An introduction to COCO

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Introduction

➢ Overview of COCO software components
➢ Overview of how this fits in to CAPE-OPEN framework
➢ Some details on implemented algorithms
➢ Interoperability demonstration
➢ Benefits of having COCO on your computer
CAPE-OPEN to CAPE-OPEN (COCO):

- Simulation environment (COFE)
- Thermodynamic property package (TEA)
- Collection of unit operations (COUSCOUS)
- Reaction package (CORN)
Simulation environment process space

- overall process model
  - built-in sub models
  - 3rd party sub models (CAPE-OPEN)
  - user sub models (non CAPE-OPEN)
Simulation environment process space

- overall process model (COFE)
- built-in sub-models
- 3rd party sub-models (CAPE-OPEN)
- user sub-models (non CAPE-OPEN)
Simulation environment process space

overall process model (COFE)

Thermo models

TEA

3rd party thermo models (CAPE-OPEN)

3rd party thermo models (CAPE-OPEN)

3rd party thermo models (CAPE-OPEN)

Unit operation models

3rd party unit models (CAPE-OPEN)

3rd party unit models (CAPE-OPEN)

CORN

Reaction models

COUSCOUS
COFE: CAPE-OPEN Flowsheeting Environment

- **Graphical flowsheeting**
- **Graphing**
- **Multiple models**
- **Logging**
- **Streams view**
COFE: CAPE-OPEN Flowsheeting Environment

- Breaking recycles by automatic tearing
- Solving recycles by hybrid Newton / Wegstein approach, using reparameterization
- Support for multiple material types, with selection for thermo and sub-set of compounds
- Material, energy and information streams
TEA: Thermodynamics for Engineering Applications

• Pure compound data library (extendible, or use DIPPR)

• 100+ Property calculation methods (25+ different properties)

• Property derivatives

• Support of external property calculation routines and external equilibrium servers

Thermodynamic models and compounds from ChemSep
TEA: Thermodynamics for Engineering Applications

VLE equilibrium calculations

- Large diversity of supported flash specifications
- Inside-out approach
- Post-checking of solution (since version 1.09)
- Back-up full Newton approach
COUSCOUS: Simple unit operations

- Expander
- Pump
- Heater
- Cooler
- Compound Splitter
- StreamConverter
- Mixer
- Splitter
- Valve
- Compressor
- Heat Exchanger
- Equilibrium Reactor
- Fixed Conversion Reactor
- Flash
- 3-phase Flash
- Turbine
- Solid Separator
- No Operation
- Property Tester
- ChemSep Column Model
COFE: OLE and Excel

EXCEL

ONLINE HELP
COFE: OLE and Excel

<table>
<thead>
<tr>
<th>Property Calculations</th>
<th>Composition for property calculation below.</th>
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<td>Phase</td>
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</table>

Compound constant example:

- Name: Hydrogen
- Molecular Weight: 2.01588
- Critical Pressure: 1313000
- Critical Temperature: 190.58
COCO: CAPE-OPEN interface support

- Full support for thermodynamic standard versions 1.0 and 1.1 in all components
- Unit operation sockets & plugs (steady state)
- Reaction package sockets & plugs
- Full support for all COSE interfaces
- All common interfaces (identification, error handling, utilities, parameters with dimensionality, persistence, …)
COCO stand-alone
Three-phase AspenPlus flash using TEA + CosmoTherm
Pro/II showing internal and COUSCOUS mixer
Pro/II using TEA
IFP/TOTAL TINA pipe model running in COFE
Why COCO?

- COCO integrates a useful set of thermodynamic property calculations, compound information and unit operation models.
- COCO has been awarded the CO-LaN CAPE-OPEN award 2006.
- COCO is widely regarded as the CAPE-OPEN interoperability testing platform.
- COCO is available free of charge.
- COCO is used world-wide.
COCO downloads per capita
Download COCO: http://www.cocosimulator.org/
(or ask for a copy during the workshop)

Contact amsterCHEM for CAPE-OPEN consulting

Interoperability testing program:
http://www.cocosimulator.org/index_compliancy.html

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- Infochem: Multiflash 3.6
- PSE: gPROMS 3.0.3
- Simsci-Esscor: PRO/II 8.1
- TUV-NEL: PPDS v4.1.0.0
- VMG: VMGThermo 5.0