FDA Express Vol. 5, No. 1, Oct. 15, 2012

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The restaurant at the end of the random walk: recent developments in the description of anomalous transport by fractional dynamics

Random walk approximation of fractional-order multiscaling anomalous diffusion

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Conferences

The Website of **International Conference on Fractional Differentiation and Its Applications (ICFDA'14)**

The organization committee of the international conference on fractional differentiation and its applications has just opened its website at:

http://www.icfda14.dieei.unict.it/

This series of conferences is the largest of its kind. Following the previous successful conferences, 2004 in France, 2006 in Portugal, 2008 Turkey, 2010 in Spain, and 2012 in China, the ICFDA'14 is expected to be the largest gathering of researchers and practitioners in this field of research and applications. For the conference details, please visit the above website. The organizing committee invites you from all over the world to come to Catania, Italy to attend this wonderful event.

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Last Reminder: Fractional dynamical systems and signals

-----A special session in European Control Conference 2013

http://www.ecc13.ch/
July 17-19 2013 in Zurich, Switzerland:

Special session invitation
Fractional dynamical systems and signals

Call for Papers

The goal of this special session is to gather colleagues that work in the field of fractional calculus in order to present the latest results in fractional dynamical systems and signals domain. Papers describing original research work that reflects the recent theoretical advances and experimental results as well as open new issues for research are invited.

This session will cover the following topics (but not limited to):
- Signal analysis and filtering with fractional tools (restoration, reconstruction, analysis of fractal noises,
- Fractional modeling especially of (but not limited to) thermal systems, electrical systems (motors, transformers, skin effect, …), dielectric materials, electrochemical systems (batteries, ultracapacitors, fuel cells, …), mechanical systems (vibration insulation, viscoelastic materials, …), Biological systems (muscles, lungs, …)
- System identification (linear, non linear, MIMO methods, …)
- Systems implementation (fractional controllers and filters implementation, …)
- Systems analysis (Stability, observability, controllability, …)
- Observers
- Control (Fractional PID, CRONE, H∞, …)
- Diagnosis of fractional systems

Submission Deadline: Contributed Papers and special issues must be submitted before **October 19, 2012.**

Submission Guidelines
Prepare our papers according to recommendations available at
http://www.ecc13.ch/call.html

Contact if you intend to participate

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Call for paper

New Challenges in Fractional Systems

The Special Issue “New Challenges in Fractional Systems” is posted on the journal Mathematical Problems in Engineering, Hindawi; at website: http://www.hindawi.com/journals/mpe/osi/

Fractional order differentiation consists in the generalization of classical integer differentiation to real or complex orders. From a mathematical point of view, several interpretations of fractional differentiation were proposed, but there is still a deep debate about it. The fractional differentiation and fractional integration are non-local operations based on an integral with a singular kernel. This explains why these operators are still not well defined and that several definitions still coexist. Since the first recorded reference work in 1695 up to the present day, many articles have been published on this subject, but much progress still to be done particularly on the relationship of these different definitions with the physical reality of a system. A fractional order system is a system described by an integro-differential equation involving fractional order derivatives of its input(s) and/or output(s). From a physical point of view, linear fractional derivatives and integrals order systems are not classical linear systems, and not quite conventional distributed parameter systems. They are in fact halfway between these two classes of systems, and are a modelling tool well suited to a wide class of phenomena with non-standard dynamic behaviour, and the applications of fractional order systems are now well accepted in the following **disciplines:**

– Signal processing (filtering, restoration, reconstruction, analysis of fractal noises, ...);
– Image processing (fractal environment modelling, pattern recognition, edge detection, ...);
– Economy (analysis of stock exchange signals, ...);
– Electrical engineering (modelling of motors, transformers, skin effect, ...);
– Electronics, telecommunications (phase locking loops, ...);
– Electromagnetism (modelling of complex dielectric materials, ...);
– Electrochemistry (modelling of batteries and ultracapacitors ...);
– Thermal engineering (modelling and identification of thermal systems, ...);
– Mechanics, mechatronics (viscoelasticity, vibration insulation, ...);
– Automatic control (system identification, observation and control of fractional systems, ...);
– Biology, biophysics (signal and models of biological systems, viscoelasticity in biology, ...);
– Physics (analysis and modelling of diffusion phenomenon, ...).

The goal of the present special issue is to address the latest developments in the area of fractional calculus application in signals and systems. Papers describing original research work that reflects the recent theoretical advances and experimental results as well as open new avenues for research are invited on all aspects of object tracking. Before submission the authors should carefully read over the journal’s
Author Guidelines and submit an electronic copy of their complete manuscript through the journal Manuscript Tracking System. Use websites:

http://www.hindawi.com/journals/mpe/guidelines/
http://mts.hindawi.com/.

Manuscript Due: November 9, 2012
First Round of Reviews: February 1, 2012
Publication Date: March 29, 2013

Lead Guest Editor: Jocelyn Sabatier
Guest Editors: Clara Ionescu, J´ozsef K´azm´er Tar, Jose A. Tenreiro Machado
Reported by J.A.Tenreiro Machado, Email: jtm@isep.ipp.pt

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Latest SCI Journal Papers on FDA

October & November 2012

from ISI Web of Science (SCI)

Title: On a jump-type stochastic fractional partial differential equation with fractional noises

Author(s): Liu, Junfeng; Yan, Litan; Cang, Yuquan

Source: NONLINEAR ANALYSIS-THEORY METHODS & APPLICATIONS Volume: 75 Issue: 16 Pages: 6060-6070 DOI: 10.1016/j.na.2012.06.012 Published: NOV 2012

Title: Existence and uniqueness results for fractional integrodifferential equations with boundary value conditions

Author(s): Karthikeyan, K.; Trujillo, J. J.

Source: COMMUNICATIONS IN NONLINEAR SCIENCE AND NUMERICAL SIMULATION Volume: 17 Issue: 11 Pages: 4037-4043 DOI: 10.1016/j.cnsns.2011.11.036 Published: NOV 2012

Title: The Sinc-Legendre collocation method for a class of fractional convection-diffusion equations with variable coefficients

Author(s): Saadatmandi, Abbas; Dehghan, Mehdi; Azizi, Mohammad-Reza

Source: COMMUNICATIONS IN NONLINEAR SCIENCE AND NUMERICAL SIMULATION Volume: 17 Issue: 11 Pages: 4125-4136 DOI: 10.1016/j.cnsns.2012.03.003 Published: NOV 2012

Title: Uncertainty propagation in stochastic fractional order processes using spectral methods: A hybrid approach

Author(s): Pham Luu Trung Duong; Lee, Moonyong

Source: COMMUNICATIONS IN NONLINEAR SCIENCE AND NUMERICAL SIMULATION Volume: 17 Issue: 11 Pages: 4262-4273 DOI: 10.1016/j.cnsns.2012.01.031 Published: NOV 2012

Title: On the natural solution of an impulsive fractional differential equation of order q is an element of (1,2)

Author(s): Wang, JinRong; Li, Xuezhu; Wei, Wei

Source: COMMUNICATIONS IN NONLINEAR SCIENCE AND NUMERICAL SIMULATION Volume: 17 Issue: 11 Pages: 4384-4394 DOI: 10.1016/j.cnsns.2012.03.011 Published: NOV 2012

Title: On well-posedness for nonlinear Schrodinger equations with power nonlinearity in fractional order Sobolev spaces

Author(s): Uchizono, Harunori; Wada, Takeshi

Source: JOURNAL OF MATHEMATICAL ANALYSIS AND APPLICATIONS Volume: 395 Issue: 1 Pages: 56-62 DOI: 10.1016/j.jmaa.2012.04.079 Published: NOV 1 2012

Title: Application of multi-scale chirplet path pursuit and fractional Fourier transform for gear fault detection in speed up and speed-down processes

Author(s): Luo, Jiesi; Yu, Dejie; Liang, Ming

Source: JOURNAL OF SOUND AND VIBRATION Volume: 331 Issue: 22 Pages: 4971-4986 DOI: 10.1016/j.jsv.2012.06.006 Published: OCT 22 2012

Title: Absorption, distribution, and elimination of graded oral doses of methylmercury in juvenile white sturgeon.

Author(s): Huang, Susie Shih-Yin; Strathe, Anders Bjerring; Fadel, James G; et al.

Source: Aquatic toxicology (Amsterdam, Netherlands) Volume: 122-123 Pages: 163-71 Published: 2012-Oct-15 (Epub 2012 Jun 26)

Title: A New Fractional -Order Chaotic System and Its Synchronization with Circuit Simulation

Author(s): Chen, Diyi; Liu, Chengfu; Wu, Cong; et al.

Source: CIRCUITS SYSTEMS AND SIGNAL PROCESSING Volume: 31 Issue: 5 Pages: 1599-1613 DOI: 10.1007/s00034-012-9408-z Published: OCT 2012

Title: DYNAMICS OF 2D STOCHASTIC NON-NEWTONIAN FLUID DRIVEN BY FRACTIONAL BROWNIAN MOTION

Author(s): Li, Jin; Huang, Jianhua

Source: DISCRETE AND CONTINUOUS DYNAMICAL SYSTEMS-SERIES B Volume: 17 Issue: 7 Pages: 2483-2508 DOI: 10.3934/dcdsb.2012.17.2483 Published: OCT 2012

Title: An analytic solution for the space-time fractional advection-dispersion equation using the optimal homotopy asymptotic method

Author(s): Pandey, Ram K.; Singh, Om P.; Baranwal, Vipul K.; et al.

Source: COMPUTER PHYSICS COMMUNICATIONS Volume: 183 Issue: 10 Pages: 2098-2106 DOI: 10.1016/j.cpc.2012.05.012 Published: OCT 2012

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Books

Topics in Fractional Differential Equations

Saïd Abbas, Mouffak Benchohra, Gaston M. N'Guérékata

(From: FCAA, Vol. 15, No. 4)

http://www.springer.com/mathematics/dynamical+systems/book/978-1-4614-4035-2.

Ser.: Developments in Mathematics, Vol. 27; ISBN: 978-1-4614-4035-2.

During the last decade, there has been an explosion of interest in fractional dynamics as it was found to play a fundamental role in the modeling of a considerable number of phenomena; in particular the modeling of memory-dependent and complex media. Fractional calculus generalizes integrals and derivatives to non-integer orders and has emerged as an important tool for the study of dynamical systems where classical methods reveal strong limitations. This book is addressed to a wide audience of researchers working with fractional dynamics, including mathematicians, engineers, biologists, and physicists. This timely publication may also be suitable for a graduate level seminar for students studying differential equations.

"Topics in Fractional Differential Equations" is devoted to the existence and uniqueness of solutions for various classes of Darboux problems for hyperbolic differential equations or inclusions involving the Caputo fractional derivative. In this book, problems are studied using the fixed point approach, the method of upper and lower solution, and the Kuratowski measure of noncompactness. An historical introduction to fractional calculus will be of

general interest to a wide range of researchers. Chapter 1 contains some preliminary background results. Chapter 2 is devoted to fractional order partial functional differential equations. Chapter 3 is concerned with functional partial differential inclusions, while in Chapter 4, functional impulsive partial hyperbolic differential equations are considered. Chapter 5 is concerned with impulsive partial hyperbolic functional differential inclusions. Implicit partial hyperbolic differential equations are considered in Chapter 6, and finally in Chapter 7, Riemann-Liouville fractional order integral equations are considered. Each chapter concludes with a section devoted to notes and bibliographical remarks. The work is self-contained but also contains questions and directions for further research.

Content Level: Research

Keywords: - Caputo Fractional derivative - Darboux problem - Riemann-Liouville Integral equations - fractional calculus - fractional differential equations - hyperbolic partial differential equation

Related subjects: Analysis - Dynamical Systems & Differential Equations

Features:

– Discusses the progress of fractional calculus as a tool in the study of dynamical systems

– Presents solutions to the various classes of Darboux problems for hyperbolic differential equations

– Addresses a wide audience of specialists including mathematicians, engineers, biologists, and physicists

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First Steps in Random Walks: From Tools to Applications

Joseph Klafter and Igor M. Sokolov

(From: FCAA, Vol. 15, No. 4)

http://www.oup.com/us/catalog/general/subject/Physics/Mathematicalphysics/?view=usa&ci=9780199234868#

ISBN13: 9780199234868 , ISBN10: 0199234868

Related subjects: Physics, Mathematical Physics

The name “random walk” for a problem of a displacement of a point in a sequence of independent random steps was coined by Karl Pearson in 1905 in a question posed to readers of “Nature”. The same year, a similar problem was formulated by Albert Einstein in one of his Annus Mirabilis works. Even earlier such a problem was posed by Louis Bachelier in his thesis devoted to the theory of financial speculations in 1900. Nowadays the theory of random walks has proved useful in physics and chemistry (diffusion, reactions, mixing in flows), economics, biology (from animal spread to motion of subcellular structures) and in many other disciplines. The random walk approach serves not only as a model of simple diffusion but of many complex sub- and super-diffusive transport processes as well. This book discusses the main variants of random walks and gives the most important mathematical tools for their theoretical description.

Features of this book:

- Unique pedagogical concept makes it accessible to undergraduate level;
- Gives practical coverage of all topics of random walk theory used in physics and chemistry;
- Includes the most up-to-date results;
- Well illustrated, including tutorial summaries, many exercises and examples;
- Solutions manual available for instructors

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4. CTRW and Aging Phenomena

5. Master Equations

6. Fractional Diffusion and Fokker-Planck Equations for Subdiffusion

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Recent Advances in Applied Nonlinear Dynamics with Numerical Analysis

*Fractional Dynamics, Network Dynamics, Classical Dynamics and Fractal Dynamics with Their Numerical Simulations

Changpin Li, Yujiang Wu and Ruisong Ye

http://www.worldscientific.com/worldscibooks/10.1142/8637

Nonlinear dynamics is still a hot and challenging topic. In this edited book, we focus on fractional dynamics, infinite dimensional dynamics defined by the partial differential equation, network dynamics, fractal dynamics, and their numerical analysis and simulation.

Fractional dynamics is a new topic in the research field of nonlinear dynamics which has attracted increasing interest due to its potential applications in the real world, such as modeling memory processes and materials. In this part, basic theory for fractional differential equations and numerical simulations for these equations will be introduced and discussed.

In the infinite dimensional dynamics part, we emphasize on numerical calculation and theoretical analysis, including constructing various numerical methods and computing the corresponding limit sets, etc.

In the last part, we show interest in network dynamics and fractal dynamics together with numerical simulations as well as their applications.

Contents:

- Gronwall Inequalities
- Existence and Uniqueness of Solutions to Fractional Differential Equations
- Finite Element Methods for Fractional Partial Differential Equations
- Fractional Step Methods for the Nonlinear Conservation Laws with Fractional Dissipation
- Error Analysis of Spectral Method for the Space and Time Fractional Fokker–Planck Equation
- The Discontinuous Galerkin Solutions for the Time Fractional Nonlinear Cauchy Problem
- Numerical Solutions of the Time Fractional Nonlinear Diffusion Equation in R2
- Asymptotic Analysis of a Singularly Perturbed Parabolic Problem in a General Smooth Domain
- Incremental Unknowns Methods for the Alternating Directional Implicit and Semi-implicit Schemes
- Stability of a Collocated Finite Volume Scheme for the Three-dimensional Navier–Stokes Equations
- Computing Multiple Solutions to the p–Henon Equation
- Multilevel Wavelet-like Block Incremental Unknowns Methods for a Class of Reaction–Diffusion Equations
- Models and Applications of Deterministically Growing Networks
- On Different Approaches to Synchronization of Spatiotemporal Chaos in Complex Networks: A Case Study
- Chaotic Dynamical Systems on Fractals and Their Application to Image Encryption
- Approximate Periodic Solutions of a Damped Harmonic Oscillator with Delayed Feedback
- The Numerical Methods in Option Pricing Problem
- Colorful Images with Group Symmetry From Dynamics
- Synchronization and its Control Between Two Coupled Networks

Readership: Senior undergraduates, postgraduates and experts in nonlinear dynamics with numerical analysis.

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Journals

Chaos

Volume 22, Number 3

Barriers to front propagation in ordered and disordered vortex flows

Dylan Bargteil and Tom Solomon

Invariant manifolds and the geometry of front propagation in fluid flows

Kevin A. Mitchell and John R. Mahoney

Horizontally propagating three-dimensional chemo-hydrodynamic patterns in the chlorite-tetrathionate reaction

Éva Pópity-Tóth, Dezső Horváth, and Ágota Tóth

Marangoni-driven convection around exothermic autocatalytic chemical fronts in free-surface solution layers

L. Rongy, P. Assemat, and A. De Wit

Influence of temperature on linear stability in buoyancy-driven fingering of reaction-diffusion fronts

D. Levitán and A. D'Onofrio

CHEMO-hydrodynamic coupling between forced advection in porous media and self-sustained chemical waves

S. Atis, S. Saha, H. Auradou, J. Martin, N. Rakotomalala, L. Talon, and D. Salin

Segmented waves in a reaction-diffusion-convection system

Federico Rossi, Marcello A. Budroni, Nadia Marchettini, and Jorge Carballido-Landeira

The heads and tails of buoyant autocatalytic balls

Michael C. Rogers and Stephen W. Morris

Ion-selective Marangoni instability—Chemical sensing of specific cation for macroscopic movement

Tetsuya Miyaoka, Jun Nishimura, Youhei Iida, Syungo Maki, and Akihisa Shioi

Chemo-Marangoni convection driven by an interfacial reaction: Pattern formation and kinetics

K. Eckert, M. Acker, R. Tadmouri, and V. Pimienta

Convection and reaction in a diffusive boundary layer in a porous medium: Nonlinear dynamics

Jeanne Therese H. Andres and Silvana S. S. Cardoso

CO_2 sequestration in a radial Hele-Shaw cell via an interfacial chemical reaction

Andrew R. White and Thomas Ward

Comment on “Generalized projective synchronization in time-delayed systems: Nonlinear observer approach” [Chaos 19, 013102 (2009); 20, 029902 (2010)]

S. Jeeva Sathya Theesar, P. Balasubramaniam, and Santo Banerjee

Erratum: “Multiple current reversals and diffusion enhancement in a symmetrical periodic potential” [Chaos 22, 033125 (2012)]

Chunhua Zeng, Hua Wang, and Linru Nie

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Classical Papers

The restaurant at the end of the random walk: recent developments in the description of anomalous transport by fractional dynamics

Ralf Metzler and Joseph Klafter

Publication information: Ralf Metzler and Joseph Klafter. The restaurant at the end of the random walk: recent developments in the description of anomalous transport by fractional dynamics. J. Phys. A: Math. Gen. 2004, 37 R161. doi:10.1088/0305-4470/37/31/R01

http://iopscience.iop.org/0305-4470/37/31/R01

Abstract

Fractional dynamics has experienced a firm upswing during the past few years, having been forged into a mature framework in the theory of stochastic processes. A large number of research papers developing fractional dynamics further, or applying it to various systems have appeared since our first review article on the fractional Fokker–Planck equation (Metzler R and Klafter J 2000a, Phys. Rep. 339 1–77). It therefore appears timely to put

these new works in a cohesive perspective. In this review we cover both the theoretical modelling of sub- and superdiffusive processes, placing emphasis on superdiffusion, and the discussion of applications such as the correct formulation of boundary value problems to obtain the first passage time density function. We also discuss extensively the occurrence of anomalous dynamics in various fields ranging from nanoscale over biological to geophysical and environmental systems.

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Random walk approximation of fractional-order multiscaling anomalous diffusion

Yong Zhang, David A. Benson, Mark M. Meerschaert, Eric M. LaBolle, Hans-Peter Scheffler

Publication information: Yong Zhang, David A. Benson, Mark M. Meerschaert, Eric M. LaBolle, Hans-Peter Scheffler. Random walk approximation of fractional-order multiscaling anomalous diffusion, Phys. Rev. E 74, 026706 (2006) [10 pages]

http://pre.aps.org/abstract/PRE/v74/i2/e026706

Abstract

Random walks are developed to approximate the solutions of multiscaling, fractional-order, anomalous diffusion equations. The essential elements of the diffusion are described by the matrix-order scaling indexes and the mixing measure, which describes the diffusion coefficient in every direction. Two forms of the governing equation (also called the multiscaling fractional diffusion equation), based on fractional flux and fractional divergence, are considered, where the diffusion coefficient and the drift vary in space. The particle-tracking algorithm is also extended to approximate anomalous diffusion with a streamline-dependent mixing measure, using a streamline-projection technique. In this and other general cases, the random walk method is the only known way to solve the nonhomogeneous equations. Five numerical examples demonstrate the flexibility, simplicity, and efficiency of the random walk method.

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The End of This Issue