

Editors: [W. Chen](#) [H.G. Sun](#) [X.D. Zhang](#) [S. Hu](#)

Institute of Soft Matter Mechanics, Hohai University

For contribution: [fdaexpress@hhu.edu.cn](mailto:fdaexpress@hhu.edu.cn)

For subscription: <http://em.hhu.edu.cn/fda/subscription.htm>

◆ **Open Issues & Discussions**

[Fractional diffusion models for particle diffusion in complex media](#)

◆ **Conferences**

[Second Announcement: The 5th IFAC Symposium on Fractional Differentiation and its Applications](#)

[\(FDA12\)](#)

[IFAC Joint Conference Symposium system Structure and Control Workshops Time-delay systems and Fractional Differentiation and Its application](#)

◆ **Books**

[Stochastic Models for Fractional Calculus](#)

[Fractional Dynamics and Control](#)

◆ **Journals**

[Fractals \(Volume 19, Issue 4, December 2011\)](#)

◆ **Researchers & Groups**

[Igor Podlubny](#)

◆ **Toolbox**

[Mittag-Leffler function](#)

◆ **Jobs**

[A permanent position of Head of R&D projects at BRGM on Water Quality](#)  
[Research Assistant Professor Position in Fracturing Laboratory Experiments](#)

---

---

## Open Issues & Discussions

---

### Fractional diffusion models for particle diffusion in complex media

(Contributed by H.G. Sun)

In recent decades, the phenomena of anomalous diffusion have been observed in many physical systems, e.g., pollutant transport through porous media, water transfer in soil and underground water, electron transfer in semiconductor and nuclear proliferation. The study of anomalous diffusion is also of special significance in chemistry, biology, environmental science, even in economics. However, in complex diffusion modeling, there are still some perplexing open research issues which are not well settled, such as

- (1) The diffusion processes which change with time evolution, spatial position or system parameters; it maybe require the variable-order diffusion models.
- (2) The diffusion processes in the inhomogeneous medium;
- (3) The multi-scale diffusion process which involves both diffusion in mobile and immobile media.
- (4) The anomalous diffusion processes under an oscillating external field.
- (5) Power law phenomena and its statistical characterization.

[\[Back\]](#)

---

---

## Conferences

---

### Second Announcement: The 5th IFAC Symposium on Fractional Differentiation and its Applications - FDA12

May 14-17 2012, Hohai University, Nanjing, China

Website: <http://em.hhu.edu.cn/fda12/>

#### Invitation to FDA12

The purpose of this Symposium in series is to provide the participants with a broad overview of the state of the art on fractional systems, leading to the cross-fertilization of new research on theoretical, experimental and computational fronts for potential uses of fractional differentiation in diverse applications. The organizing committee invites you from all over the world to come to Nanjing to attend this wonderful event.

## Topics

Anomalous diffusion; Automatic Control; Biology; Continuous Time Random Walk; Electrical Engineering; Electronics; Electrochemistry; Electromagnetism; Finance and Economics; Earth Science; Fractional Filters; Biomedical Engineering; Fractional Phase-Locked Loops; Fluid Mechanics; Fractional Variational Principles; Fractional Transforms; Fractional Wavelet; Composite Drug Signals; History of Fractional Calculus; Image Processing; Mathematical methods; Mechanics; Physics; Robotics; Signal Processing; Singularities Analysis and Integral Representations for Fractional Differential Systems; Special Functions Related to Fractional Calculus; Thermal Engineering; Viscoelasticity; etc.

## Plenary speakers

Prof. Guanrong Chen Prof. Virginia Kiryakova  
Prof. Joseph Klafter Prof. Jean-Claude Trigeassou  
Prof. Bruce J. West Prof. Weiqiu Zhu

## Important dates

Deadline for abstracts: 1 January 2012

Deadline for full papers: 15 February 2012

Deadline for early registration (fill online registration): 15 February 2012

This series of conferences is the largest of its kind. Following the previous successful conferences, 2004 in France, 2006 in Portugal, 2008 Turkey, and 2010 in Spain, we expect that 200 or so participants from around the world will attend the FDA12.

We are looking forward to meeting you at the FDA12, in Nanjing, China.

-----Organizing Committee of FDA12

[\[Back\]](#)

---

## IFAC Joint Conference Symposium system Structure and Control Workshops Time-delay systems and Fractional Differentiation and Its application

Grenoble, France, February 4-6, 2013

**SCOPE:** This “Joint Conference” gathers all the activities of IFAC TC 2.2 Linear Control Systems: Control and structure, Time-delay systems and Fractional differentiation.

The aim is to bring together experts working in systems and control to discuss new trends, exchange new ideas, establish fruitful contacts, and promote interactions among the various fields of interest. Applications and industry papers are encouraged.

The conference will be organized in 4 tracks

• **Track A: Control Theory**

Linear systems, switching systems, LPV systems, sampled-data systems, nonlinear systems, systems with saturation, uncertain systems, polynomial systems, positive systems, identification, structural approaches, MIMO control, robust control, predictive control, model reduction, observers.

• **Track B: Control Applications**

Automotive, robotics, chemical processes, biological systems, energy and nuclear, sustainable development, numerical issues in control, network controlled-systems.

• **Track C: Time-Delay Systems**

Modeling and identification, stability and stabilization, robustness issues, observation, control design, infinite dimensional systems, distributed parameter systems.

• **Track D: Fractional Differentiation and Applications**

Analysis tools, biomedical engineering, fractional earth science, fractional filters, fractional order modeling and control, fractional transforms and their applications, filtering, image processing, mechanics, observation, wavelet applications, Electrochemistry, Thermal systems, Economy, Mathematics.

**IMPORTANT DATES (deadlines):**

Invited session submission: June 1, 2012

Regular Paper Submission: June 15, 2012

Notification of acceptance: September 15, 2012

Final Paper Submission: November 1, 2012

**NATIONAL ORGANIZING COMMITTEE:** O. Sename (NOC Chair), P. Tona (NOC Vice-Chair Industry), J. Zaytoon (NMO representative, SEE, [janan.zaytoon@univ-reims.fr](mailto:janan.zaytoon@univ-reims.fr)), M-R. Alfara, A. Bratcu, T. Champier, M. Di Maria, L. Dugard, H. El Mansouri, D. Koenig, J.-J. Martinez-Molina, S. Mocanu, C. Prieur, A. Voda, E. Witrant.

[\[Back\]](#)

---

---

## New Books

---

### Stochastic Models for Fractional Calculus

(Mark M. Meerschaert and Alla Sikorskii, Michigan State University, USA)

from DeGruyter

This book is based on a series of lecture notes for a graduate course in the Department of Statistics and Probability at Michigan State University. The goal is to prepare graduate students for research in the area of fractional calculus, anomalous diffusion, and heavy tails. The basic ideas of fractional calculus and anomalous diffusion are introduced in the context of probability theory. The book includes vector models with anisotropic fractional derivatives. Although the book contains complete mathematical details, it is written in a style that should be appealing to engineers and scientists. Each section of the book provides material roughly equivalent to one lecture. Each section begins by outlining the main ideas, with examples. Then the mathematical details are collected at the end of each section. The book also contains R codes for simulation and computation, along with step-by-step instructions. .

Contents:

- Introduction
- Fractional Derivatives
- Stable Limit Distributions
- Continuous Time Random Walks
- Computations in R
- Vector Fractional Diffusion
- Applications and Extensions

[\[Back\]](#)

---

## Fractional Dynamics and Control

(Dumitru Baleanu, José António Tenreiro Machado and Albert C. J. Luo)

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.

- Discusses how fractional dynamics and control can be used to solve nonlinear science and complexity issues
- Shows how fractional differential equations and models can be used to solve turbulence and wave equations in mechanics and gravity theories and Schrodinger's equation

- Presents fractional relaxation modeling of dielectric materials and wave equations for dielectrics
- Develops new methods for control and synchronization of fractional dynamical systems

Fractional Dynamics and Control is an ideal book for scholars, researchers and advanced technical members of industrial laboratory facilities, for developing new tools and products in the field of nonlinear dynamics and control.

### **Contents:**

#### Part I Fractional Control

- A Formulation and Numerical Scheme for Fractional Optimal Control of Cylindrical Structures.
- Neural Network Assisted  $PI^1D^m$  Control.
- Application of Backstepping Control Technique to Fractional Order Dynamic Systems.
- Parameter Tuning of a Fractional-Order PI Controller Using the ITAE Criteria.
- A Fractional model predictive control for fractional order systems.
- A note on the sequential linear fractional dynamical systems from the control system view point and  $L^2$  theory.
- Stabilization of Fractional Order Unified Chaotic Systems via Linear State Feedback Controller.

#### Part II Fractional Variational Principles and Fractional Differential Equations

- Fractional variational calculus for non-differentiable functions.
- Fractional Euler-Lagrange differential equations via Caputo derivatives, Ricardo Almeida.
- Strict Stability of Fractional Perturbed Systems in Terms of Two Measures.
- Initial Time Difference Strict Stability of Fractional Dynamic Systems.
- A Fractional Order Dynamical Trajectory Approach for Optimization Problem with HPM.

#### Part III Fractional Calculus in Mathematics and Physics

- On the Hadamard type fractional differential system.
- Robust Synchronization and Parameter Identification of Fractional Order Unified Chaotic System.
- Fractional Cauchy problems on bounded domains: survey of recent results.
- Fractional analogous models in mechanics and gravity theories.
- Schrodinger equation in fractional space.
- Solutions of wave equations in fractional dimensional space.
- Fractional exact solutions and solitons in gravity.

#### Part IV Fractional Order Modeling

- Front propagation in an autocatalytic reaction-subdiffusion system.

- Numerical Solution of A Two Dimensional Anomalous Diffusion Problem.
- Analyzing Anomalous Diffusion in NMR Using a Distribution of Rate Constants.
- Using fractional derivatives to generalize the Hodgkin-Huxley model.
- An Application of Fractional Calculus to Dielectric Relaxation Processes.
- Fractional wave equation for dielectric medium with Havriliak-Negami response.

[\[Back\]](#)

---

---

## Journals

---

---

### Fractals

Volume: 19, Issue: 4 (December 2011)

#### Articles

FLOW OVER FRACTALS: DRAG FORCES AND NEAR WAKES

HYUNG SUK KANG, DUANE DENNIS and CHARLES MENEVEAU

DOI No: 10.1142/S0218348X1100549X, Page: 387-399

FRACTAL ANALYSIS OF SOIL PORE VARIABILITY WITH TWO DIMENSIONAL BINARY IMAGES

R. UTHAYAKUMAR, G. AROCKIA PRABAKAR and S. ABDUL AZIS

DOI No: 10.1142/S0218348X11005567, Page: 401-406

REMOTE-SENSING EXPERT CLASSIFICATION OF LAND USE/LAND COVER TYPES USING FRACTAL DIMENSIONS OVER A SUBTROPICAL HILLY REGION IN CHINA

JI ZHU, ZIYU LIN and XIAOZHOU LI

DOI No: 10.1142/S0218348X11005452, Page: 407-421

FRACTAL DIMENSION OF THE DROSOPHILA CIRCADIAN CLOCK

HASSAN M. FATHALLAH-SHAYKH

DOI No: 10.1142/S0218348X11005476, Page: 423-430

RECURRENT TWO-DIMENSIONAL SEQUENCES GENERATED BY HOMOMORPHISMS OF FINITE ABELIAN  $p$ -GROUPS WITH PERIODIC INITIAL CONDITIONS

MIHAI PRUNESCU

DOI No: 10.1142/S0218348X1100552X, Page: 431-442

EFFECT OF LINEAR AND NONLINEAR FILTERS ON MULTIFRACTAL DETRENDED  
CROSS-CORRELATION ANALYSIS

JIE SONG and PENGJIAN SHANG

DOI No: 10.1142/S0218348X11005464, Page: 443-453

ON MINKOWSKI MEASURABILITY

F. MENDIVIL and J. C. SAUNDERS

DOI No: 10.1142/S0218348X11005506, Page: 455-467

PIEZOELECTRIC ULTRASONIC TRANSDUCERS WITH FRACTAL GEOMETRY

A. J. MULHOLLAND and A. J. WALKER

DOI No: 10.1142/S0218348X11005555, Page: 469-479

CONNECTIVITY PROPERTIES OF SIERPIŃSKI RELATIVES

T. D. TAYLOR

DOI No: 10.1142/S0218348X11005531, Page: 481-506

AUTHOR INDEX VOLUME 19 (2011), Page: 507-509

[\[Back\]](#)

---

---

## Researchers & Groups

---

---

**Igor Podlubny**

Technical University of Kosice, Slovakia.

### **A Short Outline of His Life**

Professor of Process Control, BERG Faculty, Technical University of Kosice, Slovakia. He works on theories of fractional calculus, integral transforms, integral equations, orthogonal polynomials, special functions and its applications on viscoelasticity, heat conduction, fracture mechanics, dynamics and control systems. He is associate editor of Journal of Mathematical Analysis and Applications and Applied Mathematics and Computation, and member of American Mathematical Society, Mathematical Association of America and IEEE.

Degrees and Titles:

CSc (PhD) , Differential equations and mathematical physics, λ Odessa State University, Odessa, Ukraine (former USSR), 1989;

RNDr, Applied mathematics, Comenius University, Bratislava, 1990;  
University Docent habilitation, Process control, Technical University of Kosice, 1995;  
University Professor, Title awarded by the President of the Slovak Republic, 2001;  
DrSc, Applied mathematics, advanced (or higher) doctorate, awarded by the Slovak Technical University, 2010.

### **Selected Publications**

1. Podlubny, I., Fractional-Order Systems and PID $\mu$ -Controllers, IEEE Transactions on Automatic Control, 1999, 44(1): 208–213.
2. I. Podlubny, Fractional Differential Equations. Academic Press, 1999.
3. Podlubny, I., Geometric and Physical Interpretation of Fractional Integration and Fractional Differentiation, Fractional Calculus and Applied Analysis, 2002, 5(4): 67–386.
4. Vinagre, B. M., Petras, I., Podlubny, I. and Chen, Y. Q., Using Fractional Order Adjustment Rules Fractional Order Reference Models in Model-Reference Adaptive Control, Nonlinear Dynamics, 2002, 29(1-4): 269–279.
5. Podlubny, I., Petras, I., Vinagre, B.M., O'Leary P. and Dorcak L., Analogue Realizations of Fractional-order Controllers, Nonlinear Dynamics, 2002, 29(1-4): 281–296.
6. Chen, YQ., Vinagre, B.M. and Podlubny, I., Continued Fraction Expansion Approaches to Discretizing Fractional Order Derivatives—an Expository Review. Nonlinear Dynamics, 2004, 38(1–2): 155–170.
7. Heymans, N. and Podlubny, I., Physical interpretation of initial conditions for fractional differential equations with Riemann-Liouville fractional derivatives, 2006, Rheologica Acta, 45(5): 765–772.
8. Chen YQ, Ahn HS, Podlubny I., Robust stability check of fractional order linear time invariant systems with interval uncertainties. Signal Processing, 2006, 86(10): 2611-2618.
9. Li Y., Chen YQ, Podlubny I., Mittag–Leffler stability of fractional order nonlinear dynamic systems, 2009, 45(8): 1965-1969.

[\[Back\]](#)

---

---

## **Toolbox**

---

### **Mittag-Leffler function**

by [Igor Podlubny](#), 17 Oct 2005

(From Matlab Central, Updated 25 Mar 2009)

#### **Description**

This is a MATLAB routine for evaluating the Mittag-Leffler function with two parameters (sometimes also called generalized exponential function).

The Mittag-Leffler function with two parameters plays an important role and appears frequently in solutions of fractional differential equations (i.e. differential equations containing fractional derivatives).

Usage: MLF(alpha,beta,Z,P) is the Mittag-Leffler function  $E_{\{\alpha,\beta\}}(Z)$  evaluated with accuracy  $10^{(-P)}$  for each element of Z.

Update 2009-03-25: (1) Now Z can also be a two-dimensional array. (2) Addressed the issue reported by Li Jackie. It was caused by rounding errors during computations.

### Download

<http://www.mathworks.fr/matlabcentral/fileexchange/8738-mittag-leffler-function>

[\[Back\]](#)

---

## Jobs

---

### A permanent position of Head of R&D projects at BRGM on Water Quality

#### Job location and estimated date of taking office:

EAU – QAL – Orléans (France) – 1st quarter 2012

#### Training – Experience:

You are a **graduate engineer and/or a Ph.D. in hydrogeology or environmental geochemistry with strong background on the water quality and you have 10 years of professional experience** in the field of understanding of the transport of contaminants (organic and inorganic) in the different compartments of surface and underground water systems (reactive geochemistry), building and management of research and public service projects.

#### Context and contribution of the position:

Within the framework of the development of research, public service and international projects of the Water Quality Unit (QAL), focused on research on organic and inorganic pollutants transfer within surface and underground water systems under various constraints (including global and climate changes), you will be mainly responsible to:

- Initiate, manage and conduct research projects and public service by developing and strengthening partnerships with funding agencies (EU, NAR, Ministries, Government Departments, local and regional authorities, industrials, international funding, etc.),
- lead and manage the project program focused on "*water quality of hydrosystems*",
- apply the team skills for developing and implementation of specific projects within the French network of regional geological surveys, with other BRGM divisions, engage partners from academic research as well as partners of SMEs and industrials (through activities of the national Water Poles, i.e., WATER, DREAM and HYDREOS),
- promote the results of R & D projects by scientific publications, communication materials and popularization documents and, suggest new topics for thesis, post doc, ...

- carry out scientific expertise in accordance with the BRGM charter of the expertise,

**Competences and required qualifications:**

- open mind to all disciplines of water and environment (diffuse pollution, nitrates, pesticides, emerging pollutants, ...);
- strategic vision on the topic of water quality, national and international academic research network;
- good background on hydrogeochemistry/hydrogeology, the functioning of the unsaturated – saturated zone continuum of hydrosystems and aquifer vulnerability;
- hydrodynamic modelling (conceptual and global models, numerical models), functioning characterization of the various compartments of hydrosystems;
- ability to initiate/lead the assembly of new and innovative projects;
- knowledge of national and European regulations on the preservation of water quality and delivery in good chemical and ecological status of water bodies (i.e., EU Water Framework Directive, etc.);
- good communication skills, teamwork, and lead a project team;
- good practice in project management and writing scientific papers, technical reports;
- good fluency in English and good level in French (oral and written);

*Map of BRGM jobs: Project Manager 2*

► Thank you for sending your application and current CV before November 30, 2011 to Ms. Anita SLANSKY, DRH/MCR by e-mail ([a.slansky@brgm.fr](mailto:a.slansky@brgm.fr))

*For more information and to obtain the complete description of the position, you can contact Nathalie Dörfliger ([n.dorfliger@brgm.fr](mailto:n.dorfliger@brgm.fr)) or Mohamed Azaroual ([m.azaroual@brgm.fr](mailto:m.azaroual@brgm.fr)). The Human Resources Direction of BRGM reserves the right not to consider applications from employees with less than three years of experience in their position.*

[\[Back\]](#)

---

## **Research Assistant Professor Position in Fracturing Laboratory Experiments**

The Department of Petroleum Engineering at Colorado School of Mines is seeking a research assistant professor to work on a research project funded by RPSEA and the US Department of Energy on developing cryogenic fracturing technology for shale and tight gas reservoirs. This work is part of a \$4.5 million project to test the feasibility of cryogenic fracturing fluids in laboratory settings and expand the concept to field applications. Partners in the project include the Colorado School of Mines Petroleum Engineering Department, Lawrence Berkeley National Laboratories, Pioneer Natural Resources, and Carbo Ceramics. The tasks for the postdoctoral researcher include:

- 1) Develop and carry out various laboratory fracturing experiments using cryogenic fluids;

- 2) Model the effects of cryogenic fluids interaction with various materials including porous media; and,
- 3) Investigation of scaling laboratory results to field scale.

The position will start on approximately February 1, 2012. An initial annual salary of \$60K is offered, plus full employee benefits. The appointment will be made initially for three (3) years (2012-2014) with the potential to be extended past 2014. The research position is expected to work with Dr. Yu-Shu Wu, Dr. Xiaolong Yin, and Dr. Jennifer Miskimins in the Petroleum Engineering Department and interact with Dr. Timothy J. Kneafsey in the Lawrence-Berkeley National Laboratory.

**Required Skills:**

Experience in laboratory fracturing processes and the associated fundamental rock mechanics and thermodynamics. Scaling of laboratory processes to reservoir/field levels. Good understanding of fundamental continuum mechanics rock mechanics, heat transfer, and phase behavior of liquid cryogenic gases. Good communication and presentation skills.

**Desired Skills:**

Experience with MATLAB.

Recently graduated PhD students without all of the required skills but are exceptional in research capability and initiative will be considered. There is no specific requirement on the major of applicants but the following disciplines are preferred: Mechanic, Chemical and Civil Engineering; Soil and Environmental Science and Engineering, and Geological and Petroleum Engineering.

Interested applicants please submit an electronic CV to Dr. Yu-Shu Wu via email ([ywu@mines.edu](mailto:ywu@mines.edu)). The CV should include two references where recommendations will be sought. Application review begins now and will continue until the position is filled.

Dr. Yu-Shu Wu  
Professor  
Petroleum Engineering Department  
Colorado School of Mines

[\[Back\]](#)

