

Fractional Order Differentiation And Robust Control Design Crone H Infinity And Motion Control Intelligent Systems Control And Automation Science And Engineering

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Robust Adaptive Control for Fractional-Order Systems with Disturbance and Saturation - Mou Chen 2017-12-26

A treatise on investigating tracking control and synchronization control of fractional-order nonlinear systems with system uncertainties, external disturbance, and input saturation Robust Adaptive Control for Fractional-Order Systems, with Disturbance and Saturation provides the reader with a good understanding on how to achieve tracking control and synchronization control of fractional-order nonlinear systems with system uncertainties, external disturbance, and input saturation. Although some texts have touched upon control of fractional-order systems, the issues of input saturation and disturbances have rarely been considered together. This book offers chapter coverage of fractional calculus and fractional-order systems; fractional-order PID controller and fractional-order disturbance observer; design of fractional-order controllers for nonlinear chaotic systems and some applications; sliding mode control for fractional-order nonlinear systems based on disturbance observer; disturbance observer based neural control for an uncertain fractional-order rotational mechanical system; adaptive neural tracking control for uncertain fractional-order chaotic systems subject to input saturation and disturbance; stabilization control of continuous-time fractional positive systems based on disturbance observer; sliding mode synchronization control for fractional-order chaotic systems with disturbance; and more. Based on the approximation ability of the neural network (NN), the adaptive neural control schemes are reported for uncertain fractional-order nonlinear systems Covers the disturbance estimation techniques that have been developed to alleviate the restriction faced by traditional feedforward control and reject the effect of external disturbances for uncertain fractional-order nonlinear systems By combining the NN with the disturbance observer, the disturbance observer based adaptive neural control schemes have been studied for uncertain fractional-order nonlinear systems with unknown disturbances Considers, together, the issue of input saturation and the disturbance for the control of fractional-order nonlinear systems in the present of system uncertainty, external disturbance, and input saturation Robust Adaptive Control for Fractional-Order Systems, with Disturbance and Saturation can be used as a reference for the academic research on fractional-order nonlinear systems or used in Ph.D. study of control theory and engineering.

Intelligent Communication, Control and Devices - Sushabhan Choudhury 2019-08-28

The book focuses on the integration of intelligent communication systems, control systems, and devices related to all aspects of engineering and sciences. It includes high-quality research papers from the 3rd international conference, ICICCD 2018, organized by the Department of Electronics, Instrumentation and Control Engineering at the University of Petroleum and Energy Studies, Dehradun on 21-22 December 2018. Covering a range of recent advances in intelligent communication, intelligent control and intelligent devices., the book presents original research and findings as well as researchers' and industrial practitioners' practical

development experiences of.

Fractional-Order Electrical Circuit Theory - Bo Zhang 2021-08-16

This book presents a concise and insightful view of the knowledge on fractional-order electrical circuits, which belongs to the subject of Electric Engineering and involves mathematics of fractional calculus. It offers an overview of fractional calculus and then describes and analyzes the basic theories and properties of fractional-order elements and fractional-order electrical circuit composed of fractional-order elements. Therein, the fundamental theorems, time-domain analysis, steady-state analysis, complex frequency domain analysis and state variable analysis of fractional-order electrical circuit are included. The fractional-order two-port networks and generalized fractional-order linear electrical circuits are also mentioned. Therefore, this book provides readers with enough background and understanding to go deeper into the topic of fractional-order electrical circuit, so that it is useful as a textbook for courses related to fractional-order elements, fractional-order electrical circuits, etc. This book is intended for students without an extensive mathematical background and is suitable for advanced undergraduate and graduate students, engineers and researchers who focus on the fractional-order elements, electrical circuits and systems.

Implicit Fractional Differential and Integral Equations - Saïd Abbas 2018-02-05

This book deals with the existence and stability of solutions to initial and boundary value problems for functional differential and integral equations and inclusions involving the Riemann-Liouville, Caputo, and Hadamard fractional derivatives and integrals. A wide variety of topics is covered in a mathematically rigorous manner making this work a valuable source of information for graduate students and researchers working with problems in fractional calculus. Contents Preliminary Background Nonlinear Implicit Fractional Differential Equations Impulsive Nonlinear Implicit Fractional Differential Equations Boundary Value Problems for Nonlinear Implicit Fractional Differential Equations Boundary Value Problems for Impulsive NIFDE Integrable Solutions for Implicit Fractional Differential Equations Partial Hadamard Fractional Integral Equations and Inclusions Stability Results for Partial Hadamard Fractional Integral Equations and Inclusions Hadamard-Stieltjes Fractional Integral Equations Ulam Stabilities for Random Hadamard Fractional Integral Equations

Modelling and Simulation for Autonomous Systems - Jan Mazal 2018-03-06

This book constitutes the thoroughly refereed post-workshop proceedings of the 4th International Workshop on Modelling and Simulation for Autonomous Systems, MESAS 2017, held in Rome, Italy, , in October 2017. The 33 revised full papers included in the volume were carefully reviewed and selected from 38 submissions. They are organized in the following topical sections: M&S of Intelligent Systems - AI, R&D and Applications; Autonomous Systems in Context of Future Warfare and Security - Concepts, Applications, Standards and Legislation; Future Challenges and Opportunities of

Advanced M&S Technology.

Fault-tolerant Control and Diagnosis for Integer and Fractional-order Systems - Rafael Martínez-Guerra 2020-12-14

This book is about algebraic and differential methods, as well as fractional calculus, applied to diagnose and reject faults in nonlinear systems, which are of integer or fractional order. This represents an extension of a very important and widely studied problem in control theory, namely fault diagnosis and rejection (using differential algebraic approaches), to systems presenting fractional dynamics, i.e. systems whose dynamics are represented by derivatives and integrals of non-integer order. The authors offer a thorough overview devoted to fault diagnosis and fault-tolerant control applied to fractional-order and integer-order dynamical systems, and they introduce new methodologies for control and observation described by fractional and integer models, together with successful simulations and real-time applications. The basic concepts and tools of mathematics required to understand the methodologies proposed are all clearly introduced and explained. Consequently, the book is useful as supplementary reading in courses of applied mathematics and nonlinear control theory. This book is meant for engineers, mathematicians, physicists and, in general, to researchers and postgraduate students in diverse areas who have a minimum knowledge of calculus. It also contains advanced topics for researchers and professionals interested in the area of states and faults estimation.

Proceedings of the International Conference on Fractional Differentiation and its Applications (ICFDA'21) - Andrzej Dzielinski 2022-06-02

This book touches upon various aspects of a very interesting, and growing in popularity category of models of dynamical systems. These are the so-called fractional-order systems. Such models are not only relevant for many fields of science and technology, but may also find numerous applications in other disciplines applying the mathematical modelling tools. Thus, the book is intended for a very wide audience of professionals who want to expand their knowledge of systems modelling and its applications. The book includes the selections of papers presented at the International Conference on Fractional Calculus and its Applications organized by the Warsaw University of Technology and was held online on 6-8 September 2021. The International Conference on Fractional Calculus and its Applications (ICFDA) has an almost twenty years history. It started in Bordeaux (France) in 2004, followed by Porto (Portugal) 2006, Istanbul (Turkey) 2008, Badajoz (Spain) 2010, Nanjing (China) 2012, Catania (Italy) 2014, Novi Sad (Serbia) 2016, Amman (Jordan) 2018. Next ICFDA was planned in 2020 in Warsaw (Poland), but COVID-19 pandemic shifted it to 6-8 September 2021. Hence, the organizers were forced to change the form of the conference to the online one. In the volume twenty eight high-quality research papers presented during the ICFDA 2021 eleven Regular Sessions with an additional online Discussion Session are presented. The presented papers are scientifically inspiring, leading to new fruitful ideas. They cover a very broad range of many disciplines. Nowadays, and especially in such a subject as fractional calculus, it is very difficult to assign papers to specific scientific areas. So, many of the papers included have an interdisciplinary character.

Mathematical Techniques of Fractional Order Systems - Ahmad Taher Azar 2018-06-11

Mathematical Techniques of Fractional Order Systems illustrates advances in linear and nonlinear fractional-order systems relating to many interdisciplinary applications, including biomedical, control, circuits, electromagnetics and security. The book covers the mathematical background and literature survey of fractional-order calculus and generalized fractional-order circuit theorems from different perspectives in design, analysis and realizations, nonlinear fractional-order circuits and systems, the fractional-order memristive circuits and systems in design, analysis, emulators, simulation and experimental results. It is primarily meant for researchers from academia and industry, and for those working in areas such as control engineering, electrical engineering, computer science and information technology. This book is ideal for researchers working in the area of both continuous-time

and discrete-time dynamics and chaotic systems.

Discusses multidisciplinary applications with new fundamentals, modeling, analysis, design, realization and experimental results Includes circuits and systems based on new nonlinear elements Covers most of the linear and nonlinear fractional-order theorems that will solve many scientific issues for researchers Closes the gap between theoretical approaches and real-world applications Provides MATLAB® and Simulink code for many applications in the book

Fractional-Order Nonlinear Systems - Ivo Petráš 2011-05-30

"Fractional-Order Nonlinear Systems: Modeling, Analysis and Simulation" presents a study of fractional-order chaotic systems accompanied by Matlab programs for simulating their state space trajectories, which are shown in the illustrations in the book. Description of the chaotic systems is clearly presented and their analysis and numerical solution are done in an easy-to-follow manner. Simulink models for the selected fractional-order systems are also presented. The readers will understand the fundamentals of the fractional calculus, how real dynamical systems can be described using fractional derivatives and fractional differential equations, how such equations can be solved, and how to simulate and explore chaotic systems of fractional order. The book addresses to mathematicians, physicists, engineers, and other scientists interested in chaos phenomena or in fractional-order systems. It can be used in courses on dynamical systems, control theory, and applied mathematics at graduate or postgraduate level. Ivo Petráš is an Associate Professor of automatic control and the Director of the Institute of Control and Informatization of Production Processes, Faculty of BERG, Technical University of Košice, Slovak Republic. His main research interests include control systems, industrial automation, and applied mathematics.

Stabilization and Control of Fractional Order Systems: A Sliding Mode Approach - Bijnan Bandyopadhyay 2014-07-22

In the last two decades fractional differential equations have been used more frequently in physics, signal processing, fluid mechanics, viscoelasticity, mathematical biology, electro chemistry and many others. It opens a new and more realistic way to capture memory dependent phenomena and irregularities inside the systems by using more sophisticated mathematical analysis. This monograph is based on the authors' work on stabilization and control design for continuous and discrete fractional order systems. The initial two chapters and some parts of the third chapter are written in tutorial fashion, presenting all the basic concepts of fractional order system and a brief overview of sliding mode control of fractional order systems. The other parts contain deal with robust finite time stability of fractional order systems, integral sliding mode control of fractional order systems, co-operative control of multi-agent systems modeled as fractional differential equation, robust stabilization of discrete fractional order systems, high performance control using soft variable structure control and contraction analysis by integer and fractional order infinitesimal variations.

Intelligent Fractional Order Systems and Control - Indranil Pan 2012-08-23

Fractional order calculus is finding increasing interest in the control system community. Hardware realizations of fractional order controllers have sparked off a renewed zeal into the investigations of control system design in the light of fractional calculus. As such many notions of integer order LTI systems are being modified and extended to incorporate these new concepts. Computational Intelligence (CI) techniques have been applied to engineering problems to find solutions to many hitherto intractable conundrums and is a useful tool for dealing with problems of higher computational complexity. This book borders on the interface between CI techniques and fractional calculus, and looks at ways in which fractional order control systems may be designed or enhanced using CI based paradigms. To the best of the author's knowledge this is the first book of its kind exclusively dedicated to the application of computational intelligence techniques in fractional order systems and control. The book tries to assimilate various existing concepts in this nascent field of fractional order intelligent control and is aimed at researchers and post graduate students working in this field.

Fractional Order Systems - Ahmad Taher Azar 2018-08-16
Fractional Order Systems: Optimization, Control, Circuit Realizations and Applications consists of 21 contributed chapters by subject experts. Chapters offer practical solutions and novel methods for recent research problems in the multidisciplinary applications of fractional order systems, such as FPGA, circuits, memristors, control algorithms, photovoltaic systems, robot manipulators, oscillators, etc. This book is ideal for researchers working in the modeling and applications of both continuous-time and discrete-time dynamics and chaotic systems. Researchers from academia and industry who are working in research areas such as control engineering, electrical engineering, mechanical engineering, computer science, and information technology will find the book most informative.

Discusses multi-disciplinary applications with new fundamentals, modeling, analysis, design, realization and experimental results
Includes new circuits and systems based on the new nonlinear elements
Covers most of the linear and nonlinear fractional-order theorems that will solve many scientific issues for researchers
Closes the gap between theoretical approaches and real-world applications
Provides MATLAB® and Simulink code for many of the applications in the book

Fractional Order Systems--Control Theory and Applications - Omar Naifar 2021

This book aims to bring together the latest innovative knowledge, analysis, and synthesis of fractional control problems of nonlinear systems as well as some related applications. Fractional order systems (FOS) are dynamical systems that can be modelled by a fractional differential equation carried with a non-integer derivative. In the last few decades, the growth of science and engineering systems has considerably stimulated the employment of fractional calculus in many subjects of control theory, for example, in stability, stabilization, controllability, observability, observer design, and fault estimation. The application of control theory in FOS is an important issue in many engineering applications. So, to accurately describe these systems, the fractional order differential equations have been introduced.

Automation, Control and Energy Efficiency in Complex Systems - Hamid Khayyam 2020-12-22

This book is aimed at serving researchers, engineers, scientists, and engineering graduate and PhD students of engineering and physical science together with individuals interested in engineering and science. This book focuses on the application of engineering methods to complex systems including transportation, building, and manufacturing, with approaches representing a wide variety of disciplines of engineering and science. Throughout the book, great emphases are placed on engineering applications of complex systems, as well as the methodologies of automation, including artificial intelligence, automated and intelligent control, energy analysis, energy modelling, energy management, and optimised energy efficiency. The significant impact of recent studies that have been selected for presentation are of high interest in engineering complex systems. An attempt has been made to expose the reading audience of engineers and researchers to a broad range of theoretical and practical topics. The topics contained in the present book are of specific interest to engineers who are seeking expertise in transportation, building, and manufacturing technologies as well as mathematical modelling of complex systems, engineering approaches to engineering complex problems, automation via artificial intelligence methods, automated and intelligent control, and energy systems. The primary audience of this book are researchers, graduate students, and engineers in mechanical engineering, control engineering, computer engineering, electrical engineering, and science disciplines. In particular, the book can be used for training graduate and PhD students as well as senior undergraduate students to enhance their knowledge by taking a graduate or advanced undergraduate course in the areas of complex systems, control systems, energy systems, and engineering applications. The covered research topics are also of interest to engineers and academia who are seeking to expand their expertise in these areas.

Fractional-Order Design - Ahmed G. Radwan 2021-10-22
Fractional-Order Design: Devices, Circuits, and Systems introduces applications from the design perspective so that the reader can learn about, and get ready to,

design these applications. The book also includes the different techniques employed to comprehensively and straightforwardly design fractional-order systems/devices. Furthermore, a lot of mathematics is available in the literature for solving the fractional-order calculus for system application. However, a small portion is employed in the design of fractional-order systems. This book introduces the mathematics that has been employed explicitly for fractional-order systems. Students and scholars who wants to quickly understand the field of fractional-order systems and contribute to its different domains and applications will find this book a welcomed resource. Presents a simple and comprehensive understanding of the field of fractional-order systems
Offers practical knowledge on the design of fractional-order systems for different applications
Exposes users to the possible new areas of applications of fractional-order systems

Fractional Order Control and Synchronization of Chaotic Systems - Ahmad Taher Azar 2017-02-27

The book reports on the latest advances in and applications of fractional order control and synchronization of chaotic systems, explaining the concepts involved in a clear, matter-of-fact style. It consists of 30 original contributions written by eminent scientists and active researchers in the field that address theories, methods and applications in a number of research areas related to fractional order control and synchronization of chaotic systems, such as: fractional chaotic systems, hyperchaotic systems, complex systems, fractional order discrete chaotic systems, chaos control, chaos synchronization, jerk circuits, fractional chaotic systems with hidden attractors, neural network, fuzzy logic controllers, behavioral modeling, robust and adaptive control, sliding mode control, different types of synchronization, circuit realization of chaotic systems, etc. In addition to providing readers extensive information on chaos fundamentals, fractional calculus, fractional differential equations, fractional control and stability, the book also discusses key applications of fractional order chaotic systems, as well as multidisciplinary solutions developed via control modeling. As such, it offers the perfect reference guide for graduate students, researchers and practitioners in the areas of fractional order control systems and fractional order chaotic systems.

Positive Systems - Filippo Cacace 2017-04-01

This book presents high-quality original contributions on positive systems, including topics such as: monotone dynamical systems in mathematical biology and game theory; mathematical developments for networked systems in biology, chemistry and the social sciences; linear and nonlinear positive operators; dynamical analysis, observation and control of positive distributed parameter systems; stochastic realization theory; biological systems with positive variables and positive controls; iterated function systems; nonnegative dynamic processes; and dimensioning problems for collaborative systems. The book comprises a selection of the best papers presented at the POSTA 2016, the 5th International Symposium on Positive Systems, which was held in Rome, Italy, in September 2016. This conference series represents a targeted response to the growing need for research that reports on and critically discusses a wide range of topics concerning the theory and applications of positive systems.

New Trends in Robot Control - Jawhar Ghommam 2020-02-13

This book presents solutions to control problems in a number of robotic systems and provides a wealth of worked-out examples with full analytical and numerical details, graphically illustrated to aid in reader comprehension. It also presents relevant studies on and applications of robotic system control approaches, as well as the latest findings from interdisciplinary theoretical studies. Featuring chapters on advanced control (fuzzy, neural, backstepping, sliding mode, adaptive, predictive, diagnosis, and fault-tolerant control), the book will equip readers to easily tailor the techniques to their own applications. Accordingly, it offers a valuable resource for researchers, engineers, and students in the field of robotic systems.

Applications in Control - Ivo Petráš 2019-02-19
This multi-volume handbook is the most up-to-date and comprehensive reference work in the field of fractional calculus and its numerous applications. This sixth volume collects authoritative chapters covering several

applications of fractional calculus in control theory, including fractional controllers, design methods and toolboxes, and a large number of engineering applications of control.

Fractional Dynamics and Control - Dumitru Baleanu
2011-11-19

Fractional Dynamics and Control provides a comprehensive overview of recent advances in the areas of nonlinear dynamics, vibration and control with analytical, numerical, and experimental results. This book provides an overview of recent discoveries in fractional control, delves into fractional variational principles and differential equations, and applies advanced techniques in fractional calculus to solving complicated mathematical and physical problems. Finally, this book also discusses the role that fractional order modeling can play in complex systems for engineering and science.

Basic Theory - Anatoly Kochubei 2019-02-19

This multi-volume handbook is the most up-to-date and comprehensive reference work in the field of fractional calculus and its numerous applications. This first volume collects authoritative chapters covering the mathematical theory of fractional calculus, including fractional-order operators, integral transforms and equations, special functions, calculus of variations, and probabilistic and other aspects.

New Perspectives and Applications of Modern Control Theory - Julio B. Clempner 2017-09-30

This edited monograph contains research contributions on a wide range of topics such as stochastic control systems, adaptive control, sliding mode control and parameter identification methods. The book also covers applications of robust and adaptive control to chemical and biotechnological systems. This collection of papers commemorates the 70th birthday of Dr. Alexander S. Poznyak.

Applied Fractional Calculus in Identification and Control - Utkal Mehta 2022-09-10

The book investigates the fractional calculus-based approaches and their benefits to adopting in complex real-time areas. Another objective is to provide initial solutions for new areas where fractional theory has yet to verify the expertise. The book focuses on the latest scientific interest and illustrates the basic idea of general fractional calculus with MATLAB codes. This book is ideal for researchers working on fractional calculus theory both in simulation and hardware. Researchers from academia and industry working or starting research in applied fractional calculus methods will find the book most useful. The scope of this book covers most of the theoretical and practical studies on linear and nonlinear systems using fractional-order integro-differential operators.

PID Control in the Third Millennium - Ramon Vilanova
2012-02-03

The early 21st century has seen a renewed interest in research in the widely-adopted proportional-integral-differential (PID) form of control. PID Control in the Third Millennium provides an overview of the advances made as a result. Featuring: new approaches for controller tuning; control structures and configurations for more efficient control; practical issues in PID implementation; and non-standard approaches to PID including fractional-order, event-based, nonlinear, data-driven and predictive control; the nearly twenty chapters provide a state-of-the-art resumé of PID controller theory, design and realization. Each chapter has specialist authorship and ideas clearly characterized from both academic and industrial viewpoints. PID Control in the Third Millennium is of interest to academics requiring a reference for the current state of PID-related research and a stimulus for further inquiry. Industrial practitioners and manufacturers of control systems with application problems relating to PID will find this to be a practical source of appropriate and advanced solutions.

Fractional Order Differentiation and Robust Control Design - Jocelyn Sabatier 2015-05-06

This book provides an overview of the research done and results obtained during the last ten years in the fields of fractional systems control, fractional PI and PID control, robust and CRONE control, and fractional path planning and path tracking. Coverage features theoretical results, applications and exercises. The book will be useful for post-graduate students who are looking to learn more on fractional systems and control. In addition, it will also appeal to researchers from

other fields interested in increasing their knowledge in this area.

Analysis, Modeling and Stability of Fractional Order Differential Systems 2 - Jean-Claude Trigeassou
2020-02-26

This book introduces an original fractional calculus methodology (the infinite state approach) which is applied to the modeling of fractional order differential equations (FDEs) and systems (FDSs). Its modeling is based on the frequency distributed fractional integrator, while the resulting model corresponds to an integer order and infinite dimension state space representation. This original modeling allows the theoretical concepts of integer order systems to be generalized to fractional systems, with a particular emphasis on a convolution formulation. With this approach, fundamental issues such as system state interpretation and system initialization - long considered to be major theoretical pitfalls - have been solved easily. Although originally introduced for numerical simulation and identification of FDEs, this approach also provides original solutions to many problems such as the initial conditions of fractional derivatives, the uniqueness of FDS transients, formulation of analytical transients, fractional differentiation of functions, state observation and control, definition of fractional energy, and Lyapunov stability analysis of linear and nonlinear fractional order systems. This second volume focuses on the initialization, observation and control of the distributed state, followed by stability analysis of fractional differential systems.

Systems, Automation, and Control - Nabil Derbel
2019-11-05

The book presents selected, extended and peer reviewed papers from the International Multiconference on System, Automation and Control held Leipzig in 2018. These are complemented with solicited contributions by international experts. Main topics are automatic control, robotics, synthesis of automation systems. Application examples range from man-machine interaction, mechatronics, on to biological and economical models.

Informatics in Control, Automation and Robotics - Oleg Gusikhin 2019-04-18

The book focuses the latest endeavours relating researches and developments conducted in fields of Control, Robotics and Automation. Through more than twenty revised and extended articles, the present book aims to provide the most up-to-date state-of-art of the aforementioned fields allowing researcher, PhD students and engineers not only updating their knowledge but also benefiting from the source of inspiration that represents the set of selected articles of the book. The deliberate intention of editors to cover as well theoretical facets of those fields as their practical accomplishments and implementations offers the benefit of gathering in a same volume a factual and well-balanced prospect of nowadays research in those topics. A special attention toward "Intelligent Robots and Control" may characterize another benefit of this book.

Analysis, Modeling and Stability of Fractional Order Differential Systems 1 - Jean-Claude Trigeassou
2019-08-06

This book introduces an original fractional calculus methodology ('the infinite state approach') which is applied to the modeling of fractional order differential equations (FDEs) and systems (FDSs). Its modeling is based on the frequency distributed fractional integrator, while the resulting model corresponds to an integer order and infinite dimension state space representation. This original modeling allows the theoretical concepts of integer order systems to be generalized to fractional systems, with a particular emphasis on a convolution formulation.

Semi-Active Suspension Control Design for Vehicles - Sergio M. Savaresi 2010-08-13

Semi-Active Suspension Control Design for Vehicles presents a comprehensive discussion of designing control algorithms for semi-active suspensions. It also covers performance analysis and control design. The book evaluates approaches to different control theories, and it includes methods needed for analyzing and evaluating suspension performances, while identifying optimal performance bounds. The structure of the book follows a classical path of control-system design; it discusses the actuator or the variable-damping shock absorber, models and technologies. It also models and discusses

the vehicle that is equipped with semi-active dampers, and the control algorithms. The text can be viewed at three different levels: tutorial for novices and students; application-oriented for engineers and practitioners; and methodology-oriented for researchers. The book is divided into two parts. The first part includes chapters 2 to 6, in which fundamentals of modeling and semi-active control design are discussed. The second part includes chapters 6 to 8, which cover research-oriented solutions and case studies. The text is a comprehensive reference book for research engineers working on ground vehicle systems; automotive and design engineers working on suspension systems; control engineers; and graduate students in control theory and ground vehicle systems. Appropriate as a tutorial for students in automotive systems, an application-oriented reference for engineers, and a control design-oriented text for researchers that introduces semi-active suspension theory and practice. Includes explanations of two innovative semi-active suspension strategies to enhance either comfort or road-holding performance, with complete analyses of both. Also features a case study showing complete implementation of all the presented strategies and summary descriptions of classical control algorithms for controlled dampers.

Fractional Order Systems -

Fractional Differential Equations And Inclusions:

Classical And Advanced Topics - Said Abbas 2023-02-02

This monograph is devoted to the existence and stability (Ulam-Hyers-Rassias stability and asymptotic stability) of solutions for various classes of functional differential equations or inclusions involving the Hadamard or Hilfer fractional derivative. Some equations present delay which may be finite, infinite, or state-dependent. Others are subject to impulsive effect which may be fixed or non-instantaneous. Readers will find the book self-contained and unified in presentation. It provides the necessary background material required to go further into the subject and explores the rich research literature in detail. Each chapter concludes with a section devoted to notes and bibliographical remarks and all abstract results are illustrated by examples. The tools used include many classical and modern nonlinear analysis methods such as fixed-point theorems, as well as some notions of Ulam stability, attractivity and the measure of non-compactness as well as the measure of weak noncompactness. It is useful for researchers and graduate students for research, seminars, and advanced graduate courses, in pure and applied mathematics, physics, mechanics, engineering, biology, and all other applied sciences.

Fractional-order Systems and PID Controllers - Kishore Bingi 2019-10-31

This book presents a detailed study on fractional-order, set-point, weighted PID control strategies and the development of curve-fitting-based approximation techniques for fractional-order parameters. Furthermore, in all the cases, it includes the Scilab-based commands and functions for easy implementation and better understanding, and to appeal to a wide range of readers working with the software. The presented Scilab-based toolbox is the first toolbox for fractional-order systems developed in open-source software. The toolboxes allow time and frequency domains as well as stability analysis of the fractional-order systems and controllers. The book also provides real-time examples of the control of process plants using the developed fractional-order based PID control strategies and the approximation techniques. The book is of interest to readers in the areas of fractional-order controllers, approximation techniques, process modeling, control, and optimization, both in industry and academia. In industry, the book is particularly valuable in the areas of research and development (R&D) as well as areas where PID controllers suffice - and it should be noted that around 80% of low-level controllers in industry are PID based. The book is also useful where conventional PIDs are constrained, such as in industries where long-term delay and non-linearity are present. Here it can be used for the design of controllers for real-time processes. The book is also a valuable teaching and learning resource for undergraduate and postgraduate students.

Advances in Robust Fractional Control - Fabrizio Padula 2014-09-19

This monograph presents design methodologies for (robust) fractional control systems. It shows the reader

how to take advantage of the superior flexibility of fractional control systems compared with integer-order systems in achieving more challenging control requirements. There is a high degree of current interest in fractional systems and fractional control arising from both academia and industry and readers from both milieux are catered to in the text. Different design approaches having in common a trade-off between robustness and performance of the control system are considered explicitly. The text generalizes methodologies, techniques and theoretical results that have been successfully applied in classical (integer) control to the fractional case. The first part of *Advances in Robust Fractional Control* is the more industrially oriented. It focuses on the design of fractional controllers for integer processes. In particular, it considers fractional-order proportional-integral-derivative controllers, because integer-order PID regulators are, undoubtedly, the controllers most frequently adopted in industry. The second part of the book deals with a more general approach to fractional control systems, extending techniques (such as H-infinity optimal control and optimal input-output inversion based control) originally devised for classical integer-order control. *Advances in Robust Fractional Control* will be a useful reference for the large number of academic researchers in fractional control, for their industrial counterparts and for graduate students who want to learn more about this subject.

Fractional-order Modeling and Control of Dynamic Systems - Aleksei Tepljakov 2017-02-08

This book reports on an outstanding research devoted to modeling and control of dynamic systems using fractional-order calculus. It describes the development of model-based control design methods for systems described by fractional dynamic models. More than 300 years had passed since Newton and Leibniz developed a set of mathematical tools we now know as calculus. Ever since then the idea of non-integer derivatives and integrals, universally referred to as fractional calculus, has been of interest to many researchers. However, due to various issues, the usage of fractional-order models in real-life applications was limited. Advances in modern computer science made it possible to apply efficient numerical methods to the computation of fractional derivatives and integrals. This book describes novel methods developed by the author for fractional modeling and control, together with their successful application in real-world process control scenarios.

Fractional-order Systems and Controls - Concepción A. Monje 2010-09-28

Fractional-order Systems and Controls details the use of fractional calculus in the description and modeling of systems, and in a range of control design and practical applications. It is largely self-contained, covering the fundamentals of fractional calculus together with some analytical and numerical techniques and providing MATLAB® codes for the simulation of fractional-order control (FOC) systems. Many different FOC schemes are presented for control and dynamic systems problems. Practical material relating to a wide variety of applications is also provided. All the control schemes and applications are presented in the monograph with either system simulation results or real experimental results, or both. *Fractional-order Systems and Controls* provides readers with a basic understanding of FOC concepts and methods, so they can extend their use of FOC in other industrial system applications, thereby expanding their range of disciplines by exploiting this versatile new set of control techniques.

Advances in Modelling and Control of Non-integer-Order Systems - Krzysztof J. Latawiec 2014-08-16

This volume presents selected aspects of non-integer, or fractional order systems, whose analysis, synthesis and applications have increasingly become a real challenge for various research communities, ranging from science to engineering. The spectrum of applications of the fractional order calculus has incredibly expanded, in fact it would be hard to find a science/engineering-related subject area where the fractional calculus had not been incorporated. The content of the fractional calculus is ranged from pure mathematics to engineering implementations and so is the content of this volume. The volume is subdivided into six parts, reflecting particular aspects of the fractional order calculus. The

first part contains a single invited paper on a new formulation of fractional-order descriptor observers for fractional-order descriptor continuous LTI systems. The second part provides new elements to the mathematical theory of fractional-order systems. In the third part of this volume, a bunch of new results in approximation, modeling and simulations of fractional-order systems is given. The fourth part presents new solutions to some problems in controllability and control of non-integer order systems, in particular fractional PID-like control. The fifth part analyzes the stability of non-integer order systems and some new results are offered in this important respect, in particular for discrete-time systems. The final, sixth part of this volume presents a spectrum of applications of the noninteger order calculus, ranging from bi-fractional filtering, in particular of electromyographic signals, through the thermal diffusion and advection diffusion processes to the SIEMENS platform implementation. This volume's papers were all subjected to stimulating comments and discussions from the active audience of the RRNR'2014, the 6th Conference on Non-integer Order Calculus and Its Applications that was organized by the Department of Electrical, Control and Computer Engineering, Opole University of Technology, Opole, Poland.

Fractional Signals and Systems - Manuel Duarte Ortigueira 2020-03-09

The book illustrates the theoretical results of fractional derivatives via applications in signals and systems, covering continuous and discrete derivatives, and the corresponding linear systems. Both time and frequency analysis are presented. Some advanced topics are included like derivatives of stochastic processes. It is an essential reference for researchers in

mathematics, physics, and engineering.

Fractional Order Motion Controls - 2012-11-07

Covering fractional order theory, simulation and experiments, this book explains how fractional order modelling and fractional order controller design compares favourably with traditional velocity and position control systems. The authors systematically compare the two approaches using applied fractional calculus. Stability theory in fractional order controllers design is also analysed. Presents material suitable for a variety of real-world applications, including hard disk drives, vehicular controls, robot control and micropositioners in DNA microarray analysis. Includes extensive experimental results from both lab bench level tests and industrial level, mass-production-ready implementations. Covers detailed derivations and numerical simulations for each case. Discusses feasible design specifications, ideal for practicing engineers. The book also covers key topics including: fractional order disturbance cancellation and adaptive learning control studies for external disturbances; optimization approaches for nonlinear system control and design schemes with backlash and friction. Illustrations and experimental validations are included for each of the proposed control schemes to enable readers to develop a clear understanding of the approaches covered, and move on to apply them in real-world scenarios.

Applications in Physics - Vasily E. Tarasov 2019-02-19

This multi-volume handbook is the most up-to-date and comprehensive reference work in the field of fractional calculus and its numerous applications. This fourth volume collects authoritative chapters covering several applications of fractional calculus in physics, including classical and continuum mechanics.