

Petro-SIM Process Simulation Fundamentals and Flowsheet Modeling Training Course

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Overview

The Petro-SIM Process Simulation Fundamentals and Flowsheet Modeling Training Course is a one-week course for process engineers, production technologists, and facility designers who leave with a converged flowsheet model and simulation dossier to evaluate operational performance. Process facilities frequently struggle with inaccurate thermodynamic property package selection, uncharacterized crude assays, divergent recycle loops, and poor convergence in complex distillation column simulations. This course resolves these challenges through rigorous equation of state selection, petroleum characterization workflows, sub-flowsheet architecture, and systematic solver troubleshooting. Agile Leaders Training Center delivers the Petro-SIM Process Simulation Fundamentals and Flowsheet Modeling Training Course.

Who Should Attend

- Process engineers responsible for steady-state simulation convergence, heat and material balances, and unit operations troubleshooting.
- Production technologists optimizing oil and gas gathering systems, separation trains, and gas processing plant performance.
- Refinery operations engineers managing crude distillation units, fractionator cut points, and petroleum assay data integration.
- Facilities design specialists sizing vessels, heat exchangers, compressor loops, and plant piping networks.
- Energy optimization leads conducting pinch analysis, utility consumption audits, and emissions reduction evaluations.

The course assumes participants actively calculate basic mass and energy balances and interpret piping and instrumentation diagrams, and it leaves out fundamental thermodynamics instruction and elementary fluid mechanics.

Departments and Industries

The course draws operational cases from hydrocarbon processing facilities and continuous manufacturing plants.

- Process engineering and technology optimization divisions
- Oil and gas field operations and midstream processing facilities
- Petroleum refining and petrochemical production departments
- Technical services and facilities design engineering groups
- LNG liquefaction, regasification, and gas treating facilities
- Energy conservation and plant utilities optimization units

Learning Objectives

By the end of this course, participants will be able to:

- Apply cubic equations of state and specialized property packages to model multi-component phase equilibria.
- Build petroleum assay characterizations using distillation cuts, pseudo-components, and bulk property blending rules.
- Analyze unit operations by simulating three-phase separators, multi-stage compressors, and shell-and-tube heat exchangers.
- Evaluate distillation columns using rigorous tray-by-tray algorithms, internal hydraulics, and side stripper configurations.
- Diagnose recycle stream convergence errors using tear stream selection, damping factors, and numerical tolerances.
- Prioritize plant debottlenecking options by conducting parametric sensitivity analyses and process case studies.

Course Agenda

Day 1: Simulation Foundations and Fluid Characterization

- Petro-SIM simulation environment navigation and flowsheet topology management
- Thermodynamic fluid property packages selection using Peng-Robinson and SRK models
- Petroleum assay characterization workflows using true boiling point curves and pseudo-components
- Vapor-liquid-liquid equilibrium estimation and phase envelope generation methods
- Material stream specification standards, property tables, and reference state definitions

Day 2: Core Equipment Modeling and Heat Transfer

- Rotating equipment simulation including multi-stage centrifugal compressors and expanders
- Piping hydraulics modeling using pressure drop correlation models and elevation profiles
- Two-phase and three-phase gravity separator rating and sizing procedures
- Heat exchanger modeling using rigorous rating calculation modes and thermal utility links
- Pump hydraulics analysis and system net positive suction head verification sheets

Day 3: Separation Systems and Distillation Columns

- Rigorous multi-stage distillation column configuration and solver specification rules
- Atmospheric crude tower modeling with side strippers, pump-arounds, and condenser systems
- Column internal hydraulics profiling for sieve tray and structured packing evaluations
- Reboiler and condenser duty balance using energy stream integration protocols
- Stripper and absorber column performance diagnosis across changing reflux ratios

Day 4: Flowsheet Integration and Recycle Convergence

- Recycle stream convergence management using Wegstein acceleration and tear streams
- Sub-flowsheet hierarchy configuration and internal-external stream boundary definitions
- Adjust and balance logical unit operations for automated variable targets
- Steady-state piping network loops convergence and pressure-flow solver diagnostics
- Process case study generator utilization and automated sensitivity scenario execution

Day 5: Flowsheet Optimization and Capstone Modeling

- Suggested activity: Troubleshoot a non-converging hydrocarbon recycle loop using numerical damping techniques
- Suggested activity: Model an amine gas sweetening unit flowsheet with chemical solvent property packages
- Suggested activity: Conduct a plant debottlenecking study using automated flowsheet sensitivity tools
- Suggested activity: Evaluate distillation fractionator column hydraulics against hydraulic weeping constraints
- Capstone exercise: Assemble a complete plant flowsheet simulation model and engineering dossier

Practical Exercises

The course uses engineering design cases, authentic hydrocarbon assay records, and industrial process simulation worksheets.

- Suggested activity: Characterize an unrecognized crude assay and generate calibrated pseudo-components for distillation modeling.
- Suggested activity: Construct an integrated three-phase separation and compression loop flowsheet with closed recycle loops.
- Suggested activity: Troubleshoot a converging atmospheric fractionation column encountering specification over-definition errors.
- Suggested activity: Build a fully converged refinery gas plant flowsheet dossier evaluating capacity debottlenecking targets.

FAQs

Who suits the Petro-SIM Process Simulation Fundamentals and Flowsheet Modeling Training Course?

The Petro-SIM Process Simulation Fundamentals and Flowsheet Modeling Training Course suits process engineers, facility designers, and technical services specialists. The course assumes participants calculate heat and material balances and interpret piping and instrumentation diagrams, leaving out elementary chemistry and introductory fluid mechanics.

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How does this course differ from dynamic process simulation courses?

Dynamic simulation courses focus on transient controls, emergency shutdown timing, and pressure safety relief dynamics. The Petro-SIM Process Simulation Fundamentals and Flowsheet Modeling Training Course concentrates on steady-state flowsheet convergence, thermodynamic fluid package selection, rigorous column fractionation, and steady-state unit operations optimization.

How are crude assays characterized in Petro-SIM process simulation?

Crude characterization in Petro-SIM uses laboratory distillation assays, bulk gravity, and sulfur profiles. The software converts boiling curves into discrete pseudo-components using empirical property correlations, enabling accurate phase equilibrium and fractionation calculations across the entire flowsheet.

How does Petro-SIM flowsheet modeling resolve recycle loop convergence errors?

Recycle convergence is resolved by identifying optimal tear streams, applying numerical acceleration algorithms such as Wegstein or direct substitution, tuning damping factors, and adjusting convergence tolerance criteria to ensure steady-state mathematical stability across looped networks.

Conclusion

The completed simulation flowsheet model and debottlenecking dossier provides an authoritative operational basis for plant optimization. Engineering teams apply these validated models to eliminate trial-and-error field modifications, resolve unit bottlenecking, and verify equipment capacities prior to turnaround execution. The resulting documentation standardizes process evaluation protocols across operational and design departments.

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