Introduces the use of Matlab into the solution of vibration and vibration control problems Provides a unique blend of practical and theoretical developments Contains examples and problems along with a solutions manual and power point presentations Vibration with Control is an essential text for practitioners, researchers, and graduate students as it can be used as a reference text for its complex chapters and topics, or in a tutorial setting for those improving their knowledge of vibration and learning about control for the first time. Whether or not you are familiar with vibration and control, this book is an excellent introduction to this emerging and increasingly important engineering discipline.

Digital Control System Analysis and Design Charles L. Phillips 1990

Embedded Signal Processing with the Micro Signal Architecture Woon-Seng Gan 2007-02-26 This is a real-time digital signal processing textbook using the latest embedded Blackfin processor Analog Devices, Inc (ADI). 20% of the text is dedicated to general real-time signal processing principles. The remaining text provides an overview of the Blackfin processor, its programming, applications, and hands-on exercises for users. With all the practical examples given to expedite the learning development of Blackfin processors, the textbook doubles as a ready-to-use user's guide. The book is based on a step-by-step approach in which readers are first introduced to the DSP systems and concepts. Although, basic DSP concepts are introduced to allow easy referencing, readers are recommended to complete a basic course on "Signals and Systems" before attempting to use this book. This is also the first textbook that illustrates graphical programming for embedded processor using the latest LabVIEW Embedded Module for the ADI Blackfin Processors. A solutions manual is available for adopters of the book from the Wiley editorial department.

Digital Control Systems Benjamin C. Kuo 1980

Feedback Control of Dynamic Systems Gene F. Franklin 2011-11-21 This is the eBook of the printed book and may not include any media, website access codes, or print supplements that may come packaged with the bound book. For senior-level or first-year graduate-level courses in control analysis and design, and related courses within engineering, science, and management. Feedback Control of Dynamic Systems, Sixth Edition is perfect for practicing control engineers who wish to maintain their skills. This revision of a top-selling textbook on feedback control with the associated web site, FPE6e.com, provides greater instructor flexibility and student readability. Chapter 4 on A First Analysis of Feedback has been substantially rewritten to present the material in a more logical and effective manner. A new case study on biological control introduces an important new area to the students, and each chapter now includes a historical perspective to illustrate the origins of the field. As in earlier editions, the book has been updated so that solutions are based on the latest versions of MATLAB and SIMULINK. Finally, some of the more exotic topics have been moved to the web site.

I Excel in Math, So Do You! Jackson Tan 2012-10-17 The author shares the "secrets" of his successful learning in Math with readers in simple and clear terms. It takes the readers to discover the study techniques needed in Math and unleash their individual potential.It is the perfect book for students, parents, educators and anyone who wants to enhance their Math learning.If you want to excel in Mathematics, this is the book for you!

Digital Control Systems Benjamin C. Kuo 2007

Introduction to Robotics Saeed Niku 2010-09-07 Niku offers comprehensive, yet concise coverage of robotics that will appeal to engineers. Robotic applications are drawn from a wide variety of fields. Emphasis is placed on design along with analysis and modeling. Kinematics and dynamics are covered extensively in an accessible style. Vision systems are discussed in detail, which is a cutting-edge area in robotics. Engineers will also find a running design project that reinforces the concepts by having them apply what they've learned.

Handbook of Digital Currency David LEE Kuo Chuen 2015-05-05 Incorporating currencies, payment methods, and protocols that computers use to talk to each other, digital currencies are poised to grow in use and importance. The Handbook of Digital Currency gives readers a way to learn about subjects outside their specialties and provides authoritative background and tools for those whose primary source of information is journal articles. Taking a cross-country perspective, its comprehensive view of the field includes history, technicality, IT, finance, economics, legal, tax and regulatory environment. For those who come from different backgrounds with different questions in mind, The Handbook of Digital Currency is an essential starting point. Discusses all major strategies and tactics associated with digital currencies, their uses, and their regulations Presents future scenarios for the growth of digital currencies Written for regulators, crime prevention units, tax authorities, entrepreneurs, micro-financiers, micro-payment businesses, cryptography experts, software developers, venture capitalists, hedge fund managers, hardware manufacturers, credit card providers, money changers, remittance service providers, exchanges, and academics Winner of the 2015 "Outstanding Business Reference Source" by the Reference and User Services Association (RUSA)

Modern Multithreading Richard H. Carver 2005-11-28 Master the essentials of concurrent programming,including testingand debugging This textbook examines languages and libraries for multithreadedprogramming. Readers learn how to create threads in Java and C++,and develop essential concurrent programming and problem-solvingskills. Moreover, the textbook sets itself apart from othercomparable works by helping readers to become proficient in keytesting and debugging techniques. Among the topics covered, readersare introduced to the relevant aspects of Java, the POSIX Pthreadslibrary, and the Windows Win32 Applications ProgrammingInterface. The authors have developed and fine-tuned this book through theconcurrent programming courses they have taught for the past twentyyears. The material, which emphasizes practical tools andtechniques to solve concurrent programming problems, includesoriginal results from the authors' research. Chaptersinclude: * Introduction to concurrent programming * The critical section problem * Semaphores and locks * Monitors * Message-passing * Message-passing in distributed programs * Testing and debugging concurrent programs As an aid to both students and instructors, class libraries havebeen implemented to provide working examples of all the materialthat is covered. These libraries and the testing techniques theysupport can be used to assess student-written programs. Each chapter includes exercises that build skills in programwriting and help ensure that readers have mastered the chapter'skey concepts. The source code for all the listings in the text andfor the synchronization libraries is also provided, as well asstartup files and test cases for the exercises. This textbook is designed for upper-level undergraduates andgraduate students in

computer science. With its abundance of practical material and inclusion of working code, coupled with an emphasis on testing and debugging, it is also a highly useful reference for practicing programmers.

Flight Stability and Automatic Control Robert C. Nelson 1998 The second edition of *Flight Stability and Automatic Control* presents an organized introduction to the useful and relevant topics necessary for a flight stability and controls course. Not only is this text presented at the appropriate mathematical level, it also features standard terminology and nomenclature, along with expanded coverage of classical control theory, autopilot designs, and modern control theory. Through the use of extensive examples, problems, and historical notes, author Robert Nelson develops a concise and vital text for aircraft flight stability and control or flight dynamics courses.

Feedback Systems Karl Johan Åström 2021-02-02 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