invensys ™

Summary

PRO/II is a professional simulation tool that offers a comprehensive simulation solution for process design, revamp, and operational analysis. PRO/II performs rigorous mass and energy balances for processes ranging from oil and gas separation to reactive distillation.

Business Value

- Decrease capital costs
- Decrease operating costs
- Increase efficiency
- Increase productivity
- Reduce learning curves
- Increase profitability

# PRO/II Comprehensive Process Simulation

OVERVIEW

PRO/II has the power and flexibility to simulate a wide range of processes at steady-state, from refining to chemicals. PRO/II provides robust and accurate results based on industry-standard thermodynamic methods and physical property data. PRO/II is a valuable tool allowing engineers and management to enhance the bottom line of their process or plant. PRO/II is part of the Process Engineering Suite (PES) that handles process design and operational analysis for a wide range of applications.

SIMULATION USES

- Design new processes
- Evaluate alternate plant configurations
- Modernize or revamp existing plants
- Assess and document compliance within environmental regulations
- Troubleshoot and debottleneck plant processes
- Monitor, optimize, and improve plant yields and profitability

KEY FEATURES

- Comprehensive thermodynamics and physical property data
- Creation and management of custom component data
- Comprehensive rigorous unit operation modeling
- Customizable process modeling via Microsoft Excel
- Built-in integration with Excel for custom reporting
- SIM4ME Portal integration for simulation control and analysis from Excel
- Integration with industry-standard licensors including HTRI, OLI, & Koch-Glitsch
- Integration with Spiral CrudeSuite for assay information
- Application across multiple industries
    - Green Engineering
    - Refining
    - Oil & Gas Processing
    - Petrochemicals
    - Chemicals
    - Polymers
   - Pharmaceuticals

SimSci ™
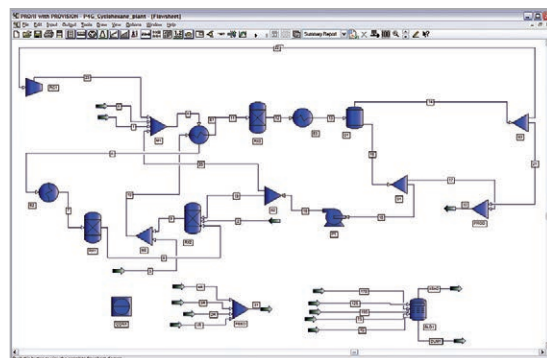
SIMULATION APPLICATIONS

PRO/II offers a wide variety of thermodynamic methods and physical property data that are applicable to virtually every industry. Below is a limited industry grouping of applications.

Green Engineering
- Integrated Gasification Combined-Cycle (IGCC)
- CO_2 recovery from fuel or flue gas
- Gasification of inedible biomass
- Biofuels production
- Solar silicon production
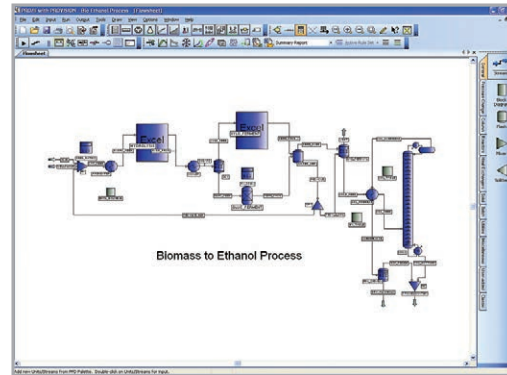
Refining
- Heavy oils processing
- Crude Preheating
- Atmospheric crude distillation
- Vacuum column
- FCC main fractionator
- Coker fractionator
- Gas plant
- Gasoline and naphtha stabilizer
- Shift and methanator reactors
- Sour water stripper
- Sulfuric and HF acid alkylation
- Deisobutanizer
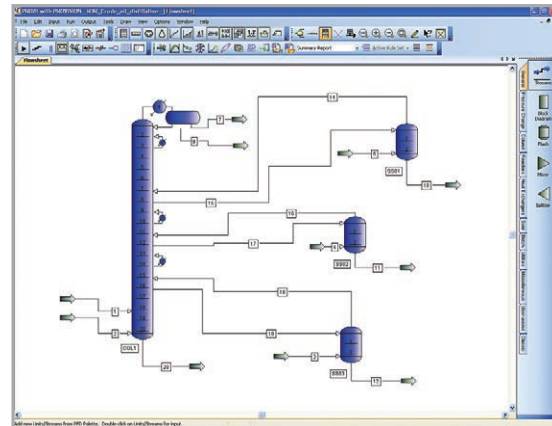
Oil & Gas Processing
- Amine Sweetening
- Cascade refrigeration & refrigeration loops
- Compressor train
- Deethanizer and demethanizer
- Expander plant
- Gas dehydration
- Hydrate formation/inhibition
- Turbo-expander optimization
- Liquefaction of natural gas
- Gas\Oil separation
- Upstream integration with PIPEPHASE
- Solid CO2 prediction
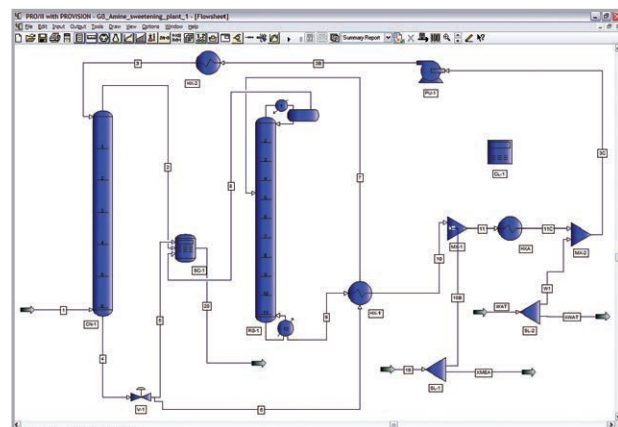
Petrochemicals

- Ethylene fractionator
- C3 splitter
- Aromatics separation
- Cyclohexane plant
- MTBE separation manufacturing
- Naphthalene recovery
- Olefin production
- Oxygenate production
- Propylene chlorination

Chemicals & Life Sciences

- Ammonia synthesis
- Azeotropic and extractive distillation
- Biofuels
- Crystallization
- Dehydration processes
- Electrolytes
- Inorganic processes
- Liquid-liquid extraction
- Phenol Distillation
- Solids handling
- Batch distillation and reactors

Polymers

- Free radical polymerization
- Step-growth polymerization
- Copolymers

Component Databanks

- 1,700+ pure component library
- Solids properties
- 1900+ components/species electrolyte databank
- Integration with Spiral CrudeSuite provides access to libraries for crude assays
- Non-library components
- Pseudocomponents and assay characterization
- User libraries
- Property prediction from UNIFAC and PROPRED structures
- Multiple assay blends
- Thermodynamic Data Manager (TDM) the ability to create, regress and manage custom libraries
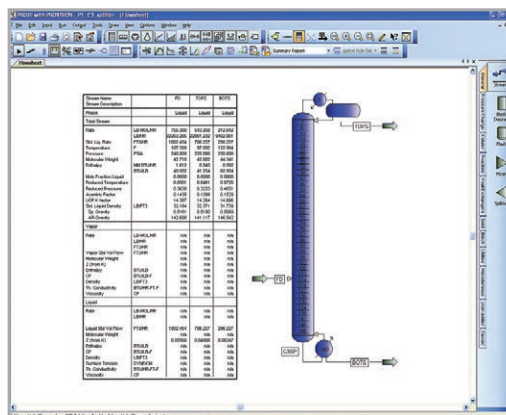
THERMODYNAMIC METHODS

Refining/Oil & Gas/Petrochemicals
- Soave-Redlich-Kwong (SRK)
- Peng-Robinson (PR)
- Huron-Vidal mixing rule (SRK & PR)
- Kabadi-Danner mixing rule (SRK & PR)
- Panagiotopoulos & Reid mixing rule (SRK & PR) original & modified
- SIMSCI mixing rule (SRK)
- Temperature-dependent Kijs
- Lee-Kesler
- Lee-Kesler-Plocker
- Chao-Seader
- Grayson-Streed
- Braun K10
- Ideal library methods
- BWRS
- Costald
- API density method
- Single and multi-fluid Rackett densities
- IF97 Steam Tables
- Free-water decant

Petrochemical/Chemicals/Polymers
- UNIFAC (VLE, LLE, & VLLE)
- UNIFAC-FV (free volume)
- UNIWAALS
- UNIQUAC
- NRTL-8 coefficient form
- Wilson
- Van Laar
- Regular solution model
- Acid dimerization
- Henry's law for non-condensibles
- Henry's law for dilute aqueous systems
- Three-phase equilibrium
- Heat of mixing
- Hayden-O'Connell
- Electrolyte models (OLI)
- Advanced Lattice Model (ALM) for polymers
- Flory-Huggins with Chi for polymers
- SAFT EOS for polymers
- PHSC EOS for polymers

UNIT OPERATIONS

General Flowsheet Models
- Flash, valve, compressor, expander, pump, pipe, AMSIM module, fuel cell, membrane separator
- Simple integration of custom units using the Excel unit operation

Heat Exchanger Models
- Shell and tube exchanger, simplified exchanger, LNG exchanger, fired heater, air cooled exchanger, heating/cooling curves
- HTRI integration, zone analysis

Flowsheet Control
- Feed-forward control, feedback controller, multivariable controller, optimizer
- Parameter cross-referencing, auto-sequencing

Polymer Modeling
- Continuous stirred tank reactor, plug flow reactor, wiped film evaporator
- Kinetics mechanism
  - Homogeneous Ziegler-Natta
  - Chain polymerization
  - Condensation polymerization

Distillation Models
- Multiple advanced solution algorithms
- Multiple initial estimate generators
- Two/Three phase distillation
- Electrolytic distillation
- Reactive and batch distillation
- Liquid-liquid extraction
- Column and tray sizing or rating
- Thermosiphon reboiler
- RATEFRAC & BATCHFRAC

Solids Modeling
- Crystallizer/dissolver, countercurrent decanter, centrifuge, rotary drum filter, dryer, solid separator, cyclone

Reactor Models
- Conversion & equilibrium reactors, plug flow reactor, continuous stirred tank reactor, shift & methanation reactors, boiling pot reactor, batch reactor
- Inline FORTRAN reaction kinetics, Gibbs free energy minimization

ADD-ON MODULES

There are several add-on modules, interfaces to third-party software and separate software such as the SIM4ME Portal that are integrated with PRO/II as licensable add-ons. These add-on modules extend the functionality of PRO/II in various ways from Excel integration to electrolytic modeling to rate-based distillation.

SIM4ME PORTAL

The SIM4ME Portal facilitates a simple, bi-directional transfer of variables between various SimSci simulation software, including PRO/II, and Microsoft Excel. The Portal allows a novice to use the simulation program through Excel.
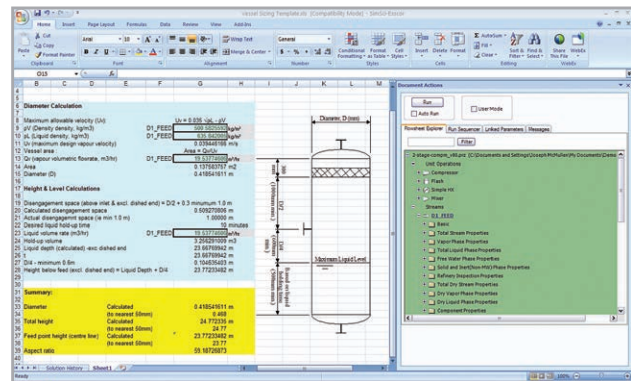
POLYMER MODULE

The polymer module provides PRO/II with the ability to simulate and analyze industrial polymer processes. Capabilities range from monomer purification and polymerization reactions to separation and finishing.

BATCH MODULE

The batch module enables the rigorous design and analysis of batch reactors and distillation columns. The batch module allows for the design, monitoring, and troubleshooting of both batch and batch/continuous processes while evaluating alternative configurations.

ELECTROLYTE MODULE

The electrolyte module extends the capabilities of PRO/II to electrolyte modeling using rigorous thermodynamics from OLI Systems, Inc. The electrolyte module includes the ability to design and analyze systems containing electrolytes as well as allowing the generation of custom electrolyte models.

MIXED SOLVENT ELECTROLYTES (MSE)

MSE is the latest product offering from OLI that provides species information and thermodynamic algorithms for electrolytic systems without a concentration limit by utilizing an activity coefficient model. MSE is ideal for systems where the components have a high miscibility with water.

AMSIM

Schlumberger's AMSIM is fully integrated into PRO/II allowing accurate simulation for the removal of H_2S, CO_2 and mercaptans from natural gas and liquefied petroleum gas (LPG) streams using chemicals (amines) and physical solvents.
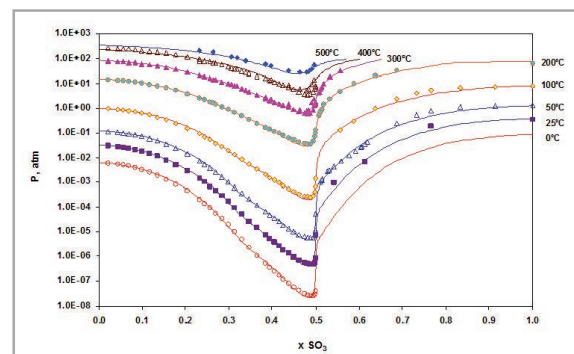
RATEFRAC

RATEFRAC is a product of Koch-Glitsch and licensed exclusively within PRO/II. RATEFRAC is a rigorous rate-based distillation model for applications where equilibrium initiative are limited by heat and mass transfer rates. RATEFRAC allows for the simulation of all types of multistage vapor-liquid columns such as absorption, stripping, and conventional azeotropic and extractive distillation.
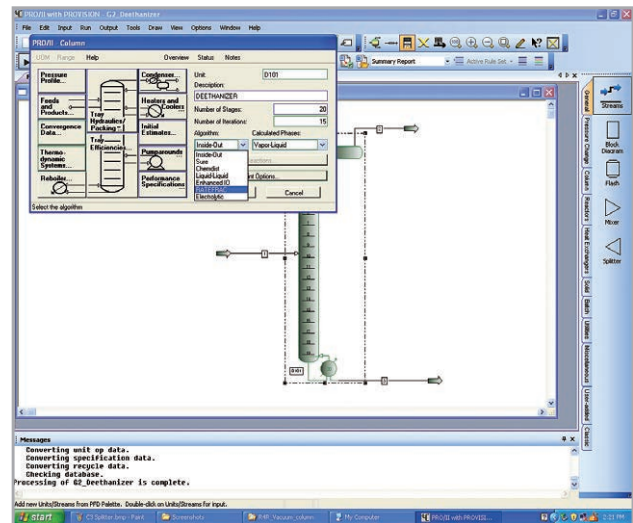
BATCHFRAC

BATCHFRAC is a product of Koch-Glitsch and licensed exclusively within PRO/II. BATCHFRAC is a rigorous distillation algorithm capable of modeling unsteady-state batch distillation processes. The BATCHFRAC module allows for simulation of reactive distillation and supports two liquid phases making it well-suited for applications within the chemicals industry.

CRUDESUITE

Spiral CrudeSuite is an industry-leading, enterprise toolset for crude oil knowledge management. It is also a key component of Spiral's enterprise-level supply chain solution, working in conjunction with the Spiral Suite toolset to support work processes across assay management, planning, scheduling, and supply and distribution. The unique features of this toolset have made CrudeSuite the assay management tool of choice across the petroleum industry. CrudeSuite helps organizations manage their data, make purchasing and blending decisions, and feed refinery plans. Integration between CrudeSuite and PRO/II extends the benefits to process design and operational support by providing accurate feedstock information to the simulations, which greatly increases the accuracy of the models.

PROCESS ENGINEERING SUITE

PRO/II is the main product of the Process Engineering Suite (PES) providing the general flowsheeting and process design capabilities. PES from Invensys is a consistent set of tools for engineering design and operational analysis. This integrated suite of software readily interfaces with other applications commonly used by process engineers, thus enhancing productivity in the plant life cycle. PES can be used for oil and gas production, refining, petrochemicals, chemicals, pharmaceuticals, and polymer plant modeling.

PRO/II – General-purpose process flowsheet simulation and optimization
HEXTRAN – Comprehensive heat transfer simulation and pinch analysis
DATACON – Plant gross error detection and data reconciliation
INPLANT – Multiphase, fluid flow simulation for plant piping networks
VISUAL FLOW – Design and modeling of safety systems and pressure relief networks

invensys

TM

Rev. 09/12   PN SE-0121