

Discrete Fractional Calculus Applications In Control And Image Processing Series In Computer Vision

Development and Application

An Introduction to Fractional Derivatives, Fractional Differential Equations, to Methods of Their Solution and Some of Their Applications

Fractional Calculus

Fractional Differential Equations

Applications in Control and Image Processing

Automation 2018

ICFDA 2018, Amman, Jordan, July 16-18

Advanced Mathematical Methods

Applications in Engineering, Life and Social Sciences

Discrete Fractional Calculus

Fractional Calculus

Bifurcation and Chaos in Fractional-Order Systems

Fractional Calculus with its Applications in Engineering and Technology

Fractional Dynamics

Applications of Fractional Calculus to Dynamics of Particles, Fields and Media

Methods, Algorithms and Applications

New Trends in Fractional Differential Equations with Real-World Applications in Physics

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The Theory of Discrete Fractional Calculus

Intelligent Mathematics: Computational Analysis

Fractional Signals and Systems

Advances in Non-Integer Order Calculus and Its Applications

Advances in Modelling and Control of Non-integer-Order Systems

Frontiers in Time Scales and Inequalities

5th Conference on Non-integer Order Calculus and Its Applications, Cracow, Poland

Discrete Fractional Calculus

ICMAC 2019, Kalavakkam, India, December 23-24

Non-Integer Order Calculus and its Applications

9th International Conference on Non-Integer Order Calculus and Its Applications, Łódź, Poland

Discrete Fractional Calculus

8th Conference on Non-integer Order Calculus and Its Applications, Zakopane, Poland

25th ICDEA, London, UK, June 24-28, 2019

Proceedings of the 10th International Conference on Non-Integer Order Calculus and Its Applications

Computational Methods In The Fractional Calculus Of Variations

New Trends in Nonlinear Dynamics

*Discrete Fractional Calculus
Applications In Control And Image
Processing Series In Computer Vision*

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JONAH MCCANN

Development and Application Walter de Gruyter GmbH & Co KG

This book comprises selected papers of the 25th International Conference on Difference Equations and Applications, ICDEA 2019, held at UCL, London, UK, in June 2019. The volume details the latest research on difference equations and discrete dynamical systems, and their application to areas such as biology, economics, and the social sciences. Some chapters have a tutorial style and cover the history and more recent developments for a particular topic, such as chaos, bifurcation theory, monotone dynamics, and global stability. Other chapters cover the latest personal research contributions of the author(s) in their particular area of expertise and range from the more technical articles on abstract systems to those that discuss the application of difference equations to real-world problems. The

book is of interest to both Ph.D. students and researchers alike who wish to keep abreast of the latest developments in difference equations and discrete dynamical systems.

An Introduction to Fractional Derivatives, Fractional Differential Equations, to Methods of Their Solution and Some of Their Applications Springer Nature

The main subject of the monograph is the fractional calculus in the discrete version. The volume is divided into three main parts. Part one contains a theoretical introduction to the classical and fractional-order discrete calculus where the fundamental role is played by the backward difference and sum. In the second part, selected applications of the discrete fractional calculus in the discrete system control theory are presented. In the discrete system identification, analysis and synthesis, one can consider integer or fractional models based on the fractional-order difference equations. The third part of the book is devoted to digital image processing.

Fractional Calculus Springer Science & Business Media

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 Differential Equations Frontiers Media SA

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.

Applications in Control and Image Processing Springer Nature

In recent years fractional calculus has played an important role in various fields such as mechanics, electricity, chemistry, biology, economics, modeling, identification, control theory and signal processing. The scope of this book is to present the state of the art in the study of fractional systems and the application of fractional differentiation. Furthermore, the manufacture of nanowires is important for the design of nanosensors and the development of high-yield thin films is vital in procuring clean solar energy. This wide range of applications is of interest to engineers, physicists and mathematicians.

Automation 2018 Springer Science & Business Media

This monograph contains the author's work of the last four years in discrete and fractional analysis. It introduces the right delta and right nabla fractional calculus on time scales and continues with the right delta and right nabla discrete fractional calculus in the Caputo sense. Then, it shows representation formulae of functions on time scales and presents Ostrowski type inequalities, Landau type inequalities, Grüss type and comparison of means inequalities, all these over time scales. The volume continues with integral operator inequalities and their multivariate vectorial versions using convexity of functions, again all these over time scales. It follows the Grüss and Ostrowski type inequalities involving s -convexity of functions; and also examines the general

case when several functions are involved. Then, it presents the general fractional Hermite–Hadamard type inequalities using m -convexity and (s, m) -convexity. Finally, it introduces the reduction method in fractional calculus and its connection to fractional Ostrowski type inequalities is studied. This book's results are expected to find applications in many areas of pure and applied mathematics, especially in difference equations and fractional differential equations. The chapters are self-contained and can be read independently, and advanced courses can be taught out of it. It is suitable for researchers, graduate students, seminars of the above subjects, and serves well as an invaluable resource for all science libraries. Contents: Foundations of Right Delta Fractional Calculus on Time Scales Principles of Right Nabla Fractional Calculus on Time Scales About Right Delta Discrete Fractionality About Right Nabla Discrete Fractional Calculus Representations and Ostrowski Inequalities over Time Scales Landau Inequalities on Time Scales Grüss and Comparison of Means Inequalities over Time Scales About Integral Operator Inequalities over Time Scales About Vectorial Integral Operator Inequalities Using Convexity over Time Scales General Grüss and Ostrowski Inequalities Using s -Convexity Essential and s -Convexity Ostrowski and Grüss Inequalities Using Several Functions General Fractional Hermite–Hadamard Inequalities Using m -Convexity and (s, m) -Convexity About the Reduction Method in Fractional Calculus and Fractional Ostrowski Inequalities Readership: Advanced graduate students and researchers interested in time scales, inequalities and difference/differential equations. Key Features: Presents new research on time scales and related inequalities Materials are crucially related to difference/differential equations Self-contained chapters that can be read independently An extensive list of references is given in each chapter The topics covered are diverse Keywords: Time Scale; Fractional Derivative; Difference Equation; Fractional Inequality

ICFDA 2018, Amman, Jordan, July 16-18 Walter de Gruyter GmbH & Co KG

This book is a landmark title in the continuous move from integer to non-integer in mathematics: from integer numbers to real numbers, from factorials to the gamma function, from integer-order models to models of an arbitrary order. For historical reasons, the word 'fractional' is used instead of the word 'arbitrary'. This book is written for readers who are new to the fields of fractional derivatives and fractional-order mathematical models, and feel that they need them for developing more adequate mathematical models. In this book, not only applied scientists, but also pure mathematicians will find fresh motivation for developing new methods and approaches in their fields of research. A reader will find in this book everything necessary for the initial study and immediate application of fractional derivatives fractional differential equations, including several necessary special functions, basic theory of fractional differentiation, uniqueness and existence theorems, analytical numerical methods of solution of fractional differential equations, and many inspiring examples of applications. A unique survey of many applications of fractional calculus Presents basic theory Includes a unified presentation of selected classical results, which are important for applications Provides many examples Contains a separate chapter of fractional order control systems, which opens new perspectives in control theory The first systematic consideration of Caputo's fractional derivative in comparison with other selected approaches Includes tables of fractional derivatives, which can be used for evaluation of all considered types of fractional derivatives

Advanced Mathematical Methods Springer Science & Business Media

This book is a collection of selected papers presented at the International Conference on Mathematical Analysis and Computing (ICMAC 2019) held at Sri Sivasubramaniya Nadar College of Engineering, Chennai, India, from 23–24 December 2019. Having found its applications in game theory, economics, and operations research, mathematical analysis plays an important role in analyzing models of physical systems and provides a sound logical base for problems stated in a qualitative manner. This book aims at disseminating recent advances in areas of mathematical analysis, soft computing, approximation and optimization through original research articles and expository survey papers. This book will be of value to research scholars, professors, and industrialists working in these areas.

Applications in Engineering, Life and Social Sciences Springer Nature

The first volume of this two-volume book, presents history, the mathematical modeling and the applications of fractional order systems, and contains mathematical and theoretical studies and research related to this domain. This volume is made up of 11 chapters. The first chapter presents an analysis of the Caputo derivative and the pseudo state representation with the infinite state approach. The second chapter studies the stability of a class of fractional Cauchy problems. The third chapter shows how to solve fractional order differential equations and fractional order partial differential equations using modern matrix algebraic approaches. Following this chapter, chapter four proposes another analytical method to solve differential equations with local fractional derivative operators. Concerning chapter five, it presents the extended Borel transform and its related fractional analysis. After presenting the analytical resolution methods for fractional calculus, chapter six shows the essentials of fractional calculus on discrete settings. The initialization of such systems is shown in chapter seven. In fact, this chapter presents a generalized application of the Hankel operator for initialization of fractional order systems. The last four chapters show some new studies and applications of non-integer calculus. In fact, chapter eight presents the fractional reaction-transport equations and evanescent continuous time random walks. Chapter nine shows a novel approach in the exponential integrators for fractional differential equations. Chapter ten presents the non-fragile tuning of fractional order PD controllers for integrating time delay systems. At the end, chapter eleven proposes a discrete finite-dimensional approximation of linear infinite dimensional systems. To sum up, this volume presents a mathematical and theoretical study of fractional calculus along with a stability study and some applications. This volume ends up with some new techniques and methods applied in fractional calculus. This volume will be followed up by a second volume that focuses on the applications of fractional calculus in several engineering domains.

Discrete Fractional Calculus Springer Nature

This text provides the first comprehensive treatment of the discrete fractional calculus. Experienced researchers will find the text useful as a reference for discrete fractional calculus and topics of current interest. Students who are interested in learning about discrete fractional calculus will find this text to provide a useful starting point. Several exercises are offered at the end of each chapter and select answers have been provided at the end of the book. The presentation of the content is designed to give ample flexibility for potential use in a myriad of courses and for independent study. The novel approach taken by the authors includes a simultaneous treatment of the fractional- and integer-order difference calculus (on a variety of time scales, including both the usual forward and backwards difference operators). The reader will acquire a solid foundation in the classical topics of the discrete calculus while being introduced to exciting recent

developments, bringing them to the frontiers of the subject. Most chapters may be covered or omitted, depending upon the background of the student. For example, the text may be used as a primary reference in an introductory course for difference equations which also includes discrete fractional calculus. Chapters 1–2 provide a basic introduction to the delta calculus including fractional calculus on the set of integers. For courses where students already have background in elementary real analysis, Chapters 1–2 may be covered quickly and readers may then skip to Chapters 6–7 which present some basic results in fractional boundary value problems (FBVPs). Chapters 6–7 in conjunction with some of the current literature listed in the Bibliography can provide a basis for a seminar in the current theory of FBVPs. For a two-semester course, Chapters 1–5 may be covered in depth, providing a very thorough introduction to both the discrete fractional calculus as well as the integer-order calculus.

Fractional Calculus World Scientific

This book covers applications of fractional calculus used for medical and health science. It offers a collection of research articles built into chapters on classical and modern dynamical systems formulated by fractional differential equations describing human diseases and how to control them. The mathematical results included in the book will be helpful to mathematicians and doctors by enabling them to explain real-life problems accurately. The book will also offer case studies of real-life situations with an emphasis on describing the mathematical results and showing how to apply the results to medical and health science, and at the same time highlighting modeling strategies. The book will be useful to graduate level students, educators and researchers interested in mathematics and medical science.

Bifurcation and Chaos in Fractional-Order Systems Walter de Gruyter GmbH & Co KG

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.

Fractional Calculus with its Applications in Engineering and Technology CRC Press

"Fractional Dynamics: Applications of Fractional Calculus to Dynamics of Particles, Fields and Media" presents applications of fractional calculus, integral and differential equations of non-integer orders in describing systems with long-time memory, non-local spatial and fractal properties. Mathematical models of fractal media and distributions, generalized dynamical systems and discrete maps, non-local statistical mechanics and kinetics, dynamics of open quantum systems, the hydrodynamics and electrodynamics of complex media with non-local properties and memory are considered. This book is intended to meet the needs of scientists and graduate students in physics, mechanics and applied mathematics who are interested in electrodynamics, statistical and condensed matter physics, quantum dynamics, complex media theories and kinetics, discrete maps and lattice models, and nonlinear dynamics and chaos. Dr. Vasily E. Tarasov is a Senior Research Associate at Nuclear Physics Institute of Moscow State University and an Associate Professor at Applied Mathematics and Physics Department of Moscow Aviation Institute.

Fractional Dynamics Discrete Fractional Calculus Applications in Control and Image Processing

This third of three volumes from the inaugural NODYCON, held at the University of Rome, in February of 2019, presents papers

devoted to New Trends in Nonlinear Dynamics. The collection features both well-established streams of research as well as novel areas and emerging fields of investigation. Topics in Volume III include NEMS/MEMS and nanomaterials: multi-sensors, actuators exploiting nonlinear working principles; adaptive, multifunctional, and meta material structures; nanocomposite structures (e.g., carbon nanotube/polymer composites, composites with functionalized nanoparticles); 0D,1D,2D,3D nanostructures; biomechanics applications, DNA modeling, walking dynamics, heart dynamics, neurodynamics, capsule robots, jellyfish-like robots, nanorobots; cryptography based on chaotic maps; ecosystem dynamics, social media dynamics (user behavior dynamics in multi-messages social hotspots, prediction models), financial engineering, complexity in engineering; and network dynamics (multi-agent systems, leader-follower dynamics, swarm dynamics, biological networks dynamics).

Applications of Fractional Calculus to Dynamics of Particles, Fields and Media World Scientific

The many technical and computational problems that appear to be constantly emerging in various branches of physics and engineering beg for a more detailed understanding of the fundamental mathematics that serves as the cornerstone of our way of understanding natural phenomena. The purpose of this Special Issue was to establish a brief collection of carefully selected articles authored by promising young scientists and the world's leading experts in pure and applied mathematics, highlighting the state-of-the-art of the various research lines focusing on the study of analytical and numerical mathematical methods for pure and applied sciences.

Methods, Algorithms and Applications MDPI

This book presents a wide and comprehensive spectrum of issues and problems related to fractional-order dynamical systems. It is meant to be a full-fledge, comprehensive presentation of many aspects related to the broadly perceived fractional-order dynamical systems which constitute an extension of the traditional integer-order-type descriptions. This implies far-reaching consequences, both analytic and algorithmic, because in general properties of the traditional integer-order systems cannot be directly extended by a straightforward generalization to fractional-order systems, modeled by fractional-order differential equations involving derivatives of a non-integer order. This can be useful for describing and analyzing, for instance, anomalies in the behavior of various systems, chaotic behavior, etc. The book contains both analytic contributions with state-of-the-art and theoretical foundations, algorithmic implementation of tools and techniques, and finally some examples of relevant and successful practical applications.

New Trends in Fractional Differential Equations with Real-World Applications in Physics Walter de Gruyter GmbH & Co KG

Fractional calculus is a collection of relatively little-known mathematical results concerning generalizations of differentiation and integration to noninteger orders. While these results have been accumulated over centuries in various branches of mathematics, they have until recently found little appreciation or application in physics and other mathematically oriented sciences. This situation is beginning to change, and there are now a growing number of research areas in physics which employ fractional calculus. This volume provides an introduction to fractional calculus for physicists, and collects easily accessible review articles surveying those areas of physics in which applications of fractional calculus have recently become

prominent. Contents: An Introduction to Fractional Calculus (P L Butzer & U Westphal) Fractional Time Evolution (R Hilfer) Fractional Powers of Infinitesimal Generators of Semigroups (U Westphal) Fractional Differences, Derivatives and Fractal Time Series (B J West & P Grigolini) Fractional Kinetics of Hamiltonian Chaotic Systems (G M Zaslavsky) Polymer Science Applications of Path-Integration, Integral Equations, and Fractional Calculus (J F Douglas) Applications to Problems in Polymer Physics and Rheology (H Schiessel et al.) Applications of Fractional Calculus Techniques to Problems in Biophysics (T F Nonnenmacher & R Metzler) Fractional Calculus and Regular Variation in Thermodynamics (R Hilfer) Readership: Statistical, theoretical and mathematical physicists. Keywords: Fractional Calculus in Physics Reviews: "This monograph provides a systematic treatment of the theory and applications of fractional calculus for physicists. It contains nine review articles surveying those areas in which fractional calculus has become important. All the chapters are self-contained." Mathematics Abstracts

Applications in Control and Image Processing Springer Nature

This book consists of papers presented at Automation 2018, an international conference held in Warsaw from March 21 to 23, 2018. It discusses the radical technological changes occurring due to the INDUSTRY 4.0, with a focus on offering a better understanding of the Fourth Industrial Revolution. Each chapter presents a detailed analysis of interdisciplinary knowledge, numerical modeling and simulation as well as the application of cyber-physical systems, where information technology and physical devices create synergic systems leading to unprecedented efficiency. The theoretical results, practical solutions and guidelines presented are valuable for both researchers working in the area of engineering sciences and practitioners looking for solutions to industrial problems.

Fractional Calculus Nova Science Pub Incorporated

The main subject of the monograph is the fractional calculus in the discrete version. The volume is divided into three main parts. Part one contains a theoretical introduction to the classical and fractional-order discrete calculus where the fundamental role is played by the backward difference and sum. In the second part, selected applications of the discrete fractional calculus in the discrete system control theory are presented. In the discrete system identification, analysis and synthesis, one can consider integer or fractional models based on the fractional-order difference equations. The third part of the book is devoted to digital image processing. Contents: Discrete-Variable Real Functions The n-th Order Backward Difference/Sum of the Discrete-Variable Function Fractional-Order Backward Difference/Sum The FOBD-S Graphical Interpretation The FOBD/S Selected Properties The FO Dynamic System Description Linear FO System Analysis The Linear FO Discrete-Time Fundamental Elements FO Discrete-Time System Structures Fractional Discrete-Time PID Controller FOS Approximation Problems Fractional Potential FO Image Filtering and Edge Detection Appendix A: Selected Linear Algebra Formulae and Discrete-Variable Special Functions Readership: Researchers, academics, professionals and graduate students in pattern recognition/image analysis, robotics and automated systems, systems engineering and mathematical modeling. Keywords: Fractional Calculus; Fractional-Order Backward-Difference; Fractional-Order Linear Difference Equation; Discrete-System; State-Space Equations

Theory World Scientific

Discrete Fractional Calculus Applications in Control and Image Processing World Scientific

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