Modeling, analysis and simulation of coagulant fluid

A short course organized by IIT Bhubaneswar

through the GIAN Scheme under MHRD, Government of India

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Overview

Coagulation (aggregation) and fragmentation (breakage) population balance equations (PBEs) are partial integro-differential equations and are used for particulate processes. These processes are well-known in various branches of engineering and science such as nano-technology, fluidized bed granulation, pharmaceutical industry, formation of Saturn ring particles, etc., involving such phenomena as crystallization, precipitation and emulsion. These processes are characterized by the presence of a continuous phase and a dispersed phase composed of particles with some distribution. The particles might be crystals, polymers, drops or bubbles and may have different properties such as size, composition, porosity or enthalpy. One very interesting application of PBEs is the synthesis of titanium dioxide (TiO2) nanoparticles which is one of the most useful oxide materials, because of its widespread applications in photocatalysis, solar energy conversion and sensors. Controlling particle size distribution of TiO2 nanoparticles is a challenging task which is of crucial importance from a fundamental and an industrial point of view and therefore heavily relies on the modeling of coagulation and fragmentation phenomena.

In this series of lectures, we focus on getting a better understanding of the coagulation and fragmentation phenomena in fluids. Discussing the mathematical modeling, analysis and simulation of coagulating fluids in various real life problems such as biology (populations evolution), chemistry (polymerization) or medicine (blood flows), we will study the important mechanisms of transport, viscosity, diffusion or capillarity. From theoretical point of view, we will discuss the balance between dissipative and dispersive effects and will analyse the well-posedness and the limit behavior of some scalar equations of Korteweg-de Vries-Burgers type. We remark that this discussion is central to answer the famous (open) 6th Hilbert Problem.

Course participants will learn the topics through lectures and tutorials. Also case studies and assignments will be shared to stimulate research motivation of participants.

Dates	25th July to 29th July 2016
Host Institute	**IIT Bhubaneswar**
You Should Attend If…	- You are a faculty or researcher from academic/technical institutions and R&D centre's. - Senior BTech/BSc students, MTech/MSc/PhD students who are working in the field of partial differential equations, partial integro-differential equations, hyperbolic conservation laws, environmental sciences, bio-math, chemical and mechanical engineering, nano-technology, financial mathematics. **Number of participants for the course will be limited to fifty.**
Course Registration Fees	**Students (BTech/MTech/MSc/PhD):** Rs. 2,000. **Participants from academic/technical/R&D institutions/industry:** Rs. 4,000. **Participants from abroad:** US$ 200. The above fee includes all instructional materials, computer use for tutorials and assignments and free internet facility. The participants will be provided with accommodation on payment basis.

The Faculty

Dr. Joaquim M. C. Correia is an assistant professor at the Department of Mathematics at ECT (School of Sciences and Technology) and member of the Research Centre for Mathematics and Applications (CIMA) at IIFA (Institute of Research and Advanced Education), University of Évora, Évora, Portugal. He is also a member of the Centre for Mathematical Analysis, Geometry and Dynamical Systems (CAMGSD) at IST (High Technology Institute), University of Lisbon, Lisbon, Portugal. He prepared his PhD on Nonlinear Hyperbolic Systems of Conservation Laws at the Centre of Applied Mathematics (CMAP), École Polytechnique, Paris, France. His research area is in Mathematical Analysis, Partial Differential Equations with main focus on Nonlinear Conservation Laws (Approximation of Nonlinear Hyperbolic Systems of Conservation Laws, Riemann Problem and Non Smooth Analysis) with applications to Models in Fluid and Solid Dynamics, Biology and Chemistry or Financial Mathematics.

http://www.uevora.pt/pessoas/(id)/5348

Dr. Amiya Kumar Pani is a Professor in Mathematics at IIT Bombay, Mumbai, India. He has received his PhD from IIT Kanpur. His research interest is primarily in the area of numerical approximations of partial differential equations. His expertise includes construction, stability and convergence analysis of finite element methods, finite difference schemes, partial integro-differential equations, coupled equations in Oil reservior studies, evolutionary variational inequalities and scientific computations for industrial applications.

http://www.math.iitb.ac.in/~akp/

Dr. Ankik Kumar Giri is an Assistant Professor in Mathematics at IIT Roorkee, Roorkee, India. He holds a PhD in Mathematics from IMPRS at OVGU Magdeburg, Germany. His research interests include partial integro-differential equations, coagulation-fragmentation processes, stochastic PDEs and regularization theory for inverse problems.

http://www.iitr.ac.in/departments/MA/pages/People+Ankik_Kumar_Giri.html

Dr. Rajesh Kumar is a Visiting Assistant Professor in the School of Basic Sciences (Mathematics) at IIT Bhubaneswar, Bhubaneswar, India. He holds a PhD in Mathematics from OVGU Magdeburg, Germany. His research interests are partial integro-differential equations, numerical analysis of PDEs, finite volume analysis, conservation laws and low rank tensor approximations for PDEs with random data.

http://www.iitbbs.ac.in/profile.php/rajesh/

Important Dates

Registration deadline: July 15, 2016

Classes start: July 25, 2016
Classes end : July 29, 2016

Venue

Indian Institute of Technology Bhubaneswar
Bhubaneswar, Odisha 751007, India
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Course Coordinator

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Register online at:
http://www.gian.iitkgp.ac.in/GREGN

(Registration deadline: July 15, 2016)