ASCOMP

MULTIPHASE FLOW SCIENCE AND TECHNOLOGY

Oil & Gas

Gravity separation, Slugging in pipes, Core-annular flow, Riser flows, Particles deposition in pipelines, Loss of drilling fluids, Sloshing in LNG tanks, Hydrate formation, Subsea flow assurance

Oil & Gas

Our Services Team relies on the unique predictive capabilities of TransAT to satisfy selective operators needs in the oil & gas industry. Detailed 3D simulations of multiphase flow are now possible for various subsurface and surface operations, including gravity separation, slugging in pipes, core-annular flow for drag reduction, riser flows, particles deposition in pipelines, loss of drilling fluids, sloshing in LNG tankers, subsea hydrate formation and flow-lines plugging.

Multiphase flow in pipelines

Slug flow in horizontal transportation pipelines features large coherent disturbances, causing pressure fluctuations and variations in the flow rates that can affect process equipments. Flow transition in vertical pipes is critical for oil production efficiency, in particular for large diameter pipes used for non-conventional exploration. With TransAT, we can predict most of the observed flow regimes in horizontal and vertical configurations, using either detailed or averaged flow topology models.

1D-3D Coupling (Olga/Ledaflow*-TransAT)

TransAT features bi-directional coupling schemes with a variety of reservoirs, bottom wells, pipes and surface network 1D models. Integrated in a result-oriented multiscale strategy, it offers a promising way to account for relevant local mechanisms without losing sight of the big picture. Promising applications are flow in an elbow, separators, riser flows, slug catcher, flows through the BOP, junctions, well-heads, bottom wells, etc.

Subsea oil spill

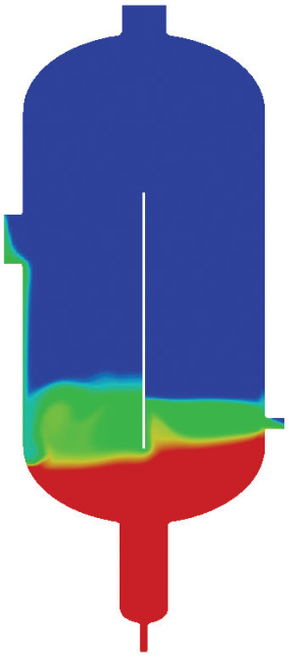
Improving the prediction of subsea oil spills helps define efficient mitigation operations to minimize environmental consequences and costs for the operator and local businesses. Subsea oil spills are multiphase flow jets combining water, methane, light & heavy oil components, further complicated by the formation of hydrates. TransAT has proven robust and efficient in predicting unsteady hydrocarbon plumes in the aftermath of hypothetical deep-sea blowouts, including with chemical inhibitors of hydrate formation.

Hydrocarbon separation

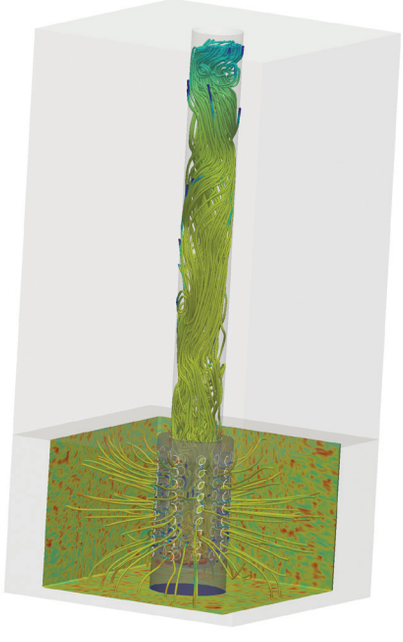
Primary separation processes are employed to remove water from oil, which can be naturally present or injected to force oil to the surface. Both formation and injected water eventually arrive to the well bore and are produced at the well head. The bulk of suspended oil in produced water is free oil, and can be removed by gravitational effects. TransAT offers a complete workflow for the purpose based on the N-phase approach with droplet population-balance* modelling and phasic rheology effects.

Cross-heating in the soil from the clustering of oil-production wells

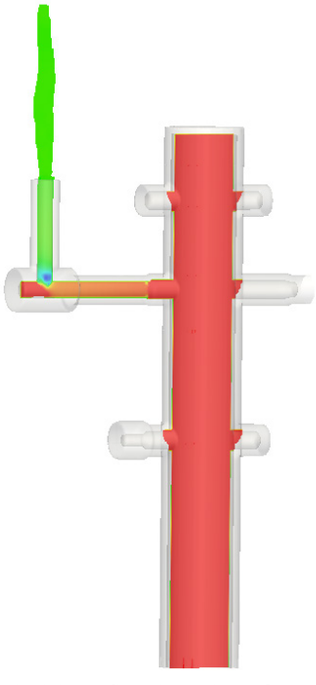
When several oil-production wells are placed in close proximity, a strong two-way thermal-flow coupling between each of well and the rock formation is expected. To assess the impact of well clustering on flowing wellhead temperatures and stresses, TransAT can be used to capture the transient heat transfer between the wells in two-dimensional planes at different depths, while coupling to 1D riser flow codes.



Three-phase flow in a vertical separator



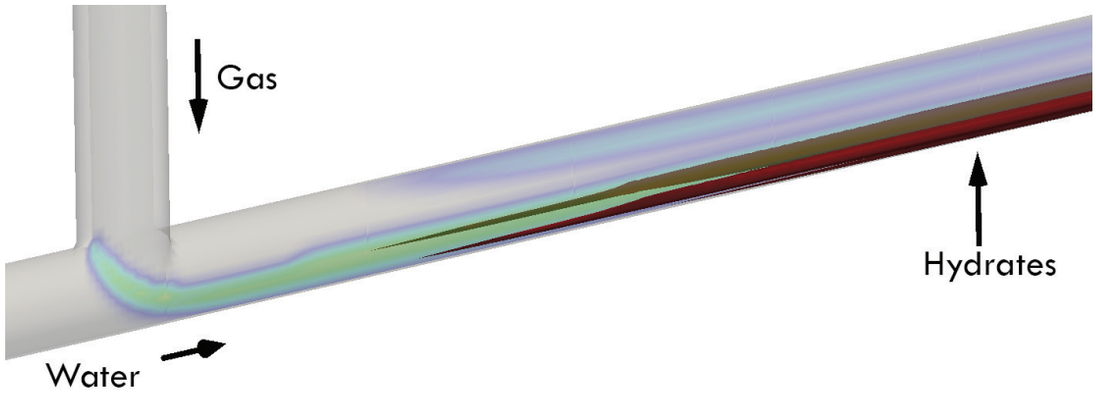
Multiphase flow through the oil well downhole

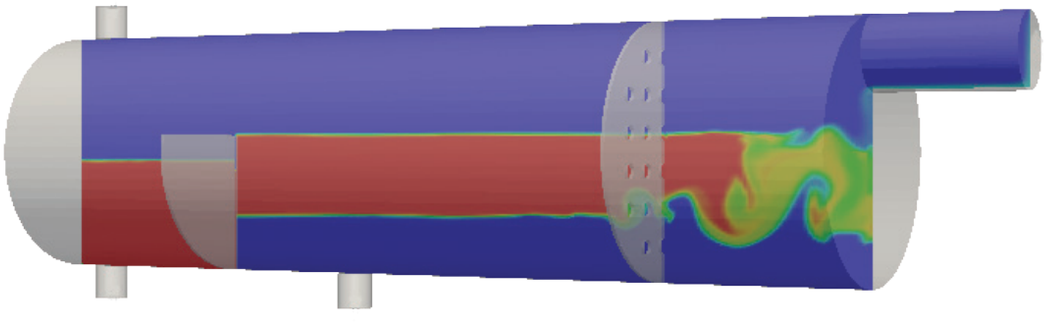


Multiphase flow through a BOP

* *Upcoming feature*

Hydrate formation and transport in a junction





Three-phase flow in a gravity separator

Safe evaporation of liquefied gas in LNG container vessels

The design of insulated container systems for maritime transport of LNG is a major safety issue. The tanks are filled with a liquid at -110°C, and insulated by a layered arrangement of complex structures. In case of an LNG leak, the emergency procedure consists in emptying the tank and drying up the flooded spaces by blowing a hot inert gas to evaporate the liquid. If evaporation takes place too quickly, confinement effects can lead to pressure build-up and structural damage. Thanks to its advanced modelling capabilities, TransAT helps design the safe heating procedure that preserves the insulating membrane integrity and complies with the regulations.

Hydrate plugging of flow-lines

Plugging of flow-lines due to hydrate formation in subsea conditions may disrubt the flow assurance. A hydrate plug in a production line may indeed immobilize the production during weeks until it finally melts down. Detailed 3D simulation could anticipate the formation of hydrates, or design strategies to ensure restarting after a long shutdown due to hydrate blockage. TransAT, specifically dedicated to N-Phase flow systems, is now capable to predict the formation and wall adhesion* (or melting) of the hydrates leading to pipe plugging. TransAT predicts now the inhibition* of the phenomenon using chemical inhibitors.

Rollover in LNG storage tanks

The onset of rollover in LNG storage tanks is a vital issue in the gas processing and transport segment. Simplistic models used until now can have high margin of errors. At ASCOMP we have introduced advanced models into TransAT to improve the modelling accuracy, based on sound theoretical principles. The model helps identifying the parameters to which the predicted rollover time is most sensitive to. The final goal is to perform 3D simulations of rollover phenomenon in order to predict BOG generation and pressure dynamics.

Particle deposition in gas pipelines

Solid particles deposition affects the flow performance of gas pipelines and may lead to severe corrosion and degradation of the pipe integrity. New models have been developed in TransAT to predict the deposition and entrainment of solid particles using the granular phase-average flow formulation. We now are able to simulate the effects of varying different operational parameters on the critical mass flow rate that can evacuate a bed of particles to avoid solid-slug formation, and wash out the pipes.

Droplet entrainment in stratified pipe flows

Entrainment of droplets occurs in stratifying annular pipe flows and represents an important mechanism for transporting the liquid to the tube walls, affecting in turn the mass flow rate. The issue is comprehensively addressed with TransAT, including gas-shear induced surface deformations, wave formation, growth and breakup. Here too, a subtle model combination is used, combining LES for the gas and liquid phases coupled at the interface, using Interface Tracking Methods for the interfacial dynamics.

EXCELLENCE IN MULTIPHASE FLOW SIMULATION

Multiphase Flow Advanced Turbulence Smart Meshing Complex Fluids Flows

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