



The image displays a 3D visualization of a compositional simulation. It shows a subsurface reservoir with various layers and wells. The simulation results are visualized using a color scale from blue (low) to red (high). Several wells are shown, with production data represented by pie charts at the wellheads. The pie charts are color-coded to match the simulation results, showing the composition of the produced fluids. The simulation is presented in a perspective view, showing the spatial distribution of the reservoir and the wells.

Compositional Simulation

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Why Compositional Simulation?

- Black oil simulation
 - ✓ Pseudo-compositional
 - ✓ Consider only vapor, liquid, water phases
- Phase envelope changes if the composition changes
- Miscibility
- ...

Compositional Mass Conservation

- Single phase

- ✓ $\frac{\partial(\rho C_\psi)}{\partial t} + \nabla \cdot (C_\psi \rho u) = \nabla \cdot (D \nabla C_\psi) + S_\psi$

- Phase $\beta = 1, \dots, N_\beta$: N_β immiscible fluid flows

- ✓ $\sum_\beta S_\beta = 1$

- Component $\kappa = 1, \dots, N_\kappa$: Phase β contains N_κ components

- ✓ $\sum_\kappa X_\beta^\kappa = 1$

- ✓ X_β^κ : mass fraction of component κ in phase β

- For component κ ,

- ✓ $\sum_\beta \frac{\partial(\phi S_\beta \rho_\beta X_\beta^\kappa)}{\partial t} + \nabla \cdot \left[-X_\beta^\kappa \rho_\beta \frac{k_{k,r\beta}}{\mu_\beta} \nabla (P_\beta - \rho_\beta g z) \right] = \nabla \cdot (\rho_\beta D_\beta^\kappa \nabla X_\beta^\kappa) + S_\kappa$

- ✓ Gravity direction is positive

- ✓ $P_\beta = P_{non-wetting} + P_{c,\beta}$

- ✓ Tables for ρ_β, μ_β

- ✓ EOS for X_β^κ ratios

- Flash calculation
 - Kinetic equilibrium (hydrate)