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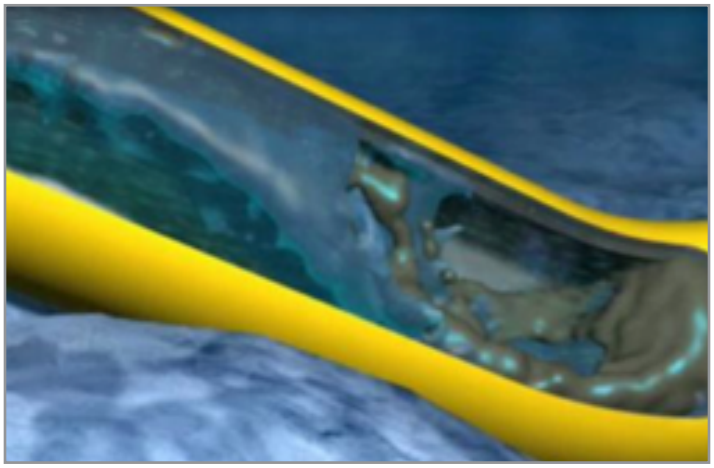
OLGA Core and Modules

Overview



Steady-state and transient multiphase simulation.

OLGA Core

The base requirement for the modules in the OLGA* dynamic multiphase flow simulator. The OLGA core includes steady-state and transient network solvers for three-phase flow—water, oil, and gas. The solvers calculate the slip (velocity difference) between the phases and also predict oil and water dispersions. Either default models or user-defined tuning factors can be used to calculate dispersion viscosities, which may deviate considerably from the oil/water average viscosities.

The OLGA core includes basic process equipment and controller logic and has a server interface that allows connection with other simulators. A risk management and optimization workflow is available for uncertainty and tuning studies. The new high-definition technology for stratified flow is an option and recommended for gas-condensate systems. The sand transportation model can be used to calculate accumulation and transportation of sand particles.

Typical cases:

- Simulating three-phase flow—oil, water, and gas
- Modeling process equipment
- Liquid holdup prediction for stratified flow in gas-condensate systems

Compositional Tracking module

Models changes in composition along the pipeline or well. The module takes into account changes in flow due to slip effects (velocity differences between phases), interfacial mass transfer, as well as the commingling of different fluids and changes in composition where networks merge. The compositional model tracks changes in time and space, and ensures more accurate fluid description in complex flow environments.

Typical cases:

- Managing merging networks and multilateral wells with varying fluids
- Simulating shut-in and startup scenarios
- Modeling gas injection and gas lift
- Handling changes in composition at inlets and sources
- Tracking gas quality
- Analyzing blowdown scenarios
- Evaluating safety processes

Slug Tracking module

Tracks each individual slug from formation to extinction or exit from the pipeline. The model considers the mechanisms of slug formation and growth, as well as the merging and decay of slugs. The module is especially useful in production facility designs, enabling engineers to determine whether downstream equipment (e.g., separators and compressors) will be capable of processing anticipated slugs.

Typical cases:

- Slugcatcher and separator design
- Control strategies and system design
- Operational procedures and guidelines
- Pigging procedures
- Operational troubleshooting

OLGA Core and Modules

Well module

Provides a straightforward workflow for engineers to create and run well transients, using the science from other OLGA modules. Furthermore, the module is designed for well flow applications where reservoir properties and inflow relationships will play an important role. The reservoir performance is specified through permeability, fluid properties, extension of the reservoir, etc., or from drawdown and buildup tests from the actual well.

Typical cases:

- Startup and shutdown of production
- Well testing
- Commingled production
- Reservoir injection–e.g., WAG
- Annular flow and gas lift
- Multilateral well simulations

Multiphase Pump module

Supports detailed simulations with centrifugal and displacement pumps. Pump characteristics are defined through pump data tables or can be user-specified. Typical sets of characteristics support many industry pumps. These criteria can be used if characteristics of the required pump are unknown. The module also regulates pump speed and recycle flow.

Typical cases:

- Inclusion of multiphase pumps
- Modeling centrifugal, helico-axial pump (standard pumps or input files from OneSubsea, a Cameron and Schlumberger company)
- Modeling displacement pumps (Bornemann or user-defined)
- Simulating ESP (Centrilift and REDA)

Inhibitor Tracking module

Shows local concentrations of the inhibitor along the line during transient operations. By considering local pressure, temperature, and inhibitor concentration, engineers can adjust the hydrate curve and easily determine whether the injected inhibitor is sufficient to prevent hydrate formation.

Typical cases:

- Determining MEG, MeOH, or EtOH concentration in the water and gas phase
- Defining inhibitor inventory
- Inhibitor distribution along the pipeline and arrival time at plant
- Tracking of tracers/low concentration additives (KHI, corrosion inhibitors, etc.)

Single Component module

Simulates transient behavior for single components: the transition between liquid and gas phase, as well as their behavior beyond critical point. The module is designed for steam and CO_2, but other single components can be entered for simulation.

Typical cases:

- CO_2 transportation and injection
- Steam injection (SAGD)
- Transient analysis of single component flow

Hydrate Kinetics module

Predicts the risk of hydrate formation and provides the operating envelope for preventing hydrate formation in well stream transport, process facilities, and design interventions.

Typical cases:

- Predicting the occurrence of hydrates and estimating the amount of hydrates formed
- Using hydrate slurry technology
- Modeling hydrate slurry flow

Complex Fluid module

Discloses severe effects on flow stability, liquid inventory, and pressure drop due to non-Newtonian liquids. Non-Newtonian effects, such as shear thinning and yield stress, affect the flow stability of production systems, especially in multiphase flow.

Typical cases:

- Non-Newtonian liquid behavior due to emulsions, hydrate slurry, and waxy oils
- Normal production in laminar flow

Corrosion module

Predicts corrosion rate along a pipeline based on variation in temperature, pressure, flow velocity, and flow regime. Three commonly used CO_2 corrosion models are available: IFE top-of-line, de Waard 1995 and Norsok M-506.

Typical cases:

- CO_2 corrosion effects
- Corrosion rate prediction
- Location of corrosion

OLGA Core and Modules

FEMtherm module

Supports screening of temperature effects on a wide range of bundle geometries and burial configurations to ensure safe conditions during normal operations. The module also predicts the impact of temperature changes during shutdown and startup procedures.

Typical cases:

- Bundled pipelines
- Buried and half-buried pipelines
- Complex risers
- Heating, cooling, and heat exchange effects

Wax module

Calculates transport and deposition of wax components along the pipeline. The module simulates the effects of increases in both pipeline roughness and the apparent viscosity of an oil phase containing solid wax particles, as well as decreases in pipeline diameter. Users can tune the fluid properties related to molecular diffusion, shear-related wax transport, and the effective viscosity of an oil/wax mixture. The module also simulates pigging operations for wax layer removal and transport.

Typical cases:

- Pigging for wax removal
- Thermal insulation due to wax layer buildup
- Active heating
- Chemical injections

ROCX module

A dynamic reservoir model that shows transient flow rates and pressures near the wellbore. The OLGA simulator sends wellbore pressure information to the ROCX module, which then sends flow rates for each phase back to the OLGA simulator.

Typical cases:

- Crossflow and backflow
- Water and gas coning
- Bullheading and injection

Tuning module

Offers access to a number of model parameters. When adjusted by a multiplication factor, these can be used to tune the model to existing data. This is applied when field data, or other information, justifies modifications of important model parameters, such as interfacial friction factor or wall frictions.

Typical cases:

- Adjust OLGA module to measured data
- Sensitivity studies

Plug-in module

Allows users to write their own routines for the OLGA engine.

Typical cases:

- Slip velocity between dispersed phases, and carrier and continuous phase
- PVT properties of the new phase and optional modification of gas/oil/water properties
- Modifications of heat transfer coefficient between the fluid and the pipe wall

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