# Test

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## Reservoir | Fundamentals 2

[ww-shortcode-divider style="thin"]Traditional finite difference simulators dominate both theoretical and practical work in reservoir simulation. Conventional Fluid Dynamics (FD) simulation is underpinned by three physical concepts: conservation of mass, isothermal fluid phase behavior, and the Darcy approximation of fluid flow through porous media. Thermal simulators (most commonly used for heavy crude oil applications) add conservation of energy to this list, allowing temperatures to change within the reservoir.[ww-shortcode-fancy-list style="1″ dividers="true"]Numerical techniques and approaches that are common in modern simulators:

- Most modern FD simulation programs allow for construction of 3-D representations for use in either full-field or single-well models.2-D approximations are also used in various conceptual models, such as cross-sections and 2-D radial grid models.
- Theoretically, finite difference models permit discretization of the reservoir using both structured and more complex unstructured grids to accurately represent the geometry of the reservoir. Local grid refinements are also a feature provided by many simulators to more accurately represent the near wellbore multi-phase flow effects. This "refined meshing" near wellbores is extremely important when analyzing issues such as water and gas coning in reservoirs.
- Representation of faults and their transmissibilities are advanced features provided in many simulators. In

these models, inter-cell flow transmissibilities must be computed for non-adjacent layers outside of conventional neighbor-to-neighbor connections.

- Natural fracture simulation (known as dual-porosity and dual-permeability) is an advanced feature which model hydrocarbons in tight matrix blocks. Flow occurs from the tight matrix blocks to the more permeable fracture networks that surround the blocks, and to the wells.
- A black oil simulator does not consider changes in composition of the hydrocarbons as the field is produced. The compositional model, is a more complex model, where the PVT properties of oil and gas phases have been fitted to an equation of state (EOS), as a mixture of components. The simulator then uses the fitted EOS equation to dynamically track the movement of both phases and components in field.

[/ww-shortcode-fancy-list]The simulation model computes the saturation change of three phases (oil, water and gas) and pressure of each phase in each cell at each time step. As a result of declining pressure as in a reservoir depletion study, gas will be liberated from the oil. If pressures increase as a result of water or gas injection, the gas is re-dissolved into the oil phase.

A simulation project of a developed field, usually requires “history matching” where historical field production and pressures are compared to calculated values. The model’s parameters are adjusted until a reasonable match is achieved on a field basis and usually for all wells. Commonly, producing water cuts or water-oil ratios and gas-oil ratios are matched.

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