Advanced Computer Aided Modelling of Chemical & Biochemical Processes

(03 - 07 September, 2018)
Department of Chemical Engineering, NIT WARANGAL

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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 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.

Lecture Schedule (maybe subject to changes)

Date	Lecture Timing	Lecture Topic*	Tutorial/Exercise** 14.00 – 17.00 hrs
03-09-2018 **Modeling Basics**	9.00 - 10.30	L1: Introduction to modelling L2: Model building framework	Introduction to MoT; Modelling exercises
	11.00 - 12.30	L2a: Conservation principles L2b: Constitutive Models	
04-09-2018 **Lumped & Distributed parameter systems**	9.00 - 10.30	L3a: Modelling lumped parameter L3b: Distributed parameter systems	Tutorial with ICAS-ModDev; Model creation-generation exercises
	11.00 - 12.30	L4: Multiscale modelling Model generation concept	
05-09-2018 **Model Analysis & Solution**	9.00 - 10.30	L5a: Model analysis: lumped & distributed parameter systems L5b: Analysis of process models	Tutorial with ICAS-MoT; Model analysis exercises; Model solution with MoT and CFD –tools
	11.00 - 12.30	L6a: Solution strategies for lumped L6b: Distributed parameter systems	
06-09-2018 **Model Identification, Validation & Discrimination**	9.00 - 10.30	L7: Model identification, calibration and validation	Tutorial with ICAS-MoT; Model parameter estimation; model identification; Model discrimination
	11.00 - 12.30	L8: Model discrimination	
07-09-2018 **Model applications and Case Studies**	9.00 - 10.30	L9: Process simulator-based modelling (*Prof. A. Sarath Babu*) Demonstration of modelling template for model reuse	Development of customized model-based computer aided tools
	11.00 - 12.30	L10: Development and application of model-based systems (customized model-based tools; Modelling of hybrid systems; modelling for product design)	

* Unless otherwise indicated, all lectures will be given by Prof. Rafiqul Gani
** Unless otherwise indicated, Prof Rafiqul Gani, Prof A. Sarath Babu, Dr. V Ramsagar, & Dr. Anjan K Tula will assist in the tutorials & exercises

Modules	- Modeling Basics - Lumped & Distributed parameter systems - Model Analysis & solution - Model Validation & Customized model development - Case Studies
You Should Attend If…	- 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	The participation fees for taking the course is as follows:
	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/-
	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/-.

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.

Dr Anjan K Tula is head of process engineering at PSE for SPEED (Thailand) and a post-doc at the Chemical Engineering Department of Auburn University.

Course Co-ordinators

Prof. Sarath Babu A & Dr. Ramsagar V
Phone: 91-94901 65346, 91-8332969406
E-mail: sarat@nitw.ac.in; ramsagar@nitw.ac.in

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http://www.nitw.ac.in