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◆ Conferences

Notice for registration and accommodation of FDA2012

◆ Books

Topics in Fractional Differential Equations

Functional Fractional Calculus

◆ Journals

Fractional Calculus and Applied Analysis

Communications in Nonlinear Science and Numerical Simulation

◆ Classical Papers

Anomalous Diffusion and Relaxation Close to Thermal Equilibrium: A Fractional Fokker-Planck Equation Approach

A fractional derivative model to describe arterial viscoelasticity

◆ Researchers & Groups

Prof. Joseph (Yossi) Klafter

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Conferences

Notice for registration and accommodation of FDA2012

By now, the Fifth IFAC symposium on Fractional Differentiation and its Application has received 322 abstracts and 243 full papers covering most research theoretical and application fields of fractional calculus. This notice is to call your attention on registration and accommodation of FDA2012.

All the participants (including conference committee members, Sino-German workshop participants, plenary and semi-plenary speakers) should send Registration Form and accommodation information to us before April 25, 2012, specifying your arrival and departure dates. The plenary speakers will stay at the Sunning Hotel and the Sino-German Workshop participants at the Nanjing Grand Hotel. If your Registration Form and accommodation information cannot be received before this date, we cannot guarantee your hotel reservation and your paper will not be included in the conference proceeding.

If you have not sent Registration Form and accommodation information to us, please do it as soon as possible (Emailbox: **fda12@hhu.edu.cn** and **sun.fda2012@gmail.com**). For information about Registration and accommodation information of FDA2012 see

http://em.hhu.edu.cn/fda12/Regaccom.html

[Back]

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Books

Topics in Fractional Differential Equations

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

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

- 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

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 one contains some preliminary background results. The second Chapter is devoted to fractional order partial functional differential equations. Chapter three is concerned with functional partial differential inclusions, while in the fourth chapter, we consider functional impulsive partial hyperbolic differential equations. Chapter five is concerned with impulsive partial hyperbolic functional differential inclusions. Implicit partial hyperbolic differential equations are considered in Chapter six, and finally in Chapter seven, 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.

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

Table of contents

[Back]

Functional Fractional Calculus

Shantanu Das

http://www.springer.com/engineering/computational+intelligence+and+complexity/book/978-3-642-20544-6

- Introduction to Fractional Calculus for scientists and engineers
- Starting point for research in application of Fractional Calculus
- Extended and completely overworked 2nd edition

When a new extraordinary and outstanding theory is stated, it has to face criticism and skeptism, because it is beyond the usual concept. The fractional calculus though not new, was not discussed or developed for a long time, particularly for lack of its application to real life problems. It is extraordinary because it does not deal with 'ordinary' differential calculus. It is outstanding because it can now be applied to situations where existing theories fail to give satisfactory results. In this book not only mathematical abstractions are discussed in a lucid manner, with physical mathematical and geometrical explanations, but also several practical applications are given particularly for system identification, description and then efficient controls.

In the second edition of this successful book the concepts of fractional and complex order differentiation and integration are elaborated mathematically, physically and geometrically. Various important new examples are presented, such as heterogeneity effects in transport background, the space having traps or islands, irregular distribution of charges, non-ideal spring with mass connected to a pointless-mass ball, material behaving with viscous as well as elastic properties, system relaxation with and without memory, or physics of random delay in computer networks . Special emphasis in this new edition is placed on the practical utility of local fractional differentiation for enhancing the character of singularity at phase transition or characterizing the irregularity measure of response function. Practical results of viscoelastic experiments, fractional order control experiments, design of fractional controller and practical circuit synthesis for fractional order elements are presented in a modern approach as well.

Keywords: Applied Fractional Calculus - Differential Equation Systems - Functional Fractional Calculus - Generalized Fractional Calculs

Related subjects: Complexity - Computational Intelligence and Complexity - Computational Science & Engineering

Table of contents

- Observation of Fractional Calculus in Physical System Description
- Concept of Fractional Divergence and Fractional Curl
- Fractional Differintegrations Insight Concepts
- Initialized Differintegrals and Generalized Calculus
- Generalized Laplace Transform for Fractional Differintegrals
- Application of Generalized Fractional Calculus in Electrical Circuit Analysis & Electromagnetics
- Application of Generalized Fractional Calculus in Other Science and Engineering Fields
- System Order Identification and Control
- Solution of Generalized Differential Equation Systems

[Back]

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Journals

Fractional Calculus and Applied Analysis

Volume 15, Issue 2

Editorial
FCAA news, related meetings and books
Virginia Kiryakova

Research Paper
On fractional order derivatives and Darboux problem for implicit differential equations
Saïd Abbas, Mouffak Benchohra and Aleksandr N. Vityuk

Research Paper
A note on the existence of solutions for some boundary value problems of fractional differential inclusions
Aurelian Cernea

Research Paper
Solvability of a Dirichlet problem for a time fractional diffusion-wave equation in Lipschitz domains
Jukka Kemppainen

Survey Paper
Moving boundary problems for time fractional and composition dependent diffusion
Colin Atkinson

Research Paper
On the oscillation of fractional differential equations
Said R. Grace, Ravi P. Agarwal, Patricia J.Y. Wong and Ağacık Zafer

Research Paper
Existence and uniqueness results for a fractional evolution equation in Hilbert space
Emilia Bazhlekova

Research Paper
Monotone iterative method for a class of nonlinear fractional differential equations
Guotao Wang, Dumitru Baleanu and Lihong Zhang

Research Paper
Non-central-symmetric solution to time-fractional diffusion-wave equation in a sphere under Dirichlet boundary condition
Yuriy Povstenko

Research Paper
A fractional operator algorithm method for construction of solutions of fractional order differential equations
Kanat M. Shinaliyev, Batirkhan Kh. Turmetov and Sabir R. Umarov

Survey Paper
Tuning and implementation methods for fractional-order controllers
Ivo Petráš

Research Paper
The mean value theorems and a Nagumo-type uniqueness theorem for Caputo's fractional calculus
Kai Diethelm

Research Paper
On the convergence of quadratic variation for compound fractional Poisson processes
Enrico Scalas and Noèlia Viles

Survey Paper
Covariant fractional extension of the modified Laplace-operator used in 3D-shape recovery
Richard Herrmann

[Back]

Communications in Nonlinear Science and Numerical Simulation

Volume 17, Issue 9

Semi-exact solution for thermo-mechanical analysis of functionally graded elastic-strain hardening rotating disks
A. Hassani, M.H. Hojjati, G.H. Farrahi, R.A. Alashti

[Back]

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Classical Papers

Anomalous Diffusion and Relaxation Close to Thermal Equilibrium: A Fractional Fokker-Planck Equation Approach

Ralf Metzler, Eli Barkai, and Joseph Klafter

Publication information: R. Metzler, E. Barkai, and J. Klafter: Anomalous Diffusion and Relaxation Close to Thermal Equilibrium. Phys. Rev. Lett. 82(1999), 3563-3567. http://prl.aps.org/abstract/PRL/v82/i18/p3563_1.

We introduce a fractional Fokker-Planck equation describing the stochastic evolution of a particle under the combined influence of an external, nonlinear force and a thermal heat bath. For the force-free case, a subdiffusive behavior is recovered. The equation is shown to obey generalized Einstein relations, and its stationary solution is the Boltzmann distribution. The relaxation of single modes is shown to follow a Mittag-Leffler decay. We discuss the example of a particle in a harmonic potential.

[Back]

A fractional derivative model to describe arterial viscoelasticity

Damian Craiem and Ricardo L. Armentano

(Contributed by Dr. ir. Clara M. IONESCU)

Publication information: D. Craiem and R. L. Armentano. A fractional derivative model to describe arterial viscoelasticity. Biorheology 44 (2007) 251–263. http://iospress.metapress.com/content/h4788364313648j6/

Arterial viscoelasticity can be described with a complex modulus (E^*) in the frequency domain. In arteries, E^* presents a power-law response with a plateau for higher frequencies. Constitutive models based on a combination of purely elastic and viscous elements can be represented with integer order differential equations but show several limitations. Recently, fractional derivative models with fewer parameters have proven to be efficient in describing rheological tissues. A new element, called “spring-pot”, that interpolates between springs and

dashpots is incorporated. Starting with a Voigt model, we proposed two fractional alternative models with one and two spring-pots. The three models were tested in an anesthetized sheep in a control state and during smooth muscle activation. A least squares method was used to fit E^*. Local activation induced a vascular constriction with no pressure changes. The E^* results confirmed the steep increase from static to dynamic values and a plateau in the range 2–30 Hz, coherent with fractional model predictions. Activation increased E^*, affecting its real and imaginary parts separately. Only the model with two spring-pots correctly followed this behavior with the best performance in terms of least squares errors. In a context where activation separately modifies E^*, this alternative model should be considered in describing arterial viscoelasticity in vivo.

[Back]

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Researchers & Groups

Prof. Joseph (Yossi) Klafter

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Brief Biography:
BSc. Physics, Bar Ilan University (1967); MSc. Physics Bar Ilan University (1969);
PhD. Chemistry Tel Aviv University (1978); Postdoctoral Fellow, Chemistry MIT (1978-1980);
Exxon Research and Engineering (1980-1987); Tel Aviv University from 1987;
Chair Professor of Chemistry from 1998. Heinemann Professor of Physical Chemistry.

Fellow American Physical Society (1993);
Alexander von Humboldt Foundation Prize (1996);
Weizmann Prize for Sciences(1999);
Kolthoff award of the Technion (2003);
Rothschild Prize in Chemistry (2004);
Israel Chemical Society Prize (2005);
Representative at the European Science Foundation, PESC committee (from 2001).
Head of Exact Sciences and Technology, Israel Science Foundation (1996-2002).
Chairman of the Academic Board of the Israel Science Foundation, ISF, (from 2002).
Fellow of the Institute for Advanced Studies (FRIAS), Freiburg

Research Interests

- **Levy flights and walks and anomalous diffusion in complex systems:** The concept of Levy walks, introduced by us, generalizes the known Brownian motion to include anomalous diffusion. Properties of these stochastic processes and applications to nonlinear system are investigated. Theoretical frameworks for both enhanced diffusion and subdiffusion are introduced.
- **Fractional Fokker-Planck equations:** Since anomalous diffusion and non-exponential relaxation are already established in a broad spectrum of complex systems, modifications of the traditional kinetic equations are needed. we propose such modifications in terms of fractional calculus, and study the properties of the resulting fractional equations.
- **Dendrimers as light harvesting antenna systems:** Energy transfer and reaction mechanisms in supermolecules such as dendrimers are investigated, following our suggestion to use these tree-like molecules for light harvesting.
- **Escape through fluctuating bottlenecks and resonant activation:** Chemical reactions, which are described in terms of crossing fluctuating barriers are studied by mapping on random walks in finite systems.
- **Atomic scale friction in sheared confined systems:** The "textbook" concepts of friction are being revisited in the light of the recent experimental results. Methods for controlling friction using mechanical and chemical approaches are introduced.
- **Molecular Engines - Car and Wheels:** We have introduced a new approach to build microscopic engines on the stomic scale that move translationally or rotationally and can preform useful functions such as pulling as of a cargo. Characteristic of these engines is the possibility to determine dynamically the directionality of the motion. The approach is based on the transformation of the fed energy to directed motion through a dynamical competition between the intrinsic lenghts of the moving object and the supporting carrier.
- **Single Molecules Processes:** Single molecule spectroscopy is by now an established approach, which can report on distributions of molecular properties such as spectral diffusion, and can provide kinetic information on conformational changes such as folding and unfolding of molecules without the scrambling that occurs due to ensemble averaging. This information can be valuable in particular for biomolecules, where rare events might have functional significant, but which can be masked in an ensemble approach. Both low temperature spectral diffusion and force measurements of single molecules are investigated and related to experimental observations.

Selected Papers

I. Eliazar and J. Klafter, Statistical resilience of random populations to random perturbations, Phys. Rev. E, 79, no. 011103 (2009)

M. Magdziarz, A. Weron and J. Klafter, Equivalence of the fractional Fokker-Planck and subordinated Langevin equations: The case of time-dependent force, Phys. Rev. Lett., 101, 210601 (2008)

I. Eliazar and J. Klafter, Fractal poisson processes, Physica A, 387,4985-4996 (2008)

S. B. Yuste, G. Oshanin, K. Lindenberg, O. Benichou and J. Klafter, Survival probability of a particle in a sea of mobile traps: A tale of tails, Phys. Rev. E, 78, 2, no. 021105, part 1 (2008)

A. Lubelski, I. M. Sokolov and J. Klafter, Nonergodicity inhomogeneity in single particle tracking, Phys. Rev. Lett., 100, 250602(4) (2008)

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S. Condamin, O. Benichou, V. Tejedor, R. Voituriez and J. Klafter, First-Passage times in complex scale-invariant media, Nature 450, 77-80 (2007)

T. Koren, M.A. Lomholt, A.V. Chechkin, J. Klafter and R. Metzler, Leapover lengths and first passage time statistics for levy flights, Phys. Rev. Lett. 99, 160602 (2007)

M. A. Lomholt, M. Urbakh, R. Metzler and J. Klafter, Manipulating Single Enzymes by an External Harmonic Force, Phys. Rev. Lett. 98, 168302 (2007)

I. M. Sokolov and J. Klafter, Field-induced dispersion in subdiffusion, Phys. Rev. Lett. 97, 140602 (2006).

R. Granek and J. Klafter, Fractons in Proteins: Can they Lead to Anomalously Decaying Time Autocorrelations, Phys. Rev. Lett. 95, 098106 (2005).

O. Flomenbom, K. Velonia, D. Loos, S. Masuo, M. Cotlet, Y. Engelborghs, Hofkens, A.E. Rowan, R.J.M. Nolte, F.C. de Schryver and J. Klafter, Stretched Exponential Decay and Correlations in the Catalytic behavior of Fluctuating Individual Lipase Molecules, Proc. Nat. Acad. Sci. (USA), 102, 2368-2372 (2005).

J. Klafter and I. M. Sokolov, Anomalous Diffusion Spreads its Wings, Physics World 18, 29-32 (2005).

Editorial Boards

- International Journal of Modern Physics B
- Israel Journal of Chemistry
- Journal of Physical Chemistry (1994-1999)
- Journal of Luminescence
- Recent Research Developments in Physical Chemistry

Selected Books

- Co Editor of a Special Issue of J. Phys. C on “Molecular Motors and Friction” (2005)
- Co Editor of a Special Issue of Chemical Physics on "Strange Kinetics" (Nov 2002)
- Co Editor of a Special Issue of Chemical Physics on “Transport Properties in Disordered Systems” 1993
- Guest Co Editor of a Special Issue of Chemical Physics in “Energy Transfer and Relaxation in Low Dimensional Systems” (October, 1990)
- Co Editor of the book “Transport and Relaxation in Random Materials” (World Scientific, Singapore, 1987).

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[Back]

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The End of This Issue