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Recent Advances in Control Problems of Dynamical Systems and Networks - Ju H. Park 2020-08-11
This edited book introduces readers to new analytical techniques and controller design schemes used to solve the emerging “hottest” problems in dynamic control systems and networks. In recent years, the study of dynamic systems and networks has faced major changes and challenges with the rapid advancement of IT technology, accompanied by the 4th Industrial Revolution. Many new factors that now have to be considered, and which haven’t been addressed from control engineering perspectives to date, are naturally emerging as the systems become more complex and networked. The general scope of this book includes the modeling of the system itself and uncertainty elements, examining stability under various criteria, and controller design techniques to achieve specific control objectives in various dynamic systems and networks. In terms of traditional stability matters, this includes the following special issues: finite-time stability and stabilization, consensus/synchronization, fault-tolerant control, event-triggered control, and sampled-data control for classical linear/nonlinear systems, interconnected systems, fractional-order systems, switched systems, neural networks, and complex networks. In terms of introducing graduate students and professional researchers studying control engineering and applied mathematics to the latest research trends in the areas mentioned above, this book offers an excellent guide.
Nonlinear Biomedical Signal Processing, Volume 2 - Metin Akay 2000-09-20
Publisher description: Biomedical / Electrical Engineering Nonlinear Biomedical Signal Processing Volume I: Fuzzy Logic, Neural Networks, and New Algorithms A volume in the IEEE Press Series on Biomedical Engineering Metin Akay, Series Editor For the first time, eleven experts in the fields of signal processing and biomedical engineering have contributed to an edition on the newest theories and applications of fuzzy logic, neural networks, and algorithms in biomedicine. Nonlinear Biomedical Signal Processing, Volume I provides comprehensive coverage of nonlinear signal processing techniques. In the last decade, theoretical developments in the concept of fuzzy logic have led to several new approaches to neural networks. This compilation delivers plenty of real-world examples for a variety of implementations and applications of nonlinear signal processing technologies to biomedical problems. Included here are discussions that combine the various structures of Kohenen, Hopfield, and multiple-layer "designer" networks with other approaches to produce hybrid systems. Comparative analysis is made of

methods of genetic, back-propagation, Bayesian, and other learning algorithms. Topics covered include: * Uncertainty management * Analysis of biomedical signals * A guided tour of neural networks * Application of algorithms to EEG and heart rate variability signals * Event detection and sample stratification in genomic sequences * Applications of multivariate analysis methods to measure glucose concentration Nonlinear Biomedical Signal Processing, Volume I is a valuable reference tool for medical researchers, medical faculty and advanced graduate student, s as well as for practicing biomedical engineers. Nonlinear Biomedical Signal Processing, Volume I is an excellent companion to Nonlinear Biomedical Signal Processing, Volume II: Dynamic Analysis and Modeling.

Automotive Mechatronics: Operational and Practical Issues - B. T. Fijalkowski 2011-03-14

This book presents operational and practical issues of automotive mechatronics with special emphasis on the heterogeneous automotive vehicle systems approach, and is intended as a graduate text as well as a reference for scientists and engineers involved in the design of automotive mechatronic control systems. As the complexity of automotive vehicles increases, so does the dearth of high competence, multi-disciplined automotive scientists and engineers. This book provides a discussion into the type of mechatronic control systems found in modern vehicles and the skills required by automotive scientists and engineers working in this environment. Divided into two volumes and five parts, Automotive Mechatronics aims at improving automotive mechatronics education and emphasises the training of students' experimental hands-on abilities, stimulating and promoting experience among high education institutes and produce more automotive mechatronics and automation engineers. The main subject that are treated are: VOLUME I: RBW or XBW unibody or chassis-motion mechatronic control hypersystems; DBW AWD propulsion mechatronic control systems; BBW AWB dispulsion mechatronic control systems; VOLUME II: SBW AWS conversion mechatronic control systems; ABW AWA suspension mechatronic control systems. This volume was developed for undergraduate and postgraduate students as well as for professionals involved in all disciplines related to the design or research and development of automotive vehicle dynamics, powertrains, brakes, steering, and shock absorbers (dampers). Basic knowledge of college mathematics, college physics, and knowledge of the functionality of automotive vehicle basic propulsion, dispulsion, conversion and suspension systems is required.

Solutions Manual for Continuous and Discrete Signal and System Analysis - Clare D. McGillem 1995-06

Smart Education and Smart e-Learning - Vladimir L. Uskov 2015-06-09

This book contains the contributions presented at the 2nd international KES conference on Smart Education and Smart e-Learning, which took place in Sorrento, Italy, June 17-19, 2015. It contains a total of 45 peer-reviewed book chapters that are grouped into several parts: Part 1 - Smart Education, Part 2 – Smart Educational Technology, Part 3 – Smart e-Learning, Part 4 – Smart Professional Training and Teachers' Education, and Part 5 – Smart Teaching and Training related Topics. This book can be a useful source of research data and valuable information for faculty, scholars, Ph.D. students, administrators, and practitioners - those who are interested in innovative areas of smart education and smart e-learning.

Advances in Mathematical Systems Theory - Fritz Colonius 2001

This volume contains the lectures presented at the workshop on "Advances in Mathematical Systems Theory," held on the island of Borkum, Germany (April 20-23, 1999). The book will be of interest to graduate students and researchers interested in control theory and mathematical systems theory, who will find in-depth analysis and presentations from diverse perspectives interacting in this lively area. The editors are proud to dedicate this volume to Diederich Hinrichsen on the occasion of his 60th birthday in acknowl- edgment of his major contributions to linear systems theory and control theory and his long-term achievements in establishing mathematical sys- tems theory in Germany. We all owe much to him as a teacher, colleague, and friend. The editors thank the Graduiertenkolleg "Komplexe Dynamische Sys- teme" at the University of Bremen as well as the European

"Nonlinear Control Network" for providing financial support that enabled this work- shop. Augsburg, Germany Fritz Colonius Wiirzburg, Germany Uwe Helmke Kaiserslautern, Germany Dieter Pratzel-Wolters Bremen, Germany Fabian Wirth Introduction The workshop "Advances in Mathematical Systems Theory" took place in honor of Diederich Hinrichsen on the occasion of his 60th birthday. The following chapters are based on invited lectures and cover a wide range of topics in linear and nonlinear systems theory including parameteriza- tion problems, behaviors of linear systems and convolutional codes, as well as complementarity systems and hybrid systems.

Optimal Estimation of Dynamic Systems - John L. Crassidis 2004-04-27

Most newcomers to the field of linear stochastic estimation go through a difficult process in understanding and applying the theory.This book minimizes the process while introducing the fundamentals of optimal estimation. Optimal Estimation of Dynamic Systems explores topics that are important in the field of control where the signals receiv

Adaptive Filtering - Paulo S. R. Diniz 2019-11-28

In the fifth edition of this textbook, author Paulo S.R. Diniz presents updated text on the basic concepts of adaptive signal processing and adaptive filtering. He first introduces the main classes of adaptive filtering algorithms in a unified framework, using clear notations that facilitate actual implementation. Algorithms are described in tables, which are detailed enough to allow the reader to verify the covered concepts. Examples address up-to-date problems drawn from actual applications. Several chapters are expanded and a new chapter ‘Kalman Filtering’ is included. The book provides a concise background on adaptive filtering, including the family of LMS, affine projection, RLS, set-membership algorithms and Kalman filters, as well as nonlinear, sub-band, blind, IIR adaptive filtering, and more. Problems are included at the end of chapters. A MATLAB package is provided so the reader can solve new problems and test algorithms. The book also offers easy access to working algorithms for practicing engineers.

Analysis of Linear Dynamic Systems - John Barkley Lewis 1977

Circuits, Signals, and Systems - William McC. Siebert 1986

These twenty lectures have been developed and refined by Professor Siebert during the more than two decades he has been teaching introductory Signals and Systems courses at MIT. The lectures are designed to pursue a variety of goals in parallel: to familiarize students with the properties of a fundamental set of analytical tools; to show how these tools can be applied to help understand many important concepts and devices in modern communication and control engineering practice; to explore some of the mathematical issues behind the powers and limitations of these tools; and to begin the development of the vocabulary and grammar, common images and metaphors, of a general language of signal and system theory. Although broadly organized as a series of lectures, many more topics and examples (as well as a large set of unusual problems and laboratory exercises) are included in the book than would be presented orally. Extensive use is made throughout of knowledge acquired in early courses in elementary electrical and electronic circuits and differential equations. Contents:Review of the "classical" formulation and solution of dynamic equations for simple electrical circuits; The unilateral Laplace transform and its applications; System functions; Poles and zeros; Interconnected systems and feedback; The dynamics of feedback systems; Discrete-time signals and linear difference equations; The unilateral Z-transform and its applications; The unit-sample response and discrete-time convolution; Convolutional representations of continuous-time systems; Impulses and the superposition integral; Frequency-domain methods for general LTI systems; Fourier series; Fourier transforms and Fourier's theorem; Sampling in time and frequency; Filters, real and ideal; Duration, rise-time and bandwidth relationships: The uncertainty principle; Bandpass operations and analog communication systems; Fourier transforms in discrete-time systems; Random Signals; Modern communication systems. William Siebert is Ford Professor of Engineering at MIT. Circuits, Signals, and Systemsis included

in The MIT Press Series in Electrical Engineering and Computer Science, copublished with McGraw-Hill.

Fundamentals of Adaptive Signal Processing - Aurelio Uncini 2014-12-30

This book is an accessible guide to adaptive signal processing methods that equips the reader with advanced theoretical and practical tools for the study and development of circuit structures and provides robust algorithms relevant to a wide variety of application scenarios. Examples include multimodal and multimedia communications, the biological and biomedical fields, economic models, environmental sciences, acoustics, telecommunications, remote sensing, monitoring and in general, the modeling and prediction of complex physical phenomena. The reader will learn not only how to design and implement the algorithms but also how to evaluate their performance for specific applications utilizing the tools provided. While using a simple mathematical language, the employed approach is very rigorous. The text will be of value both for research purposes and for courses of study.

Identification of Linear Systems - J. Schoukens 2014-06-28

This book concentrates on the problem of accurate modeling of linear systems. It presents a thorough description of a method of modeling a linear dynamic invariant system by its transfer function. The first two chapters provide a general introduction and review for those readers who are unfamiliar with identification theory so that they have a sufficient background knowledge for understanding the methods described later. The main body of the book looks at the basic method used by the authors to estimate the parameter of the transfer function, how it is possible to optimize the excitation signals. Further chapters extend the estimation method proposed. Applications are then discussed and the book concludes with practical guidelines which illustrate the method and offer some rules-of-thumb.

From Algebraic Structures to Tensors - Gérard Favier 2019-12-04

Nowadays, tensors play a central role for the representation, mining, analysis, and fusion of multidimensional, multimodal, and heterogeneous big data in numerous fields. This set on Matrices and Tensors in Signal Processing aims at giving a self-contained and comprehensive presentation of various concepts and methods, starting from fundamental algebraic structures to advanced tensor-based applications, including recently developed tensor models and efficient algorithms for dimensionality reduction and parameter estimation. Although its title suggests an orientation towards signal processing, the results presented in this set will also be of use to readers interested in other disciplines. This first book provides an introduction to matrices and tensors of higher-order based on the structures of vector space and tensor space. Some standard algebraic structures are first described, with a focus on the hilbertian approach for signal representation, and function approximation based on Fourier series and orthogonal polynomial series. Matrices and hypermatrices associated with linear, bilinear and multilinear maps are more particularly studied. Some basic results are presented for block matrices. The notions of decomposition, rank, eigenvalue, singular value, and unfolding of a tensor are introduced, by emphasizing similarities and differences between matrices and tensors of higher-order.

Signals and Systems using MATLAB - Luis Chaparro 2010-11-10

This new textbook in signals and systems provides a pedagogically rich approach to what can commonly be a mathematically dry subject. With features like historical notes, highlighted common mistakes, and applications in controls, communications, and signal processing, Chaparro helps students appreciate the usefulness of the techniques described in the book. Each chapter contains a section with MatLab applications. Pedagogically rich introduction to signals and systems using historical notes, pointing out "common mistakes", and relating concepts to realistic examples throughout to motivate learning the material Introduces both continuous and discrete systems early, then studies each (separately) in more depth later Extensive set of worked examples and homework assignments, with applications to controls, communications, and signal processing throughout Provides review of all the background math necessary to

study the subject MatLab applications in every chapter

On Distributed and Cooperative Control Design for Networks of Dynamical Systems - Georg Seyboth 2016-06-17

This thesis contributes to the development of a cooperative control theory for homogeneous and heterogeneous multi-agent systems consisting of identical and non-identical dynamical agents, respectively. The goal is to explain fundamental effects of non-identical agent dynamics on the behavior of a distributed system and, primarily, to develop suitable control design methods for a wide range of multi-agent coordination problems. Output synchronization problems as well as cooperative disturbance rejection and reference tracking problems in multi-agent systems are investigated. Suitable controller design methods for networks consisting of identical or non-identical linear time-invariant systems, linear parameter-varying systems, and selected classes of nonlinear systems are developed. These controller design methods provide a solution to a wide variety of distributed coordination and cooperative control scenarios.

Scientific and Technical Aerospace Reports - 1991

International Aerospace Abstracts - 1999

Data Assimilation for the Geosciences - Steven J. Fletcher 2022-11-25

Data Assimilation for the Geosciences: From Theory to Application, Second Edition brings together all of the mathematical and statistical background knowledge needed to formulate data assimilation systems into one place. It includes practical exercises enabling readers to apply theory in both a theoretical formulation as well as teach them how to code the theory with toy problems to verify their understanding. It also demonstrates how data assimilation systems are implemented in larger scale fluid dynamical problems related to land surface, the atmosphere, ocean and other geophysical situations. The second edition of Data Assimilation for the Geosciences has been revised with up to date research that is going on in data assimilation, as well as how to apply the techniques. The new edition features an introduction of how machine learning and artificial intelligence are interfacing and aiding data assimilation. In addition to appealing to students and researchers across the geosciences, this now also appeals to new students and scientists in the field of data assimilation as it will now have even more information on the techniques, research, and applications, consolidated into one source. Includes practical exercises and solutions enabling readers to apply theory in both a theoretical formulation as well as enabling them to code theory Provides the mathematical and statistical background knowledge needed to formulate data assimilation systems into one place New to this edition: covers new topics such as Observing System Experiments (OSE) and Observing System Simulation Experiments; and expanded approaches for machine learning and artificial intelligence

Identification of Dynamic Systems - Rolf Isermann 2010-11-22

Precise dynamic models of processes are required for many applications, ranging from control engineering to the natural sciences and economics. Frequently, such precise models cannot be derived using theoretical considerations alone. Therefore, they must be determined experimentally. This book treats the determination of dynamic models based on measurements taken at the process, which is known as system identification or process identification. Both offline and online methods are presented, i.e. methods that post-process the measured data as well as methods that provide models during the measurement. The book is theory-oriented and application-oriented and most methods covered have been used successfully in practical applications for many different processes. Illustrative examples in this book with real measured data range from hydraulic and electric actuators up to combustion engines. Real experimental data is also provided on the Springer webpage, allowing readers to gather their first experience with the methods presented in this book. Among others, the book covers the following subjects: determination of the non-parametric frequency response, (fast) Fourier transform, correlation analysis, parameter estimation with a focus on the method of Least Squares and modifications,

identification of time-variant processes, identification in closed-loop, identification of continuous time processes, and subspace methods. Some methods for nonlinear system identification are also considered, such as the Extended Kalman filter and neural networks. The different methods are compared by using a real three-mass oscillator process, a model of a drive train. For many identification methods, hints for the practical implementation and application are provided. The book is intended to meet the needs of students and practicing engineers working in research and development, design and manufacturing.

Continuous Signals and Systems with MATLAB - Taan ElAli 2018-10-03

Designed for a one-semester undergraduate course in continuous linear systems, Continuous Signals and Systems with MATLAB®, Second Edition presents the tools required to design, analyze, and simulate dynamic systems. It thoroughly describes the process of the linearization of nonlinear systems, using MATLAB® to solve most examples and problems. With updates and revisions throughout, this edition focuses more on state-space methods, block diagrams, and complete analog filter design. New to the Second Edition • A chapter on block diagrams that covers various classical and state-space configurations • A completely revised chapter that uses MATLAB to illustrate how to design, simulate, and implement analog filters • Numerous new examples from a variety of engineering disciplines, with an emphasis on electrical and electromechanical engineering problems Explaining the subject matter through easy-to-follow mathematical development as well as abundant examples and problems, the text covers signals, types of systems, convolution, differential equations,Fourier series and transform, the Laplace transform, state-space representations, block diagrams, system linearization, and analog filter design. Requiring no prior fluency with MATLAB, it enables students to master both the concepts of continuous linear systems and the use of MATLAB to solve problems.

Applied Mechanics Reviews - 1974

Advances in Processing and Pattern Analysis of Biological Signals - I. Gath 2013-06-29

In recent years there has been rapid progress in the development of signal processing in general, and more specifically in the application of signal processing and pattern analysis to biological signals. Techniques, such as parametric and nonparametric spectral estimation, higher order spectral estimation, time-frequency methods, wavelet transform, and identifi cation of nonlinear systems using chaos theory, have been successfully used to elucidate basic mechanisms of physiological and mental processes. Similarly, biological signals recorded during daily medical practice for clinical diagnostic procedures, such as electroen cephalograms (EEG), evoked potentials (EP), electromyograms (EMG) and electrocardio grams (ECG), have greatly benefitted from advances in signal processing. In order to update researchers, graduate students, and clinicians, on the latest developments in the field, an International Symposium on Processing and Pattern Analysis of Biological Signals was held at the Technion-Israel Institute of Technology, during March 1995. This book contains 27 papers delivered during the symposium. The book follows the five sessions of the symposium. The first section, Processing and Pattern Analysis of Normal and Pathological EEG, accounts for some of the latest developments in the area of EEG processing, namely: time varying parametric modeling; non-linear dynamic modeling of the EEG using chaos theory; Markov analysis; delay estimation using adaptive least-squares filtering; and applications to the analysis of epileptic EEG, EEG recorded from psychiatric patients, and sleep EEG.

Advanced methods for fault diagnosis and fault-tolerant control - Steven X. Ding 2020-11-24

The major objective of this book is to introduce advanced design and (online) optimization methods for fault diagnosis and fault-tolerant control from different aspects. Under the aspect of system types, fault diagnosis and fault-tolerant issues are dealt with for linear time-invariant and time-varying systems as well as for nonlinear and distributed (including networked) systems. From the methodological point of view, both model-based and data-driven schemes are investigated.To allow for a self-contained study and enable an easy implementation in real

applications, the necessary knowledge as well as tools in mathematics and control theory are included in this book. The main results with the fault diagnosis and fault-tolerant schemes are presented in form of algorithms and demonstrated by means of benchmark case studies. The intended audience of this book are process and control engineers, engineering students and researchers with control engineering background.

Official Gazette of the United States Patent and Trademark Office - 2004

Modelling and Control of Dynamic Systems Using Gaussian Process Models - Juš Kocijan 2015-11-21

This monograph opens up new horizons for engineers and researchers in academia and in industry dealing with or interested in new developments in the field of system identification and control. It emphasizes guidelines for working solutions and practical advice for their implementation rather than the theoretical background of Gaussian process (GP) models. The book demonstrates the potential of this recent development in probabilistic machine-learning methods and gives the reader an intuitive understanding of the topic. The current state of the art is treated along with possible future directions for research. Systems control design relies on mathematical models and these may be developed from measurement data. This process of system identification, when based on GP models, can play an integral part of control design in data-based control and its description as such is an essential aspect of the text. The background of GP regression is introduced first with system identification and incorporation of prior knowledge then leading into full-blown control. The book is illustrated by extensive use of examples, line drawings, and graphical presentation of computer-simulation results and plant measurements. The research results presented are applied in real-life case studies drawn from successful applications including: a gas–liquid separator control; urban-traffic signal modelling and reconstruction; and prediction of atmospheric ozone concentration. A MATLAB® toolbox, for identification and simulation of dynamic GP models is provided for download.

Pattern Recognition - Volker Roth 2017-09-06

This book constitutes the refereed proceedings of the 39th German Conference on Pattern Recognition, GCPR 2017, held in Basel, Switzerland, in September 2017.The 33 revised full papers presented were carefully reviewed and selected from 60 submissions. The papers are organized in topical sections on biomedical image processing and analysis; classification and detection; computational photography; image and video processing; machine learning and pattern recognition; mathematical foundations, statistical data analysis and models; motion and segmentation; pose, face and gesture; reconstruction and depth; and tracking.

Hydrodynamic Control of Wave Energy Devices - Umesh A. Korde 2016-09-26

For researchers and practitioners, an accessible and integrated treatment of hydrodynamic control of wave energy devices.

Linear Dynamic Systems and Signals - Zoran Gajic 2003

The author's twelve years of experience with linear systems and signals are reflected in this comprehensive book. The book contains detailed linear systems theory essentials. The intent of this book is to develop the unified techniques to recognize and solve linear dynamical system problems regardless of their origin. Includes Space state techniques as the time domain approach for studying linear systems. Provides a solid foundation on linear dynamic systems and corresponding systems using the dynamic system point of view. Parallels continuous- and discrete-time linear systems throughout to help users grasp the similarities and differences of each. Three part organization: Part I covers frequency-domain approach to linear dynamic systems, Part II covers the time-domain approach to linear dynamic systems, and Part III discusses the linear system approach to electrical engineering, to allow the user to focus of the subject matter as it pertains to their needs. For anyone interested in linear systems and signals

Introduction to Stochastic Control Theory - Karl J. Åström 2012-05-11

This text for upper-level undergraduates and graduate students explores stochastic control theory in terms of analysis, parametric optimization, and optimal stochastic control. Limited to linear systems with quadratic criteria,

it covers discrete time as well as continuous time systems. The first three chapters provide motivation and background material on stochastic processes, followed by an analysis of dynamical systems with inputs of stochastic processes. A simple version of the problem of optimal control of stochastic systems is discussed, along with an example of an industrial application of this theory. Subsequent discussions cover filtering and prediction theory as well as the general stochastic control problem for linear systems with quadratic criteria. Each chapter begins with the discrete time version of a problem and progresses to a more challenging continuous time version of the same problem. Prerequisites include courses in analysis and probability theory in addition to a course in dynamical systems that covers frequency response and the state-space approach for continuous time and discrete time systems.

Issues of Fault Diagnosis for Dynamic Systems - Ron J. Patton 2013-06-29

Since the time our first book Fault Diagnosis in Dynamic Systems: The ory and Applications was published in 1989 by Prentice Hall, there has been a surge in interest in research and applications into reliable methods for diag nosing faults in complex systems. The first book sold more than 1,200 copies and has become the main text in fault diagnosis for dynamic systems. This book will follow on this excellent record by focusing on some of the advances in this subject, by introducing new concepts in research and new application topics. The work cannot provide an exhaustive discussion of all the recent research in fault diagnosis for dynamic systems, but nevertheless serves to sample some of the major issues. It has been valuable once again to have the co-operation of experts throughout the world working in industry, gov emment establishments and academic institutions in writing the individual chapters. Sometimes dynamical systems have associated numerical models available in state space or in frequency domain format. When model infor mation is available, the quantitative model-based approach to fault diagnosis can be taken, using the mathematical model to generate analytically redun dant alternatives to the measured signals. When this approach is used, it becomes important to try to understand the limitations of the mathematical models i. e. , the extent to which model parameter variations occur and the effect of changing the systems point of operation.

Forthcoming Books - Rose Arny 1997

Advances in Ubiquitous Networking 2 - Rachid El-Azouzi 2016-11-03

This volume offers the proceedings of the 2nd UNet conference, held in Casablanca May 30 - June 1, 2016. It presents new trends and findings in hot topics related to ubiquitous computing/networking, covered in three tracks and three special sessions: Main Track 1: Context-Awareness and Autonomy Paradigms Track Main Track 2: Mobile Edge Networking and Virtualization Track Main Track 3: Enablers, Challenges and Applications Special Session 1: Smart Cities and Urban Informatics for Sustainable Development Special Session 2: Unmanned Aerial Vehicles From Theory to Applications Special Session 3: From Data to Knowledge: Big Data applications and solutions

Adaptive Systems in Control and Signal Processing 1995 - Cs. Banyasz 2014-05-23

Leading academic and industrial researchers working with adaptive systems and signal processing have been given the opportunity to exchange ideas, concepts and solutions at the IFAC Symposia on Adaptive Systems in Control and Signal Processing. This postprint volume contains all those papers which were presented at the 5th IFAC Symposium in Budapest in 1995. The technical program was composed of a number of invited and contributed sessions and a special case study session, providing a good balance between applications and theory oriented papers.

Dynamic Systems Biology Modeling and Simulation - Joseph DiStefano III 2015-01-10

Dynamic Systems Biology Modeling and Simuation consolidates and unifies classical and contemporary multiscale methodologies for mathematical modeling and computer simulation of dynamic biological systems – from molecular/cellular, organ-system, on up to population levels. The book pedagogy is developed as a well-annotated, systematic tutorial – with clearly spelled-out and unified nomenclature – derived from the author’s own modeling efforts, publications and teaching over

half a century. Ambiguities in some concepts and tools are clarified and others are rendered more accessible and practical. The latter include novel qualitative theory and methodologies for recognizing dynamical signatures in data using structural (multicompartmental and network) models and graph theory; and analyzing structural and measurement (data) models for quantification feasibility. The level is basic-to-intermediate, with much emphasis on biomodeling from real biodata, for use in real applications. Introductory coverage of core mathematical concepts such as linear and nonlinear differential and difference equations, Laplace transforms, linear algebra, probability, statistics and stochastics topics; PLUS ..... The pertinent biology, biochemistry, biophysics or pharmacology for modeling are provided, to support understanding the amalgam of "math modeling" with life sciences. Strong emphasis on quantifying as well as building and analyzing biomodels: includes methodology and computational tools for parameter identifiability and sensitivity analysis; parameter estimation from real data; model distinguishability and simplification; and practical bioexperiment design and optimization. Companion website provides solutions and program code for examples and exercises using Matlab, Simulink, VisSim, SimBiology, SAAMII, AMIGO, Copasi and SBML-coded models. A full set of PowerPoint slides are available from the author for teaching from his textbook. He uses them to teach a 10 week quarter upper division course at UCLA, which meets twice a week, so there are 20 lectures. They can easily be augmented or stretched for a 15 week semester course. Importantly, the slides are editable, so they can be readily adapted to a lecturer's personal style and course content needs. The lectures are based on excerpts from 12 of the first 13 chapters of DSBMS. They are designed to highlight the key course material, as a study guide and structure for students following the full text content. The complete PowerPoint slide package (~25 MB) can be obtained by instructors (or prospective instructors) by emailing the author directly, at: joed@cs.ucla.edu

Optimal Trajectory Tracking of Nonlinear Dynamical Systems - Jakob Löber 2016-12-20

By establishing an alternative foundation of control theory, this thesis represents a significant advance in the theory of control systems, of interest to a broad range of scientists and engineers. While common control strategies for dynamical systems center on the system state as the object to be controlled, the approach developed here focuses on the state trajectory. The concept of precisely realizable trajectories identifies those trajectories that can be accurately achieved by applying appropriate control signals. The resulting simple expressions for the control signal lend themselves to immediate application in science and technology. The approach permits the generalization of many well-known results from the control theory of linear systems, e.g. the Kalman rank condition to nonlinear systems. The relationship between controllability, optimal control and trajectory tracking are clarified. Furthermore, the existence of linear structures underlying nonlinear optimal control is revealed, enabling the derivation of exact analytical solutions to an entire class of nonlinear optimal trajectory tracking problems. The clear and self-contained presentation focuses on a general and mathematically rigorous analysis of controlled dynamical systems. The concepts developed are visualized with the help of particular dynamical systems motivated by physics and chemistry.

Integral Dynamical Models: Singularities, Signals And Control - Sidorov Denis 2014-09-05

This volume provides a broad introduction to nonlinear integral dynamical models and new classes of evolutionary integral equations. It may be used as an advanced textbook by postgraduate students to study integral dynamical models and their applications in machine learning, electrical and electronic engineering, operations research and image analysis.

Modeling and Analysis of Dynamic Systems, Second Edition - Ramin S. Esfandiari 2014-04-24

Modeling and Analysis of Dynamic Systems, Second Edition introduces MATLAB®, Simulink®, and SimscapeTM and then uses them throughout the text to perform symbolic, graphical, numerical, and simulation tasks. Written for junior or senior level courses, the

textbook meticulously covers techniques for modeling dynamic systems, methods of response analysis, and provides an introduction to vibration and control systems. These features combine to provide students with a thorough knowledge of the mathematical modeling and analysis of dynamic systems. See What's New in the Second Edition: Coverage of modeling and analysis of dynamic systems ranging from mechanical to thermal using Simscape Utilization of Simulink for linearization as well as simulation of nonlinear dynamic systems Integration of Simscape into Simulink for control system analysis and design Each topic covered includes at least one example, giving students better comprehension of the subject matter. More complex topics are accompanied by multiple, painstakingly worked-out examples. Each section of each chapter is followed by several exercises so that students can immediately apply the ideas just learned. End-of-chapter review exercises help in learning how a combination of different ideas can be used to analyze a problem. This second edition of a bestselling textbook fully integrates the MATLAB Simscape Toolbox and covers the usage of Simulink for new purposes. It gives students better insight into the involvement of actual physical components rather than their mathematical representations.

Theory of Sensitivity in Dynamic Systems - Mansour Eslami 2013-11-09

This book provides a comprehensive treatment of the development and present state of the theory of sensitivity of dynamic systems. It is intended as a textbook and reference for researchers and scientists in electrical engineering, control and information theory as well as for mathematicians. The extensive and structured bibliography provides an overview of the literature in the field and points out directions for further research.

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.

FLIM Microscopy in Biology and Medicine - Ammasi Periasamy 2009-07-06

Detecting Signals at the Single Molecule Level: Pioneering Achievements in Microscopy Recent advances have led to such remarkable improvements in fluorescence lifetime imaging microscopy's (FLIM) capacity for contrast and sensitivity that researchers can now employ it to detect signals at the single molecule level. FLIM also offers the additional benefit of independence from fluorophore concentration and excitation intensity. Moreover, its unique sensitivity makes it an excellent reporter of conformational changes and of variations in the molecular surroundings of biological molecules. Most of this improvement and discovery have occurred during the past decade, and, to date, information that would benefit a broad range of researchers remains scattered in the literature. Edited by two of the top pioneers in the field, FLIM Microscopy in Biology and Medicine presents the fundamentals of FLIM along with a number of advanced considerations so that a wider audience can appreciate recent and potential improvements that make it such a valuable tool. New Opportunities for Biomedical Researchers... New Challenges for Microscopy Researchers Discussion sections in all the chapters clearly show the challenges for implementing FLIM for various applications. Certain chapters discuss limits on the number of photons required for highly accurate lifetime determinations, as well as the accuracy with

which multiple, closely associated lifetime components can reliably be determined. Such considerations are important for the user when he or she is selecting the most advantageous method of FLIM to use for a particular application. While this book provides an introduction for those new to FLIM, it gathers a wealth of material to enhance the work of experts involved in pioneering technological improvements, as well as those research opportunities in this unique and promising area of microscopy.