Mini-symposia

A mini-symposium is a special session consisting of coordinated presentations on selected topics of substantial current interest and importance in Fractional Calculus. A part of the mini-symposium will be two hours long, 25 minutes for each presentation, and additional 5 minutes for comments of the organizers and discussions.

The fractional dynamic systems under uncertainty: Theoretical and numerical aspects with the application to the engineering problems

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The theory of fractional calculus developed mainly as a pure theoretical field of mathematics, in the last decades. It was applied in modeling of many physical and chemical processes and in engineering. However, the realistic information available on a considered dynamical system is often incomplete, imprecise, imperfect, and vague which this causes a dilemma in applications of fractional calculus (e.g. in this contribution fractional differential equations) which are suitable in the case of a perfect, precise knowledge about the considered system.
Although there were recently various attempts to establish this new and interesting concept and theory for fractional differential equations, it is still in its infant stage and needs to be attained a considerable attention for the researchers in this field. From this perspective, we believe that the presented symposium will be useful for the development of the theory of the fuzzy fractional calculus and fuzzy fractional differential equations (FFDEs) with their applications in the engineering sciences.
The topics of this mini symposium include, but are not limited to:
the theoretical foundations of fuzzy fractional calculus such as properties of fractional derivatives in the sense of fuzzy concept; the existence and uniqueness of the solution of (FFDEs) regarding to the different types of fractional derivatives; numerical methods for solving FFDEs; applications of FFDEs in the physical systems and phenomena.

Recent trends in numerical methods for fractional PDEs

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Partial differential equations (PDEs) of fractional order are employed for the description and the simulation of a large variety of models in different applicative areas, such as for instance biology, engineering, finance, physics and so on. As a consequence the need of accurate and efficient numerical methods is becoming an emerging field of research. This mini-symposium follows the positive experience of the International Symposium on Fractional PDEs held in Newport (U.S.A.) in 2013, a mini-symposium devoted to the numerical treatment of fractional PDEs. The aim of the mini-symposium is to bring together scientists from different geographical areas and discuss new trends in the numerical solution of fractional PDEs. This mini-symposium is expected to facilitate the exchange of information about new techniques recently investigated in this field and to promote the collaboration between experts working on specific and challenging problems. Both established experts and post-doctoral students will be invited with the aim of connecting people at different level of expertise.

Anomalous diffusion: theory, numerical methods and applications

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Anomalous diffusion is one of most successful research fields of fractional calculus. Fick's law is the standard law describing water flow and solute diffusion in homogenous media. However, numerous experimental data and field measurements have shown strong derivation of diffusion from the Fick's law, most likely due to the intrinsic heterogeneity embedded in real and usually fractal media. Numerous physical and mathematical models have been proposed to interpret anomalous diffusion over the past decades. Successful stochastic models developed for anomalous diffusion include the fractional derivative model, the continuous time random walk method, and the stable statistical method, etc. The existing numerical methods for fractional derivative diffusion equations include finite difference method, finite element method, meshless method, spectral collocation method, Lagrangian method, and various approximate methods, etc. Most importantly, anomalous diffusion models have been applied in multiple disciplines, such as hydrology, geophysics, biology and fluid mechanics. The aim of this session is to present the recent research progresses in related topics including theory, numerical methods and applications of anomalous diffusion.
Topics related to anomalous diffusion include, but are not limited to:
recent development of fractional derivative diffusion models; analytical and approximate solutions; continuous random walk model; statistical description of anomalous diffusion; numerical methods and numerical analysis; the link between fractional-model parameters and geophysical medium properties; application in hydrology, geophysics, biology, fluid mechanics, etc.; experimental results of water and/or solute transport in porous media; scaling problem of anomalous transport.

Integral Transforms and Special Functions of Fractional Calculus

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