

Vicky Athanasiou October 12th, 2017 UNISIM® DESIGN SUITE Current CAPE-OPEN Capabilities



### **Your Presenter Today**



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- Vicky has a Science Bachelor degree in Chemical Engineering from Massachusetts Institute of Technology, in Cambridge, Massachusetts, USA; a Masters degree in Biomedical Engineering from Imperial College of Science, Technology and Medicine, in London, UK; and a MBA in General Management from London Business School in London, UK.
- Vicky has 14 years of working experience in process simulation for process design and operator training simulation systems and 7 years in commercial roles including sales, sales support, business development and product and strategic marketing.



- Why does Honeywell support CAPE-OPEN?
- UniSim Design Suite Current Capabilities
  - CAPE-OPEN Thermodynamic Sockets
  - CAPE-OPEN Unit Operation Sockets
  - UniSim Thermo CAPE-OPEN Package
  - UniSim CAPE-OPEN Mixer/Splitter Example
- Demo
- Q&A



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# Why Does Honeywell Support CAPE-OPEN?

- UniSim Design provides individual CAPE-OPEN Thermodynamic and Unit-Op sockets to flexibly communicate and interoperate with third party extensions.
- We are accommodating customers who use more than one simulation technology and/or want to use certain in-house developed tools/IP across multiple commercially available simulators. For example, customers who:
  - develop & use their own proprietary thermo
  - develop & use their own unit operations

This allows them to more accurately simulate their processes and plant assets and minimize the amount of maintenance for their in-house tools.

• CAPE-OPEN is one of several options for open architecture that UniSim Design supports.

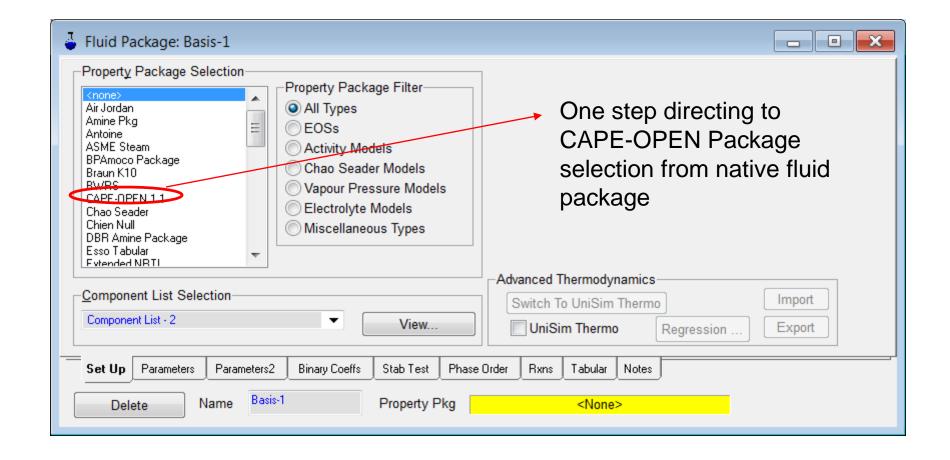


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# **CAPE-OPEN Thermodynamic Sockets**

• Simplified set-up of a CAPE-OPEN package:





# **CAPE-OPEN** Thermodynamic Sockets

- CAPE-OPEN Thermo-socket supported both CAPE-OPEN 1.0 and CAPE-OPEN 1.1 standards
- With CAPE-OPEN 1.1:
- 1. The flash calculation performance has improved
- 2. Supported flash types are queried

| Select CAPE-OPEN Thermodynamic Property Pack | age:          |                             |
|--|---------------|-----------------------------|
| CAPE-OPEN 1.1                                | Provider:     | <please select=""></please> |
| CAPE-OPEN 1.0<br>CAPE-OPEN 1.1               | Package:      |                             |
| All CAPE-OPEN packages                       | Description:  |                             |
|  | Implements:   |                             |
|  | Prog ID:      |                             |
|  | CLSID:        |                             |
|  | Vendor IIRI • |                             |

### **CAPE-OPEN Thermodynamic Sockets**

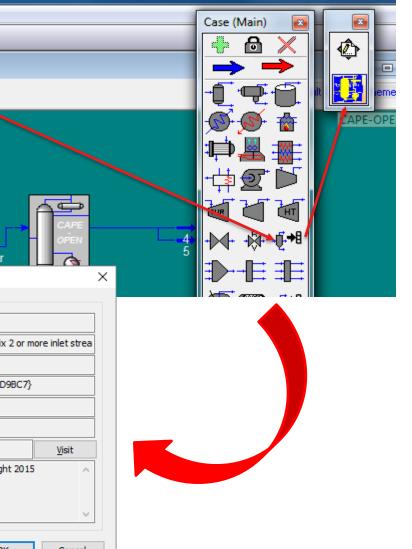
- UniSim Design supports persistence: it can save and load the changes made within the CAPE-OPEN package.
- Also, it is easy to access the CAPE-OPEN package for editing.

| <ul> <li>Fluid Package: C1_C2 (EOS)-1</li> <li>Model Selection</li> <li>Antoine</li> <li>Braun K10</li> <li>CAPE-OPEN</li> <li>CAPE-OPEN 1.0</li> <li>DBRAmine</li> <li>Esso Tabular</li> <li>ExtPkg</li> <li>GERG</li> <li>HF Package</li> <li>Ideal Gas</li> <li>Kabadi-Danner</li> <li>CAPE-OPEN</li> <li>CAPE-OPEN</li> <li>CAPE-OPEN</li> <li>Cape-OPEN</li> <li>Cape-OPEN</li> <li>Cape-OPEN</li> <li>Cape-OPEN</li> <li>Cape-OPEN</li> <li>Cape-OPEN</li> <li>Extended Flash</li> <li>Extended Flash Setup</li> <li>Extended PropPkg Setup</li> <li>CAPE-OPEN</li> <li>Component List Selection</li> <li>Component List - 2</li> <li>View.</li> </ul> | SAPE-OPEN Model         Prop System         Prop System         TEA (CAPE-OPEN 1.1)         Prop Package         C1_C2 (EOS)         Custom View         Model Options         Advanced Thermodynamics         Switch To UniSim Thermo         Import         Vision Thermo         Regression |
|--|--|
| Set Up         Parameters         Parameters2         Binary Coeffs         Stab Test           Delete         Name         C1_C2 (EOS)-1         Property   | Phase Order     Rxns     Tabular     Notes       Pkg     Vapor: CAPE-OPEN     Liquid:     Edit Properties  |



- Implemented as Unisim Extensions
  - Insert via Unit-Op palette (Recommended) or Unit Operation dialog
  - Select a CAPE-OPEN unit operation by name
  - Meta information is displayed while the unit operation is selected

| Name:         |  |   |
|---------------|--|---|
| Name:         | Mixer  |   |
| Description:  | Mixer - unit operation to adiabatically mix 2 or mor                   | e inlet strea   |
| ProgID:       | COCO_COUS.Mixer  |   |
| Class ID:     | {5E216BDD-C82F-45FE-830C-61FDDD2D9BC7}                                 |   |
| CAPE Version: | 1.0  |   |
| Version:      | 3.2.0.2  |   |
| URL:          | http://www.cocosimulator.org/  | Visit   |
| About:        | CAPE-OPEN 1.0 unit operation - Copyright 2015<br>www.cocosimulator.org | ^   |
|               |  | ~   |
| -             | ProgID:<br>Class ID:<br>CAPE Version:<br>Version:<br>URL:<br>About:    | ProgID:       COCO_COUS.Mixer         Class ID:       {5E216BDD-C82F-45FE-830C-61FDDD2D9BC7}         CAPE Version:       1.0         Version:       3.2.0.2         URL:       http://www.cocosimulator.org/         About:       CAPE-OPEN 1.0 unit operation - Copyright 2015 www.cocosimulator.org |



| Dynamic port col     | llectio   | n           |           | Support for Material an          | d Energ | ју ро       | orts     |
|----------------------|-----------|-------------|-----------|----------------------------------|---------|-------------|----------|
| 🚺 Mixer - 10         |           |             |           |                                  | _       |             | ×        |
| Connections Variable | Variables | Reports   A | bout ]    |                                  |         | 1           |          |
|                      | Port      | Туре        | Direction | Connected to                     |         |             |          |
|                      | Inlet 1   | Material    | Input     |                                  |         |             |          |
|                      | Net 2 N   | Material    | Input     |                                  |         |             |          |
|                      | Inlet 3 N | Material    | Input     |                                  |         |             |          |
|                      | I         | Material    | Input     |                                  |         |             |          |
|                      | Outlet N  | Material    | Output    |                                  |         |             |          |
|                      |           |             |           |                                  |         |             |          |
| Mixe                 | reed      |             | not       | all material ports are connected |         | Show Unit C | GUI      |
| Validation status    | alway     | /s vis      | sible     |                                  | Sup     | port        | for Edit |

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Support for:

- Persistence
- Logging and Reports
- Thermo 1.0 & 1.1

| Dynamic parameter collection                 | Parameter dimensionality<br>and unit conversions |      |               |
|--|--|------|---------------|
| HeaterCooler - 100:                          |  |      |               |
| Connections Variables Reports About Variable | Value<br>Heat duty                               | Unit | 1             |
| Outlet temperature                           | 26.85  | c    |               |
| Heat duty                                    | 0  | kijh |               |
| Pressure drop                                | 0  | kPa  |               |
| Thermo Version                               | 1.0  |      |               |
| Reset  |  |      |               |
| not all material ports are o                 | connected  |      | Show Unit GUI |
|  |  |      |               |



- CAPE-OPEN Parameters can be used in any context normal parameters can be used (such as spreadsheet table or adjuster)
- Calculations are on hold while the user is inside the edit log'
- A unit op is not recalculated unless an input parameter or feed stream changes.

|          | Image: Spring | Browsable<br>Angles in: Rad V |
|----------|---|-------------------------------|
| CO - 100 | A B C<br>1 1000<br>2 2 20.00<br>3 4<br>5 6<br>7 8   |                               |
|          | · · · · · · · · · · · · · · · · · · ·   |                               |
|          | Connections     Parameters     Formulas     Spreadsheet     Calculation Order       OK       Delete     Function Help     Spreadsheet   | Initialize From Variables     |

# **UniSim Thermo CAPE-OPEN Package**

• UniSim Thermo provides a server to make a CAPE-OPEN package (CAPE-OPEN 1.0)

| Select CAPE-OPEN Thermodynamic Property Pack                           | (age:        |   |  |  |
|--|--------------|---|--|--|
| CAPE-OPEN 1.0  | Provider:    | UniSim Thermo server  |  |  |
| CapeOpen.CPropertyPackage  | Package:     | C1_C2_C3_PR   |  |  |
| ⊕ ▲ CPP Ideal Thermo System     ⊕ ▲ OATS Thermo System (CAPE-OPEN 1.0) | Description: | UniSim Thermo server  |  |  |
|  | Implements:  | CAPE-OPEN 1.0   |  |  |
| <u>Ă</u> benzene<br><u>Ă</u> C1_C2_C3_PR                               | Prog ID:     | eThermo.CO.COTHsys  |  |  |
| COCoPAr<br>A Peng  | CLSID:       | {95ADFF1F-44AA-42E0-9200-3961444F82DC}  |  |  |
| Lest<br>Lest   | Vendor URL:  | http://www.honeywell.com  |  |  |
|  | About:       | Property packages will be read from .XML & .CTF<br>files in directory specified \nin parameter<br>FluidPackagesPath within file HypCOTh.ini \n(which<br>is in UniSim CAPE-OPEN Kit installation). \nSee<br>'UniSim Thermo CAPE-OPEN Server v1.0.doc' for<br>more information. |  |  |
|  |              | OK Cancel   |  |  |



# **UniSim CAPE-OPEN Mixer/Splitter Example**

• There is a Mixer/Splitter example of UniSim CAPE-OPEN unit operation.

| Select CAPE-OPEN Unit Operatio   | on:   |   |   |   |
|--|---|---|---|---|
| GibbsReactor<br>HeaterCooler<br>HeatExchanger<br>HeatOfCombustionUnit<br>InformationCalculator<br>MakeUpMixer<br>MeasureUnit<br>Mixer<br>NoOperation<br>PFR<br>PropertyTester<br>Pump<br>SolidSeparator<br>Splitter<br>StreamConverter<br>Thermal Energy Mixer<br>Thermal Energy Splitter<br>Turbine<br>UnISIM / Mixer-Splitter<br>Valve | Details:<br>Name:<br>Description:<br>ProgID:<br>Class ID:<br>CAPE<br>Version:<br>URL:<br>About: | UniSim / Mixer-Splitter<br>Mixer Splitter with multiple inputs and outputs<br>Mixer.MixerCO<br>(A33AA47A-FD14-42D5-91D5-922D46B9C33F}<br>1.0<br>1.0<br>http://www.honeywell.com/ps<br>Visit<br>A Honeywell Process Solutions Product<br>OK Cancel | Steady State Mixer/Splitter Mode<br>Steady State Mixer/Splitter Mode<br>Steady State Mixer/Splitter Mode<br>Steady State Mixer/Splitter Mode<br>Material Templates supported by the Simulator<br>Steady State Mixer/Splitter Mode<br>Material Templates supported by the Simulator<br>Steady State Mixer/Splitter Mode<br>Material Templates supported by the Simulator<br>Steady State Mixer/Splitter Mode<br>Steady State Mixer/Splitter Mode<br>Material Templates supported by the Simulator<br>Steady State Mixer/Splitter Mode<br>Steady Steady | Refresh Template calculations         Properties calculated with Package assigned to FEED         port ID       FEED         material ID       1         temperature       298.2         pressure       100000.000         vaporised ft       1.000         light liquid ff       0.000         solid fraction       0.000         molarflow (i       0.3         enthalpy (J/       -35.5         x (Methane)       0.5000 |

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100

Templat

- Cunto

Report

TBPs (disabled)

Worksheet

Specifications

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• Q&A

#### Demo





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Q&A







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