

## **Systematic Process Simulation, Design and Analysis**

2-day MSc-level course, 29-30 November 2018

Chemical Engineering Department, Chulalongkorn University

### **Course Outline**

Process simulation has a very important role in almost all areas of chemical engineering. The development of any engineering project demands some form of model-based simulation studies – from conceptual design, to techno-economic feasibility analysis, to detailed engineering design, to operation of the process, involves some form of process simulation. The generation of new processes or retrofit analysis of existing processes requires the integration of concepts of chemical engineering, where at each step data generated through process simulation or collected through pilot plant studies are needed. For example, better design and safe-reliable operation of the process is achieved through energy integration and optimization, sustainability analysis, and controllability-dynamics analysis.

Chemical process simulation aims to represent a process of chemical or physical transformation through a mathematical model that involves the calculation of mass and energy balances coupled with phase equilibrium and with transport and chemical kinetics equations. The objective is to predict the behavior of a process of known structure (flowsheet), in which some preliminary data of the equipment that constitute the process are known. The mathematical models employed in process simulation contain linear, nonlinear, and differential algebraic equations, which represent equipment or process operations, physical–chemical properties, connections between the equipment and operations and their specifications. Combining process simulation with process synthesis, helps to identify and verify the processing route (flowsheet). Combining process simulation with optimization, helps to determine the optimal design of the process flowsheet. Integrating process simulation with analysis tools such as heat integration, sustainability, safety, etc., helps to determine a more sustainable design of a process that is efficient, reliable, safe and operates with reduced waste and lower environmental impact.

The important issue of process simulation is not what it can do but how to use it most efficiently and obtain the results reliably and fast. Also, process simulation alone is not able to provide all the needed answers. It needs to be integrated with a set of computer aided tools that can enhance the scope and significance of any process simulator.

The course will introduce the basic concepts of process simulation along with process synthesis, design, and analysis together with the associated computer-aided methods and tools. Case studies will be used to illustrate the concepts and the solution of typical process engineering problems.

### **Course Schedule**

The 2-day course is divided into four sessions each with its corresponding lectures and tutorial exercises. The lectures will introduce the participants to the concepts for systematic simulation, design and analysis methods. The tutorials will introduce the participants to the associated computer-aided tools and their efficient and reliable use.

## Day 1

Session 1: Introduction of concepts and use of systematic methods for process simulation, process synthesis, process design and process analysis.

Session 2: Process simulation and design with systematic computer-aided tools

## Day 2

Session 3: Process analysis for sustainable and retrofit design to reduce waste, improve energy efficiency, reduce environmental impacts and improve economic feasibility

Session 4: Detailed case study highlighting the commercial feasibility study of a chemical process, that is, a techno-economic analysis. Will cover new process design as well as retrofit analysis.

## **Course Lecturer**

Professor Rafiqul Gani, CEO of PSE for SPEED company (Thailand-Denmark) and distinguished visiting professor at Texas A&M University (USA), Zhejiang University (China), Tsinghua University (China).