

Computational Fluid Dynamic Modeling of Fluidized Beds

(12 – 16 November, 2018)

Department of Chemical Engineering, NIT WARANGAL

1. Overview

Fluidized bed reactors offer the advantages of excellent solid mixing and heat transfer characteristics. These reactors find widespread applications in the chemical, petrochemical, pharmaceutical, metallurgical, energy and food industries. Some typical applications of fluidized beds include coal gasification, synthesis reactions, metallurgical operations, physical operations, cracking of hydrocarbons, combustion and incineration, biomass conversion and drying of solid particles, etc. Despite the widespread use, the complex hydrodynamics of fluidized bed reactors is still not completely understood. In analyzing important issues such as the formation of local hot spots, by-passing, solids entrainment, designing internals and so on, detailed fluid dynamic models would be necessary and Computational Fluid Dynamic (CFD) based models can contribute uniquely in this regard. Computational flow modeling may greatly accelerate the entire reactor development program with enhanced confidence levels and better performance. Hence, this course on computational fluid dynamic modeling of fluidized beds which discusses the fundamentals and reviews the modeling strategies would be of immense value to the participants.

The course is well organized in terms of the lectures covering the fundamentals of multiphase flow CFD and fluidization, numerical treatment of gas-solid flows, heat and mass transfer and chemical reactions in multiphase flows and the application of computational fluid dynamic (CFD) modeling to fluidized bed reactors. These lectures will be complimented with necessary hands-on tutorial sessions using ANSYS Fluent and open source software MFIX. The course includes hands-on tutorials illustrating solution of several problems on bubbling fluidized bed, two-fluid model, pipe-flow problem, circulating fluidized bed, writing user defined functions etc.

This course is organized in the form of lectures, tutorial / practical sessions and project work, all spread over five days. Course participants will learn these topics through lectures, tutorials and assignments. A graded examination / project work will be conducted on the last day of the course.

Leading international researchers and academics with extensively recognized expert, and demonstrable ability in teaching, consultancy, research, and training in the field of multiphase flow modeling using CFD and fluidization will deliver lectures and discuss the latest trends in the course.

2. Objectives

On completion of the training, participants will be able to:

- i) Understand the theory of multiphase flow and fluidization
- ii) Familiarize with the two-fluid model and its application to fluidized beds
- iii) Model heat and mass transfer and chemical reactions in multiphase flows
- iv) Apply multiphase CFD to fluidized bed reactors
- v) Learn the best practices in using multiphase CFD for practical applications.

Dates	12 – 16 November, 2018
Modules	<ul style="list-style-type: none"> • Introduction to fluidization and Hydrodynamics of fluidized beds • Multiphase CFD and different modeling approaches • Multiphase turbulence • Heat and mass transfer and chemical reactions in multiphase flows. • Verification, Validation and Uncertainty quantification • Case studies
You Should Attend If...	<ul style="list-style-type: none"> • you are a faculty member/research scientist/ industry professional working or interested in multiphase flow of fluidized beds • you are a chemical or mechanical or materials professional working or interested in computational modeling of fluidized beds • you are a UG/PG student or research scholar interested / working in fluidized beds or fluidization
Fees	<p>The participation fees for taking the course is as follows:</p> <p>Participants from abroad : US \$ 300 Industry/ Research Organizations: Rs. 10,000/- Faculty: Rs. 4,000/- Students & Research Scholars: Without award of Grade: Rs. 1,000/- With award of Grade: Rs. 1,500/-</p> <p>The above fee includes all instructional materials, computer use for tutorials and assignments. The participants from academic/research institutes and Industry will be provided with boarding and lodging on additional payment of Rs. 4,000/- in Visitors Block on twin sharing basis. Students & Research Scholars will be provided with boarding and lodging in Institute Hostels (DASA) on additional payment of Rs. 2,500/-. Please note that, accommodation inside NITW campus is very limited and same will be provided to participants on first-cum-first-serve basis. The accommodation facility is basic in nature. You can contact coordinators if you are interested in opting for better accommodation in nearby hotels on payment basis. Also, note that, if you are working in academia/industry and pursuing PhD, you are required to register under Faculty/Industry category and not as a student.</p>

The Faculty

	<p>Dr. Madhava Syamlal is a Senior Fellow in Computational Engineering division at National Energy Technology Laboratory (NETL), U.S. Department of Energy, Morgantown, WV, USA. His degrees are in chemical engineering: B.Tech from IIT (BHU), and MS and PhD from IIT, Chicago. As the founding Technical Director, he established the Carbon Capture Simulation Initiative (CCSI) for developing a multi-scale computational toolset for accelerating carbon capture technology development. The toolset is currently being used for carbon capture technology development and is under evaluation for commercialization by a software company. Dr. Syamlal previously led the development of the widely used open-source multiphase CFD code MFIX, multiscale co-simulation of process and device scales, and C3M chemical kinetics software. He led the development of the first commercial software for linking CFD models in FLUENT® with process simulation models in Aspen Plus® for enabling high fidelity process modeling that accounts for the effect of device-scale behavior on the overall process. He is a fellow of AIChE and the recipient of numerous awards such as DOE Secretary's Achievement Honor Award and AIChE's Fluidization Process Recognition Award. He has published several research papers in international journals and conferences. He organized many sessions and workshops on multiphase flow; established a multiphase flow conference series at NETL. For more details: https://mfix.netl.doe.gov/team_manager/madhava-syamlal-ph-d/</p>
	<p>Dr. P. V. Suresh is an Assistant Professor in Department of chemical engineering at NIT Warangal, India. His current research interests include Fuel Cells, Flow batteries, CO₂ capture technologies – Chemical Looping Combustion, Modelling and Simulation and Computational Fluid Dynamics. For more details: http://www.nitw.ac.in/faculty/id/16329/</p>
	<p>Dr. Y. Pydi Setty is a Professor in Department of chemical engineering at NIT Warangal, India with more than 30 years of teaching and research experience. His research interests include hydrodynamics and RTD studies in fluidized beds, fluidized bed drying and Biological wastewater treatment. For more details: http://www.nitw.ac.in/faculty/id/16320/</p>

Course Coordinators

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