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PetroMod Advanced Technical Features

Petroleum systems modeling software advanced technical features

PetroMod* petroleum systems modeling software combines seismic, well, and geological information to model the evolution of a sedimentary basin. PetroMod software will predict if, and how, a reservoir has been charged with hydrocarbons, including the source and timing of hydrocarbon generation, migration routes, quantities, and hydrocarbon type in the subsurface or at surface conditions.

Advanced level of integration

- Fully integrated 1D, 2D, and 3D interface and simulators
- Consistent data formats on all platforms and operating systems
- Ability to use multiple simulation methods on the same data model
- Individual configuration of the modular PetroMod software suite to suit user needs and budget

PetroMod software is platform independent, providing a standardized user interface across the entire 1D, 2D, and 3D software suite. It uses the same simulators in 1D, 2D, and 3D; all technical features and tools are available and identical in all dimensions. It also enables multiple simulation methods—darcy, flow path (ray tracing), and invasion percolation, as well as the PetroMod hybrid simulation method that combines all three—to be used with the same data models.

Advanced modeling technology

- Fully coupled PVT-controlled, *n*-component modeling through the entire migration process
- Advanced handling of component/phase relationships using flash calculation technology
- Most complete range of special modeling tools, such as salt and igneous intrusion

PetroMod oil and gas migration modeling technology is the most advanced commercially available tool and the only commercial system with fully PVT-controlled modeling of *n*-component/three-phase relationships during the entire migration process. The 2D and 3D migration modeling technology uses flash calculations throughout the entire model and its geologic history. This delivers an improved understanding and prediction of petroleum properties and oil versus gas probability assessments.

Source rock tracking is possible in both 2D and 3D migration modeling; multiple source units can be defined. Each unit can have its own kinetics and generate multiple components that can be tracked separately along the entire migration process. Geoscientists gain an improved understanding of complex petroleum systems (e.g., the relative risks of charging from different source units or areas). Source rock tracking enables the user to evaluate any number of hydrocarbon components—such as methane, ethane, and C_2–C_5—from any number of different source rocks throughout the entire generation and migration process, and identify the components in each accumulation.

Four migration simulation methods

- **Darcy flow:** Describes multicomponent three-phase flow based on the relative permeability and capillary pressure concept. Migration velocities and accumulation saturations are calculated in one step.
- **Flow path:** Simulates lateral petroleum flow, which occurs instantaneously on geologic time scales in high-permeability layers. This can be modeled with geometrically constructed flow paths to predict the locations and compositions of accumulations; the spilling between and merging of drainage areas is taken into account.
- **Invasion percolation:** Assumes that on geologic time scales petroleum moves instantaneously through the basin driven by buoyancy and capillary pressure to better model fluid flow in faults. The invasion percolation method can use high-resolution facies maps (e.g., from seismic inversion workflows) or special controls to mimic capillary pressure heterogeneity.
- **Hybrid (darcy, flow path, and invasion percolation):** Enables detailed, high-resolution models to be processed with sophisticated full-physics technology. Compared with pure darcy flow approaches, it accurately simulates the relationship between hydrocarbon column heights and seal breakthroughs.

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Specialized technology

- **Crustal modeling:** Improves heat flow assessments in specific geologic scenarios, such as rifting basins. It ensures higher-quality simulations by providing optimal settings for the boundary conditions.
- **Facies refinement:** Enables users to directly incorporate high-resolution facies distributions based on seismic data into a 2D or 3D model. With this tool, facies can be assigned to layers in more detail than has been possible before. This is especially useful for highly detailed reservoir characterization.
- **Local grid refinement:** Enables users to generate a locally defined, high-resolution model within a larger PetroMod 3D model, such as a higher-resolution reservoir within an existing model. Users can therefore take full advantage of high-resolution input maps.
- **Geomechanics:** Allows the elastic properties of lithologies to be defined to simulate the stress-and-strain field of the model. Stress and strain directly influence the calculated material properties; the tool yields a more accurate pore pressure prediction, especially in compressional and extensional tectonic settings.
- **Biodegradation:** Assesses biodegradation grade in accumulations for each component through use of a fully integrated and coupled module. The degraded amount of each component is simulated through time, providing information on the effect on API gravity and GOR values.
- **Gas hydrates:** Simulates and displays the stability zone of gas hydrates through time. The simulation of gas hydrate generation is coupled directly to the generation and migration of hydrocarbons from the source and is included in the material balance of the model.

Specifications

PetroMod software is available on all hardware platforms running Microsoft® Windows Vista® (64-bit), Windows® 7 (64-bit), or Red Hat® Enterprise Linux® 5.3 (64-bit) operating systems. PetroMod software provides the same interface, functionality, and binary data formats on all platforms so input/output files can be easily transferred within mixed hardware systems.

Schlumberger Information Solutions

Schlumberger Information Solutions (SIS) is an operating unit of Schlumberger that provides software, information management, IT, and related services. SIS collaborates closely with oil and gas companies to solve today's tough reservoir challenges with an open business approach and comprehensive solution deployment. Through our technologies and services, oil and gas companies empower their people to improve business performance by reducing exploration and development risk and optimizing operational efficiencies.

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