**COMPOSITIONAL & UNCONVENTIONAL RESERVOIR SIMULATOR**

**APPLICATIONS**

**UNCONVENTIONAL RESERVOIRS**
- Shale oil, gas & shale liquids
- Liquids rich
- Tight oil & gas
- Naturally & hydraulically fractured reservoirs
- Coal Bed Methane (CBM)

**DRY GAS, GAS CONDENSATE & VOLATILE OIL**
- Gas cycling and re-cycling
- Condensate blocking
- Underground gas storage
- Fractured gas condensate wells
- Gas-oil gravity drainage

**ENHANCED OIL RECOVERY**
- Multiple contact miscibility
- Lowering of interfacial tension
- Water-Alternating-Gas (WAG) process
- VAPEX processes for heavy oil
- Asphaltene precipitation, flocculation, deposition and plugging

**GREENHOUSE GAS**
- CO₂ and other acid gas storage
- Aqueous equilibrium chemical reactions
- Mineral dissolution and precipitation

**FEATURES**

**MULTIPLE REGIONS**
- Independent initialization, rock-type and EoS regions
- Initial fluid contacts and properties by region
- Regionally define rock, EoS component properties and viscosity models
- Temperature-dependence for all viscosity models
- Temperature dependent volume shifts
- Generalized asphaltene modelling input to allow each EoS region to have own parameters (version 2014)
- 3-point end point scaling of rock-fluid data (version 2014)
- Cation exchange capacity correlation (version 2014)

**ENHANCED OIL RECOVERY**
- Miscible and immiscible displacement
- Gas composition and injection pressure
- Oil swelling and oil viscosity reduction
- Interfacial tension between oil and gas
- Model low-salinity wateringflood with new ion-exchange mechanism
- Adsorption of aqueous phase components on rock surface (version 2014)
- Polymer flood option to model aqueous phase viscosity models, shear effects, polymer adsorption, salinity effects and degradation (version 2014)
- Full field or hybrid low salinity waterfloods
- Ion exchange, geochemistry, wettability

**NATURALLY & HYDRAULICALLY FRACUTRED MODELS**
- Dual porosity and permeability
- Gravity Drainage with Sub-domain dual permeability
- Matrix-fracture diffusion
- Multi-phase non-Darcy flow
- Mechanistic geomechanical modelling
- Compaction tables in recurrent data
- Fracture initiation and growth for unconventional reservoir modelling (version 2014)
- Hydraulic fracture keywords to simplify fracture definitions (version 2014)
- Hydraulic fracture properties written directly to dataset (version 2014)
FEATURES (CONTINUED)

WELLS & RECURRENT DATA
- Convergence criteria on block residuals (version 2014)
- Adaptive implicit criteria in recurrent (version 2014)
- DynaGrid updates allow up to a 30% run time improvement (version 2014)
- Improvements to flash convergence near critical point (version 2014)
- Well element geometry data to calculate well index is optional (version 2014)
- Current constraints without violation checking (version 2014)
- Injected gas composition setting (version 2014)
- Thermal hydraulic tables (version 2014)
- Well stream aqueous phase output (version 2014)

GEOMECHANICS
- Porosity-dependent and solid-component-dependent geomechanical properties
- Mechanistic 3D compaction/dilation modelling
- Iteratively coupled, finite-element based module
- Matrix permeability as function of stress or strain
- Control method used to compute stress return to the yield surface
- Specify cutting plane algorithm approach for Mohr-Coulomb and Drucker-Prager models
- Fracture initiation and growth to understand fracturing mechanism and impact of stress or strain dynamics (version 2014)
- Safety factor output (version 2014)
- Geomechanical input on per-grid-block basis (version 2014)

FLEXIBLE SURFACE SEPARATOR FACILITIES
- Surface separators modelled with EoS or gas plant stages
- Gas plant stages model complex separator trains
- Control oil, water and gas
- Control intermediate hydrocarbon stream at surface
- Optimize separator conditions for best overall recovery

PRIMARY & ENHANCED CBM
- Standard and extended multi-component Langmuir Isotherms
- Palmer-Mansoori shrinkage/swelling (standard & multi-component)
- Priority ranking criterion for auto drilling
- Adsorption input modifier
- Simplification of relative permeability input
- Vary initialization by regions
  - User-input matrix
  - Depth-average vertical equilibrium in fractures

GREENHOUSE GAS SEQUESTRATION
- CO₂ and other acid gas storage
- Aqueous equilibrium chemical reactions
- Mineral dissolution and precipitation
- Water vaporization model reformulated for two-phase hydrocarbon systems
- Improved H₂O equilibrium calculation
- Aqueous-liquid-vapor systems
- Dynamic dimensioning of reactions

GRID PROCESSING
- Local grid refinement (LGR)
- Cartesian
- Cylindrical
- Fully non-orthogonal corner point grids
- Transmissibility multipliers
- Corner-point to node-based grid conversion

WELL MANAGEMENT
- Control well production and injection at the field, group, platform, and well levels
- Voidage replacement
- Gas lift optimization
- Gas recycling
- Calculation of well index for directional wells
- History-matching mode for treatment of observed surface phase rates

ADAPTIVE IMPLICIT FORMULATION
- Run-Time Dimensioning
- Comprehensive Rock-Fluid Interaction
- Relative permeability with hysteresis
- End-point scaling
- Capillary pressure with hysteresis

PARALLEL PROCESSING
- Automatic parallel partitioning in two-grid dimensions

64-BIT WINDOWS AND LINUX
- Operating environments and performance standardized for 64-bit compatibility for Windows, Linux, Intel and IBM

CMG simulators have a base set of common modules to ensure compatibility, speed and quality of output remains consistent.

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