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Fractional-order Modeling of Nuclear Reactor: From Subdiffusive Neutron Transport to Control-oriented Models

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Fractional viscoelastic models with non-singular kernels

◆ Websites of Interest
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Fractional Calculus & Applied Analysis
Latest SCI Journal Papers on FDA

(Searched on Nov. 30, 2018)

Estimating lead and zinc concentrations in peri-urban agricultural soils through reflectance spectroscopy: Effects of fractional-order derivative and random forest.
By: Hong, Yongsheng; Shen, Ruili; Cheng, Hang; etc.

Regularity criterion for a critical fractional diffusion model of two-dimensional micropolar flows
By: Tan, Wen; Dong, Bo-Qing; Chen, Zhi-Min
JOURNAL OF MATHEMATICAL ANALYSIS AND APPLICATIONS Volume: 470 Issue: 1 Pages: 500-514 Published: FEB 1 2019

Crowds involving individuals with disabilities: Modeling heterogeneity using Fractional Order Potential Fields and the Social Force Model
By: Stuart, Daniel S.; Sharifi, Mohammad Sadra; Christensen, Keith M.; etc.
PHYSICA A-STATISTICAL MECHANICS AND ITS APPLICATIONS Volume: 514 Pages: 244-258 Published: JAN 15 2019

Stability approach to the fractional variational iteration method used for the dynamic analysis of viscoelastic beams
By: Martin, Olga
JOURNAL OF COMPUTATIONAL AND APPLIED MATHEMATICS Volume: 346 Pages: 261-276 Published: JAN 15 2019

Stability analysis of a fractional order model for the HIV/AIDS epidemic in a patchy environment
By: Kheiri, Hossein; Jafari, Mohsen
JOURNAL OF COMPUTATIONAL AND APPLIED MATHEMATICS Volume: 346 Pages: 323-339 Published: JAN 15 2019

On a space fractional backward diffusion problem and its approximation of local solution
By: Triet Le Minh; Tran Thi Khieu; Tra Quoc Khanh; etc.
JOURNAL OF COMPUTATIONAL AND APPLIED MATHEMATICS Volume: 346 Pages: 440-455 Published: JAN 15 2019

Identification of time-dependent convection coefficient in a time-fractional diffusion equation
By: Sun, Liangliang; Yan, Xiongbin; Wei, Ting
JOURNAL OF COMPUTATIONAL AND APPLIED MATHEMATICS Volume: 346 Pages: 505-517 Published: JAN 15 2019

Transient vibrations of a fractional Kelvin-Voigt viscoelastic cantilever beam with a tip mass and subjected to a base excitation
By: Freundlich, Jan
JOURNAL OF SOUND AND VIBRATION Volume: 438 Pages: 99-115 Published: JAN 6 2019

A nonlinear constitutive model by spring, fractional derivative and modified bounding surface model to represent the amplitude, frequency and the magnetic dependency for Magneto-sensitive rubber
Numerical modeling and experimental validation of fractional heat transfer induced by gas adsorption in heterogeneous coal matrix
By: Kang, Jianhong; Zhang, Di; Zhou, Fubao; etc.
INTERNATIONAL JOURNAL OF HEAT AND MASS TRANSFER Volume: 128 Pages: 492-503 Published: JAN 2019

A fractional model to relative viscosity prediction of water-in-crude oil emulsions
By: do Carmo, Wesley P.; Lenzi, Marcelo K.; Lenzi, Ervin K.; etc.
JOURNAL OF PETROLEUM SCIENCE AND ENGINEERING Volume: 172 Pages: 493-501 Published: JAN 2019

Lie symmetry analysis, conservation laws and numerical approximations of time-fractional Fokker-Planck equations for special stochastic process in foreign exchange markets
By: Habibi, Noora; Lashkarian, Elham; Dastranj, Elham; etc.
PHYSICA A-STATISTICAL MECHANICS AND ITS APPLICATIONS Volume: 513 Pages: 750-766 Published: JAN 1 2019

Modelling temporal decay of aftershocks by a solution of the fractional reactive equation
By: Sanchez C, Ewin; Vega-Jorquera, Pedro
APPLIED MATHEMATICS AND COMPUTATION Volume: 340 Pages: 43-49 Published: JAN 1 2019

Blood vessel segmentation in retinal fundus images using Gabor filters, fractional derivatives, and Expectation Maximization
By: Aguirre-Ramos, Hugo; Gabriel Avina-Cervantes, Juan; Cruz-Aceves, Ivan; etc.
APPLIED MATHEMATICS AND COMPUTATION Volume: 339 Pages: 568-587 Published: DEC 15 2018

Application of fractional-order active disturbance rejection controller on linear motion system
By: Shi, Xinxin; Chen, YangQuan; Huang, Jiacai
CONTROL ENGINEERING PRACTICE Volume: 81 Pages: 207-214 Published: DEC 2018

Fractional Integration Versus Structural Change: Testing the Convergence of CO2 Emissions
By: Barassi, Marco R.; Spagnolo, Nicola; Zhao, Yuqian
ENVIRONMENTAL & RESOURCE ECONOMICS Volume: 71 Issue: 4 Pages: 923-968 Published: DEC 2018

Closed-form expressions for effective viscoelastic properties of fiber-reinforced composites considering fractional matrix behavior
By: Hofer, U.; Luger, M.; Traxl, R.; etc.
MECHANICS OF MATERIALS Volume: 127 Pages: 14-25 Published: DEC 2018

The concentration-compactness principle for fractional order Sobolev spaces in unbounded domains and applications to the generalized fractional Brezis-Nirenberg problem
By: Fernandez Bonder, Julian; Saintier, Nicolas; Silva, Analia
NODEA-NONLINEAR DIFFERENTIAL EQUATIONS AND APPLICATIONS Volume: 25 Issue: 6 Document number: 52 Published: DEC 2018

Macroeconomic models with long dynamic memory: Fractional calculus approach
By: Tarasov, Vasily E.; Tarasova, Valentina V.
APPLIED MATHEMATICS AND COMPUTATION Volume: 338 Pages: 466-486 Published: DEC 1 2018

Numerical computations of fractional nonlinear Hartmann flow with revised heat flux model
By: Rasheed, Amer; Anwar, Muhammad Shoib
COMPUTERS & MATHEMATICS WITH APPLICATIONS Volume: 76 Issue: 10 Pages: 2421-2433 Published: NOV 15 2018

Co-Estimation of State of Charge and State of Health for Lithium-Ion Batteries Based on Fractional-Order Calculus
By: Hu, Xiaosong; Yuan, Hao; Zhou, Changfu; etc.
IEEE TRANSACTIONS ON VEHICULAR TECHNOLOGY Volume: 67 Issue: 11 Pages: 10319-10329 Published:
Call for Papers

Special Issue "Applications of Statistical Thermodynamics"

Entropy (IF:2.305)

Special Issue Information

Dear Colleagues,

Statistical thermodynamics span the bridge between the visible macroscopic world and the invisible atomistic world to evaluate values of atomistic interaction parameters with unambiguous physical significance from measured values of state parameters, such as temperature, pressure and chemical composition under equilibrium state. Unlike conventional thermodynamics, in which entropy, enthalpy, and free energy are defined mathematically in terms of state parameters and thus applicable universally to any system, even without knowing exactly the nature of compound under consideration, statistical thermodynamic analysis must be started from unambiguous a priori modeling of compounds under consideration. When an unrealistic model is chosen at the onset of the statistical thermodynamic approach, the evaluated parameters are without valid physical significance. This inherent nature of the statistical thermodynamic approach might make use of this unique analysis tool somewhat difficult for experimentalists to use casually. However, there also lies a merit of this unique analysis tool to provide a feedback channel to check the validity of the a priori model with reference to the compatibility of the evaluated atomistic interaction parameter values with the macroscopic state parameter values.

The Guest Editor wishes this Special Issue will attract the attention of authors who have been working on entropy and enthalpy aspects of materials science, as well as physicists and chemists using statistical thermodynamics as an analysis tool.

Prof. Dr. Nobumitsu Shohoji
Guest Editor

Special Issue Editor

Guest Editor
Prof. Dr. Nobumitsu Shohoji
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Website | E-Mail
Phone: +351 21 092 9600 (ext. 4234)
Interests: 1. Statistical thermodynamic analysis of non-stoichiometric interstitial compounds; 2. Synthesis of carbide, nitride and carbo-nitride (using concentrated solar beam as the heat source as well as using conventional electric furnace); 3. Formation and characterization of non-equilibrium solid phases

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Submitted manuscripts should not have been published previously, nor be under consideration for publication elsewhere (except conference proceedings papers). All manuscripts are thoroughly refereed through a single-blind peer-review process. A guide for authors and other relevant information for submission of manuscripts is available on the Instructions for Authors page. Entropy is an international peer-reviewed open access monthly journal published by MDPI.

Please visit the Instructions for Authors page before submitting a manuscript. The Article Processing Charge (APC) for publication in this open access journal is 1500 CHF (Swiss Francs). Submitted papers should be well formatted and use good English. Authors may use MDPI's English editing service prior to publication or during author revisions.

Keywords
- Statistical thermodynamics
- Entropy (configurational, electronic)
- Enthalpy
- Free Energy
- Saddle point approach
- Non-stoichiometry
- Interstitial
- Substitutional

Further information, see https://www.mdpi.com/si/entropy/Statistical_Thermodynamics

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**Books**

**Fractional-order Modeling of Nuclear Reactor: From Subdiffusive Neutron Transport to Control-oriented Models**

( Vishwesh VyawaharePaluri S. V. Nataraj)


**Introduction**

This book addresses the topic of fractional-order modeling of nuclear reactors. Approaching neutron transport in the reactor core as anomalous diffusion, specifically subdiffusion, it starts with the development of fractional-order neutron telegraph equations. Using a systematic approach, the book then examines the development and analysis of...
various fractional-order models representing nuclear reactor dynamics, ultimately leading to the fractional-order linear and nonlinear control-oriented models. The book utilizes the mathematical tool of fractional calculus, the calculus of derivatives and integrals with arbitrary non-integer orders (real or complex), which has recently been found to provide a more compact and realistic representation to the dynamics of diverse physical systems.

Including extensive simulation results and discussing important issues related to the fractional-order modeling of nuclear reactors, the book offers a valuable resource for students and researchers working in the areas of fractional-order modeling and control and nuclear reactor modeling.

**Chapters**

- Fractional Calculus
- Introduction to Nuclear Reactor Modeling
- Development and Analysis of Fractional-order Neutron Telegraph Equation
- Development and Analysis of Fractional-order Point Reactor Kinetics Model
- Further Developments Using Fractional-order Point Reactor Kinetics Model
- Development and Analysis of Fractional-order Point Reactor Kinetics Models with Reactivity Feedback
- Development and Analysis of Fractional-order Two-Group Models and Fractional-order Nodal Model


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**Journals**

**Physica A: Statistical Mechanics and its Applications**

(Selected)

*The fractional space – time radial diffusion equation in terms of the Fox’s H-function*


*The role of power decay, exponential decay and Mittag-Leffler function’s waiting time distribution: Application of cancer spread*

Abdon Atangana, Sonal Jain

*Market efficiency of Baltic stock markets: A fractional integration approach*
Luis A. Gil-Alana, Rangan Gupta, Olanrewaju I. Shittu, Olaoluwa S. Yaya

Analytical solution of the space–time fractional hyperdiffusion equation

Ashraf M. Tawfik, Horst Fichtner, A. Elhanbaly, Reinhard Schlickeiser

Suspension concentration distribution in turbulent flows: An analytical study using fractional advection–diffusion equation

Snehasis Kundu

A time fractional convection–diffusion equation to model gas transport through heterogeneous soil and gas reservoirs

Ailian Chang, HongGuang Sun, Chunmiao Zheng, Bingqing Lu, Yong Zhang

Variable-order fractional MSD function to describe the evolution of protein lateral diffusion ability in cell membranes

Deshun Yin, Pengfei Qu

Analytical solutions of the space–time fractional Telegraph and advection–diffusion equations

Ashraf M. Tawfik, Horst Fichtner, Reinhard Schlickeiser, A. Elhanbaly

A numerical solution for a variable-order reaction–diffusion model by using fractional derivatives with non-local and non-singular kernel


A fractional model with parallel fractional Maxwell elements for amorphous thermoplastics

Dong Lei, Yingjie Liang, Rui Xiao

Communications in Nonlinear Science and Numerical Simulation

(Selected)

Variational approach for breathers in a nonlinear fractional Schrödinger equation

Manna Chen, Qi Guo, Daquan Lu, Wei Hu

Analytical and numerical solutions of time and space fractional advection–diffusion–reaction equation

Alessandra Jannelli, Marianna Ruggieri, Maria Paola Speciale

Neglecting nonlocality leads to unreliable numerical methods for fractional differential equations

Roberto Garrappa

Exact general solution and first integrals of a remarkable static Euler-Bernoulli beam equation

A. Ruiz, C. Muriel, J. Ramírez
Fractional calculus via Laplace transform and its application in relaxation processes
E. Capelas de Oliveira, S. Jarosz, J. Vaz

Simulations of variable concentration aspects in a fractional nonlinear viscoelastic fluid flow
Amer Rasheed, Muhammad Shoaib Anwar

A spatial fractional seepage model for the flow of non-Newtonian fluid in fractal porous medium
Xu Yang, Yingjie Liang, Wen Chen

Method of separation variables combined with homogenous balanced principle for searching exact solutions of nonlinear time-fractional biological population model
Chun Wu, Weiguo Rui

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Paper Highlight

Conformable derivative: Application to non-Darcian flow in low-permeability porous media
Yang Shuai; Wang Liping; Zhang Shuqin

Publication information: APPLIED MATHEMATICS LETTERS Volume: 79 Pages: 105-110 Published: MAY 2018

http://apps.webofknowledge.com/full_record.do?product=UA&search_mode=GeneralSearch&qid=2&SID=8FO6OoHpxwjWi3nCmmM&page=1&doc=16&cacheurlFromRightClick=no

Abstract
The conformable derivative is used to develop the Swartzendruber model for description of non-Darcian flow in porous media. The proposed conformable Swartzendruber models are solved employing the Laplace transform method and validated on the basis of water flow in compacted fine-grained soils. The results of fitting analysis present a good agreement with experimental data. Furthermore, sensitivity analyses are carried out to illustrate the effects of related parameters on the conformable Swartzendruber models.
Fractional viscoelastic models with non-singular kernels

Long Jianmin; Xiao Rui; Chen Wen

Publication information: MECHANICS OF MATERIALS Volume: 127 Pages: 55-64 Published: DEC 2018

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product=UA&search_mode=GeneralSearch&qid=5&SID=8FO6OoHpxwjWi3nCmmM&page=1&doc=1&cacheurlFromRightClick=no

Abstract

New definitions of fractional derivative with non-singular kernels are proposed recently. In the present paper, we apply the classical and new definitions of fractional derivative to four fractional viscoelastic models, namely, fractional Maxwell model, fractional Kelvin-Voigt model, fractional Zener model and fractional Poynting-Thomson model. For each fractional viscoelastic model, the stress relaxation modulus, creep compliance and dynamic modulus are derived analytically under the classical and new fractional derivative definitions. The performance of these models under different fractional derivative definitions is further compared. The results show that the fractional Zener model and fractional Poynting-Thomson model are equivalent in all conditions. Compared with the classical fractional derivative definition with a power function kernel, the fractional derivative definition with a logarithmic function kernel can be used to describe the ultraslow creep and relaxation behaviors. However, the performance of fractional Maxwell model with the exponential function kernel is close to that of integer-order Maxwell model. Fractional Maxwell model and fractional Zener model with the Mittag-Leffler function kernel do not provide accurate descriptions of the stress relaxation modulus at shortest time and the storage modulus at highest frequency. Thus, specific modification is needed when applying the new definitions of fractional derivative to viscoelasticity.