

Advanced Computer Aided Modelling of Chemical & Biochemical Processes

(03 - 07 September, 2018)

Department of Chemical Engineering, NIT WARANGAL

1. Overview

Process engineering is all about manufacturing of just about anything! To manage processing and manufacturing systematically, the engineer has to bring together many different techniques and analyses of the interaction between various aspects of the process. For example, process engineers would apply model-based tools to perform feasibility analyses of novel process designs, assess environmental impact, and/or detect potential hazards or accidents. Also, almost all chemical engineers have developed and/or used models at some time in their work and the question is, how much time and resources do they spend in model related work? To manage complex systems and enable process design, it is essential to understand the behavior of systems so as to represent them in appropriate mathematical forms, which needs to be analyzed, solved and validated before application. The course will therefore aim to provide a systematic approach to the mathematical development of process models and highlight how to analyze and solve those models.

The course provides coverage of advanced process modelling and solution concepts for different types of models (lumped and distributed systems), different modes of models (steady state and dynamic) and different forms of models (simple-complex, large-reduced, discrete-continuous). Starting with definition of the modelling objectives, to the derivation of the model equations representing the system, to the analysis of the model equations, to developing different solution strategies for different modelling objectives to final application of the developed model will be covered in the course. It will be illustrated why using a systematic modelling approach has advantages, what methods and tools need to be used and how they can be applied. The objective is to save time and resources as well as to provide a good understanding of the domain system and leading to reliable problem solution for a wide range of problems. The course should help the participant to develop skills in model formulation, analysis, solution of the model equations as well as configure and apply model-based tools for practical problem solution.

2. Objectives

The primary objectives of the course are as follows:

- i) To train the participants on the use of advanced (systematic) modelling methods and tools for various modelling objectives.
- ii) To develop skills in model formulation, analysis and solution of the model equations.
- iii) To develop skills in configuring and applying model-based tools for practical problem solution.
- iv) To provide rich hands on experience on the methods and tools.

Suggested Lecture Schedule

Date	Lecture Timing	Topic	Tutorial/exercise 14.15 hrs to 17.15 hrs
03-09-2018 Modeling Basics	9.00 to 11.00	Introduction to modelling and Model building framework - Rafiqul Gani	Introduction to MoT; Modelling exercises Rafiqul Gani, A. Sarath Babu and V Ramsagar
	11.15 to 13.15	Conservation principles and Constitutive Models – A. Sarath Babu	
04-09-2018 Lumped & Distributed parameter systems	9.00 to 11.00	Modelling lumped parameter and distributed parameter systems – Rafiqul Gani	Tutorial with ICAS-ModDev; Model creation-generation exercises Rafiqul Gani, A. Sarath Babu and V Ramsagar
	11.15 to 13.15	Computer-aided model generation and Multiscale modelling – Rafiqul Gani	
05-09-2018 Model Analysis & solution	9.00 to 11.00	Analysis of process models: lumped parameter and distributed parameter systems – Rafiqul Gani	Tutorial with ICAS-MoT; Model analysis exercises; Model solution with MoT and CFD –tools Rafiqul Gani, A. Sarath Babu and V Ramsagar
	11.15 to 13.15	Solution strategies for lumped and distributed parameter systems – V Ramsagar	
06-09-2018 Model Validation & Customized model development	9.00 to 11.00	Model identification, calibration and validation and Model discrimination – Rafiqul Gani	Tutorial with ICAS-MoT; Model parameter estimation; model identification; Model discrimination Rafiqul Gani, A. Sarath Babu and V Ramsagar
	11.15 to 13.15	Customized model development and Template-based modelling – Rafiqul Gani	
07-09-2018 Case Studies	9.00 to 11.00	Development and application of model-based systems (customized model-based tools; Modelling of hybrid systems; modelling for product design) - Rafiqul Gani	Customized modelling exercise; use of a dynamic model for discrete event analysis; combining models to simulate hybrid systems; combining models for product analysis Rafiqul Gani, A. Sarath Babu and V Ramsagar
	11.15 to 13.15	Process simulator; modelling of discrete event systems – A. Sarath Babu	

Modules	<ul style="list-style-type: none"> ▪ Modeling Basics ▪ Lumped & Distributed parameter systems ▪ Model Analysis & solution ▪ Model Validation & Customized model development ▪ Case Studies
You Should Attend If...	<ul style="list-style-type: none"> ▪ you are a faculty member/research scientist in chemical & Biochemical engineering interested in process modeling, simulation and optimization. ▪ you are a professional chemical or bio-process engineer interested in process design, operation and retrofitting studies. ▪ you are a student of chemical engineering / biotechnology interested in learning how to model and simulate chemical processes
Fees	<p>The participation fees for taking the course is as follows:</p> <p>Participants from abroad : US \$500 Industry/ Research Organizations: Rs. 10,000/- Faculty: Rs. 4,000/- Students & Research Scholars: Without award of Grade: Rs. 1,500/- With award of Grade: Rs. 2,000/-</p> <p>The above fee includes all instructional materials, computer use for tutorials and assignments and 24 hr free internet facility. 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 sharing basis. Students & Research Scholars will be provided with boarding and lodging in Institute Hostels on additional payment of Rs. 2,500/-.</p>

The Faculty



Prof. Rafiqul Gani, CEO, PSE for SPEED, Skyttemosen 6, DK 3450 Allerod, Denmark



Dr. Sarath Babu Anne is a Professor of Chemical Engineering at NIT Warangal. His research interests are Process Modeling, Simulation and Optimization.



Dr. Ramsagar Vooradi is an Assistant Professor of Chemical Engineering at NIT, Warangal. His research interests are Batch-Scheduling and Process Simulation.

Course Co-ordinators

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