

Fractional Order Control And Synchronization Of Chaotic

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Fractional Order Control and Synchronization of Chaotic ...

A control and switching synchronization technique is proposed that uses switching parameters to decide the role of each system as a master or slave. A generalized scheme for synchronizing a fractional-order chaotic system with another one or with a linear combination of two other fractional-order chaotic systems is presented.

Control and Synchronization of Fractional-Order Chaotic ...

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 ...

Fractional Order Control and Synchronization of Chaotic ...

Then introducing control schemes to stabilize the fractional Ikeda map and to synchronize it with another fractional-order chaotic map. Numerical simulations, including bifurcation diagrams and computation of the Lyapunov exponent, are presented to verify the theoretical results. 2. Fractional form of the Ikeda map

On the dynamics, control and synchronization of fractional ...

This was the seed that started the long use of chaotic systems in the field of communications. Throughout the years, many studies have considered the synchronization of integer-order chaotic and hyperchaotic maps including [25,26,27,28,29] but very few can be found for those of fractional-order [30,31,32,33,34].

Chaos, control, and synchronization in some fractional ...

Furthermore, a new synchronization scheme is introduced whereby a new 2D fractional-order chaotic map is considered as the master system and the fractional-order Ikeda map is considered as the...

On the dynamics, control and synchronization of fractional ...

Based on the stability theory of fractional-order discrete maps, a stabilization controller is proposed to control the chaos of the map. The synchronization between the proposed map and a fractional-order discrete Loren map is studied and realized. 2.

A Fractional-Order Discrete Noninvertible Map of Cubic ...

It is shown that chaos appears in the fractional-order Chen system when the order is less than 3. A linearizing feedback has successfully been applied on this chaotic system. In , synchronization of fractional-order chaotic systems has been studied. Utilizing an approximation approach of fractional operator drives the system to behave chaotic, when the order is less than number of the state, i.e. 3.

Chaotic fractional-order Couillet system: Synchronization ...

This paper demonstrates dynamics, chaos control, and synchronization in Samardzija-Greller population model with fractional order between zero and two. The fractional-order case is shown to exhibit rich variety of nonlinear dynamics. Lyapunov exponents are calculated to confirm the existence of wide range of chaotic dynamics in this system.

Dynamics, Chaos Control, and Synchronization in a ...

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Fractional Order Control and Synchronization of Chaotic ...

Chaos, control, and synchronization in some fractional-order difference equations. ... The following theorem proposes control laws for the fractional-order. Stefanski map (11).

Chaos, control, and synchronization in some fractional ...

Fractional Order Control and Synchronization of Chaotic Systems (Studies in Computational Intelligence Book 688) eBook: Azar, Ahmad Taher, Vaidyanathan, Sundarapandian, Ouannas, Adel: Amazon.in: Kindle Store

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.

This book provides a general overview of several concepts of synchronization and brings together related approaches to secure communication in chaotic systems. This is achieved using a combination of analytic, algebraic, geometrical and asymptotical methods to tackle the dynamical feedback stabilization problem. In particular, differential-geometric and algebraic differential concepts reveal important structural properties of chaotic systems and serve as guide for the construction of design procedures for a wide variety of chaotic systems. The basic differential algebraic and geometric concepts are presented in the first few chapters in a novel way as design tools, together with selected experimental studies demonstrating their importance. The subsequent chapters treat recent applications. Written for graduate students in applied physical sciences, systems engineers, and applied mathematicians interested in synchronization of chaotic systems and in secure communications, this self-contained text requires only basic knowledge of integer ordinary and fractional ordinary differential equations. Design applications are illustrated with the help of several physical models of practical interest.

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.

In the recent years, fractional-order systems have been studied by many researchers in the engineering field. It was found that many systems can be described more accurately by fractional differential equations than by integer-order models. Advanced Synchronization Control and Bifurcation of Chaotic Fractional-Order Systems is a scholarly publication that explores new developments related to novel chaotic fractional-order systems, control schemes, and their applications. Featuring coverage on a wide range of topics including chaos synchronization, nonlinear control, and cryptography, this publication is geared toward engineers, IT professionals, researchers, and upper-level graduate students seeking current research on chaotic fractional-order systems and their applications in engineering and computer science.

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: 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 calculus dates to the 19th century but has been resurrected as a prevalent research subject due to its provision of more adequate and realistic descriptions of physical aspects within the science and engineering fields. What was once a classical form of mathematics is currently being reintroduced as a new modeling technique that engineers and scientists are finding modern uses for. There is a need for research on all facets of these fractional-order systems and studies of its potential applications. Advanced Applications of Fractional Differential Operators to Science and Technology provides emerging research exploring the theoretical and practical aspects of novel fractional modeling and related dynamical behaviors as well as its applications within the fields of physical sciences and engineering. Featuring coverage on a broad range of topics such as chaotic dynamics, ecological models, and bifurcation control, this book is ideally designed for engineering professionals, mathematicians, physicists, analysts, researchers, educators, and students seeking current research on fractional calculus and other applied mathematical modeling techniques.

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

After a short introduction to the fundamentals, this book provides a detailed account of major advances in applying fractional calculus to dynamical systems. Fractional order dynamical systems currently continue to gain further importance in many areas of science and engineering. As with many other approaches to mathematical modeling, the first issue to be addressed is the need to couple a definition of the fractional differentiation or integration operator with the types of dynamical systems that are analyzed. As such, for the fundamentals the focus is on basic aspects of fractional calculus, in particular stability analysis, which is required to tackle synchronization in coupled fractional order systems, to understand the essence of estimators for related integer order systems, and to keep track of the interplay between synchronization and parameter observation. This serves as the common basis for the more advanced topics and applications presented in the subsequent chapters, which include an introduction to the 'Immersion and Invariance' (I&I) methodology, the masterslave synchronization scheme for partially known nonlinear fractional order systems, Fractional Algebraic Observability (FAO) and Fractional Generalized quasi-Synchronization (FGqS) to name but a few. This book is intended not only for applied mathematicians and theoretical physicists, but also for anyone in applied science dealing with complex nonlinear systems.

This book is focused on fractional order systems. Historically, fractional calculus has been recognized since the inception of regular calculus, with the first written reference dated in September 1695 in a letter from Leibniz to L ' Hospital. Nowadays, fractional calculus has a wide area of applications in areas such as physics, chemistry, bioengineering, chaos theory, control systems engineering, and many others. In all those applications, we deal with fractional order systems in general. Moreover, fractional calculus plays an important role even in complex systems and therefore allows us to develop better descriptions of real-world phenomena. On that basis, fractional order systems are ubiquitous, as the whole real world around us is fractional. Due to this reason, it is urgent to consider almost all systems as fractional order systems. This Special Issue explores applications of such systems to control, synchronization, and various mathematical models, as for instance, MRI, long memory process, diffusion.

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