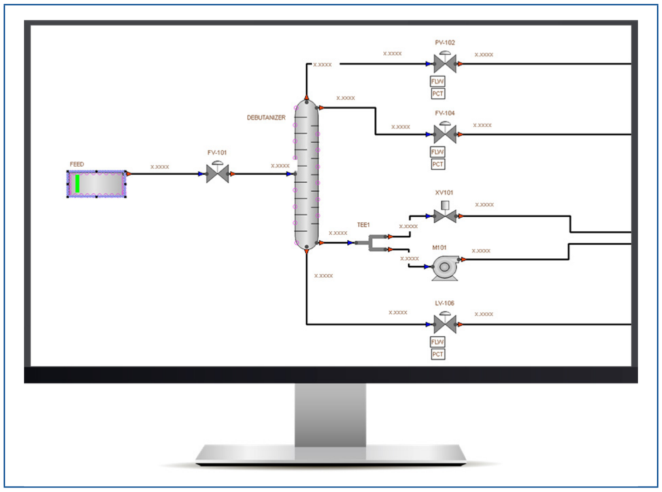
DeltaV™ Mimic Process – Separations

- Intuitive unit operation modeling
- Supports the use of material thermodynamic properties and vapor-liquid equilibrium equations
- Scalable model complexity using unit operation configuration parameters
- Reduces model tuning requirements with advanced thermodynamics methods



Introduction

DeltaV™ Mimic Process – Separations provides high-fidelity dynamic modeling objects for Vapor-Liquid-Liquid Equilibrium (VLLE) based separation unit operations, include columns, condensers, and flashing vessels. These objects can be used for application software testing, operator training, and process or operation improvements.

Benefits

- **Intuitive unit operation modeling –** These process objects come with modeling infrastructure that makes the development of accurate models quick and easy. Models are configured with actual plant design specifications resulting in accurate dynamic response.
- **Supports the use of material thermodynamic properties and vapor-liquid equilibrium equations –** Mimic Process – Separations calculates the separation of inlet components into vapor, liquid, and heavy liquid, with optional additions of jacket or coil heat exchangers and column reboilers. Using the same properties and equations, the objects can also calculate the temperature and phase change of inlet components.
- **Scalable model complexity using unit operation configuration parameters –** Dynamic models of separations unit operations can be implemented with different options depending on needs and scope of the simulation. Control the level of the model complexity by means of physical settings, composition, sources, and more.
- **Reduces model tuning requirements with advanced thermodynamics methods –** Included with the additional objects are advanced thermodynamic capabilities designed to reduce the time and effort to build high-fidelity simulations. Intuitive wizards guide users through required component data, as when selecting binary interaction parameters.

Product Description

DeltaV Mimic Process – Separations provides high-fidelity dynamic models. The objects include:

- Separator
- Vessel (VLE)
- Surface Condenser
- Jet Condenser
- Distillation Column
- Stripper
- Simple Fractionator

Each process object in Mimic Process – Separations includes specific parameters designed for quick configuration.

Separator

The Separator object simulates a vessel with up to 5 (five) Inlet material streams and up to 4 (four) Outlet material streams.

- Vapor Product stream
- Vapor Vent stream
- Liquid (or Light liquid) Product stream
- Heavy Liquid stream (if object is specified as Two Liquid Separator)

External Heat Input to Separator can be specified by the user, and the Heat losses to ambient can optionally be calculated by the object. The heavy liquid stream is specified by the user. An additional Vapor Vent stream can be optionally specified.

This object uses the material and energy balances, component thermodynamic properties, and Vapor-Liquid Equilibrium (VLE) equations to calculate pressure and temperature in the vessel, the separator vapor and liquid phase compositions, the volumes of vapor and liquid, and the levels of liquid and heavy liquid (if specified).

Vessel (VLE)

The Vessel (VLE) object simulates a vessel with up to 8 (eight) Inlet material streams and up to 8 (eight) outlet material streams. Additionally, there is an internal heat exchanger that simulates a jacket or coil.

The object uses the material and energy balances, component thermodynamic properties, and Vapor-Liquid Equilibrium (VLE) equations to calculate pressure and temperature in the vessel, the vapor and liquid phase compositions, the volumes of vapor and liquid, and liquid level.

Surface Condenser

The Surface Condenser simulates a vessel with up to 8 (eight) Inlet material streams and up to 8 (eight) Outlet material streams. Additionally, there is one Coolant inlet and one Coolant outlet stream.

The object uses the material and energy balances, component thermodynamic properties, and Vapor-Liquid Equilibrium (VLE) equations to calculate pressure and temperature in the condenser, the vapor and liquid phase compositions, the volumes of vapor and liquid, and condensate level.

Jet Condenser

The Jet Condenser object simulates a vessel with up to 8 (eight) Inlet material streams and up to 8 (eight) Outlet material streams. Inlet Streams carry vapor to be condensed and coolant which is sprayed over the vapor space.

The object uses the material and energy balances, component thermodynamic properties, and Vapor-Liquid Equilibrium (VLE) equations to calculate pressure and temperature in the Condenser, the vapor and liquid phase compositions, the volumes of vapor and liquid, and the level of condensate.

Distillation Column

The Distillation Column provides a high-fidelity dynamic model for a wide range of distillation column configurations. Features supported in this process object include:

- **Multi-sectional columns –** Three column sections with different tray/column diameters, tray spacing, and weir heights. 75 trays can be configured per column section.
- **Multiple feeds and side draws –** Five feed streams and five side draw streams per column.
- **Total condenser and partial condenser –** Automatic switching between the modes depending on current operational conditions.
- **Choice of the Reboiler –** Reboiler heat exchanger with a heating agent (steam) flow, controlled by valve, or an external reboiler heater (for instance, fired heater) with manipulated heat duty.
- **One or Two liquid phases in the Reflux Drum –** Option with two liquid phases provides simulation of separation of the light and heavy liquids in the Drum and knocking out the heavy liquid from the process.

Flexible configuration of the column over-head section, matching to most of the connection schemes for the condenser and reflux drum (reflux receiver).

Stripper

The Stripper object provides a high-fidelity dynamic model for a wide range of stripper column configurations. Features supported in this process object include:

- **Multi-sectional columns –** Three column sections with different tray/column diameters, tray spacing, and weir heights. 75 trays can be configured per column section.
- **Multiple feeds and side draws –** Five feed streams and five side draw streams per column.
- **Choice of the Reboiler –** Reboiler heat exchanger with a heating agent (steam) flow, controlled by valve, or an external reboiler heater (for instance, fired heater) with manipulated heat duty.

Simple Fractionator

The Simple Fractionator object provides a flexible column that can be used to create high fidelity models of multi-component vapor-liquid separation. Features supported in this process object include:

- **Simple or Advanced Configuration options –** Use the calculated parameters (Simple) or enter custom values (advanced) for Top/Bottom Pressures, Tray efficiency, aeration coefficient, weep rate, minimum velocity for no weep, heat duty, and equilibrium tuning.
- **Multi-sectional column –** Up to 400 trays can be configured per column. Trays may be arranged in any combination of column sections with customizable active tray area, velocity area, tray spacing, and weir heights.
- **Multiple feeds and side draws –** 16 feed streams and 16 side draw streams per column.
- **Easily view Fractionator Performance –** During runtime, view performance information for your fractionator including enthalpies, tray flows, temperatures, pressures, compositions, and hold ups.

Advanced Thermodynamics Methods

Used to configure and utilize rigorous thermodynamic model methodologies. This expanded modeling capability stems from the broad addition of two classes of functionality:

- **Cubic (van der Waals like) Equation of State Models.** These Equation of State models can be used to calculate compressibility and enthalpy departure. The most widely used EOS types are included:
  - Peng-Robinson (PR76)
  - Peng-Robinson (PR76 - Boston Mathias)
  - Peng-Robinson (PR78)
  - Peng-Robinson (PR78 - Boston Mathias)
  - Predictive Peng-Robinson by Jaubert and Mutelet (PPR78)
  - Soave-Redlich-Kwong (SRK)
  - Soave-Redlich-Kwong (SRK - Boston Mathias)
  - Predictive Soave-Redlich-Kwong by Jaubert and Privat (SRK-JP)

Equations of State utilize one empirical binary interaction parameter (BIPs) for each binary pair in a mixture. These parameters characterize the nonideality of interaction between component pairs, with a value of zero indicating negligible interaction. Advanced Thermodynamics contains two methods for leveraging BIPs in EOS models

- Constant values of BIPs, defined by the approximation of experimental data for each binary pair in a mixture for the PR76, PR78, and SRK models (as well as their Boston Mathias modifications).
- Temperature dependent values of BIPs, calculated by a group contribution method for the binary pair in a mixture by application of the predictive models PPR78 and SRK-JP.

- **Non-Random Two Liquid (NRTL) equations for the liquid phase.** The vapor phase is based on the Ideal Gas EOS. The NRTL model is applied for the calculation of liquid phase activity coefficients as well as excess enthalpy (enthalpy of mixing).

Product Support

Mimic Product Support is delivered through Guardian™. Guardian is Emerson's digital platform for addressing the end-to-end lifecycle needs of automation & control software and asset performance management solutions. The Guardian digital experience enables users to quickly connect to product support; securely manage subscriptions; get intuitive views into system health; and explore additional software and services that propel performance.

Ordering Information

DeltaV Mimic is licensed on a Flexible Subscription Unit (FSU) basis. An FSU is a currency that can be used to access any Mimic feature licensed on an FSU basis, with each feature requiring its own number of FSUs. The FSU subscription is offered in one-year, three-year, and five-year terms. To purchase, extend, or expand a license, please contact your Emerson Sales Representative.

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- DeltaV Mimic Foundation
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