Design Guidelines for Utilizing Process Engineering Simulation Software in the Real World

Introduction

The success of every company depends of each employee's understanding of the business's key components. Employee training and development will unlock the companies' profitability and reliability. When people, processes and technology work together as a team developing practical solutions, companies can maximize profitability and assets in a sustainable manner.

There are times when the virtual world of computers needs to be taken to the real world. Is should be remembered that machine calculations are for the purpose of improving only the speed of the calculation – the engineer must supply correct input data and correct judgment of results. Without the key concepts of the correct input data and estimates of the results, the two worlds may collide.

Course Objective

This course will guide the participates to develop key concepts and techniques to confirm that their process engineering simulation software results can be utilized in the field (real world). A conversed solution can be very far from reality. The correct selection of actual field efficiencies, vapor and liquid equilibrium data, feed modeling, and hydraulic behavior will influence the accuracy of the model's results.

These key concepts can be utilized to make process engineering simulation software a troubleshooting tool to help solve distillation tower problems. The key concepts taught in this course are independent of the clients chosen software and will apply to all the industry standard simulation packages.

What You Can Expect To Gain

- An overview of distillation, practical solutions as well as theory
- Development of key concepts for simulation in the real world
- How to select the proper input data
- How estimate realistic stage efficiencies, variables affecting separation
- Proper selection of VLE Data
- Feed modeling techniques
- How to make difficult operations converge
- Hydraulic analysis techniques
- Methods to cross check the results
- Troubleshooting guidelines
- Workshops based on your plant's towers

Course Syllabus

The goal of the course would be to refresh the knowledge of those who have a basic understanding of process simulation software techniques and to build a foundation to those who are new to the process simulation software.

Typical Course Outline

A. General Introduction

1. General Column Design

- The components of a distillation system, more than just a tower – it is a system of different components
- History of distillation
- Different types of distillation columns
- Differences among batch, flash, and multistage distillation process
- Relative advantages of tray and packed columns
- Steps in the process design
- The keys of column inlets and outlets

2. Tray Column Design

- The major design differences between tray types
- The operational limits for trays – operating window
- Size a distillation column for a given vapor rate
- Calculate the turndown ratio
- Calculate a tray pressure drop
- Calculate a tray downcomer capacity

3. Packed Column Design

- The different types of packing and their characteristics
- The best type of packing for a given system
- Size a packed column diameter
- Calculate the packed bed pressure drop

- Design an effective distributor system for both liquid and vapor handling

4. Distillation Column Control

- Typical process variables in a distillation column
- Select appropriate composition and column pressure control schemes
- Process settings during column operation

B. Thermodynamics and Equilibrium

1. Vapor Liquid Equilibrium

- Select the correct vapor-liquid equilibrium equation for your system
- Review vapor pressure and equilibrium diagrams
- Interpret mole fraction equilibrium curves, commonly called y-x diagrams
- Break multi-component designs into simpler systems with binary pairs
- Azeotropes and the challenges they create for distillation

2. Stages & Transfer Units Efficiencies

- Calculate the number of equilibrium stages using short cut methods
- Calculate minimum reflux and stages using graphical & analytical methods
- Determine number of theoretical stages needed in a distillation column
- Adapt binary design methods to multi-component systems
- Design separation process for an azetrope and multiple components
- Set-up and troubleshoot rigorous calculations using simulation programs

3. Stage Efficiency

- Four methods for determining efficiency
- Calculate an overall column efficiency for tray columns
- Calculate point and tray efficiencies, and their difference
- Calculate the number and height of transfer units for packing
- Effects on distillation column by changing amount of reflux and reflux temperature
- How flooding and foaming affects efficiencies and capacities

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C. Troubleshooting

1. Introduction

- Build a list of troubleshooting strategies
- Evaluate operation of a packed column
- Evaluate operation of liquid distributors
- Evaluate operation of a tray column
- Use tools to diagnosis problems

2. Installation

- Develop a checklist of common column installation mistakes
- Build a list necessary tasks to insure a proper installation

3. Commissioning

- Build a list of common start up problems which occur and steps to minimize them
- List common reasons for column problems and understand how to correct them

D. Workshops (which are mixed in the lectures)

1. Simulation of DePropanizer

- Comparison of VLE
- Choosing distillation device
- Selection of stage efficiency
- Preliminary hydraulics

2. Simulation of Crude Tower

- Comparison of VLE
- Choosing distillation device
- Selection of stage efficiency

- Preliminary hydraulics

3. Simulation of Gas Plant

- Comparison of VLE
- Choosing distillation device
- Selection of stage efficiency
- Preliminary hydraulics

4. Simulation of one of your plants towers

- Comparison of VLE
- Choosing distillation device
- Selection of stage efficiency
- Preliminary hydraulics

Who Should Attend

- People who are making day to day decisions regarding operation, design, maintenance, and economics of process industry plants.

- An engineer or chemist who must troubleshoot and solve distillation problems in a plant, an engineering office or laboratory.

- Technical Engineers, Operating Engineers, Process Support Personnel, Chemist, and Managers

- Ideal for veterans and those with only a few years of experience who want to review or broaden their understanding of process safety.

- Other professionals who desire a better understanding of the subject matter.

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