Thermal & Advanced Processes Reservoir Simulator

Benefits

- Accurately model the physics of in-situ recovery processes

- Model complex wellbore physics associated with heat transfer and fluid flow in the wellbore

- Full physics capabilities to support modelling of a wide range of chemical EOR processes

- Test impact of recovery process on reservoir rock by including geomechanical effects in the simulation model

- Attain results faster than ever before with increased parallel speed-up

New Features

- Use new FlexWell formulation that insures much more numerically stable models resulting in faster run times especially for models with vertical wellbores or trajectory undulations

- Implement total aquifer influx as a constraint to easily control and history match field pressure

- Define flux boundaries for faster simulator run times and history matches

STARS is the undisputed industry standard for the advanced modelling of recovery processes involving the injection of steam, solvents, air and chemicals.

- **Thermal Processes** (SAGD, expanding-solvent/hybrid SAGD, steam flooding, CSS, thermal VAPEX, air injection)
- **Chemical EOR Processes** (emulsions, gels, foams, ASP, microbial EOR, VAPEX, low salinity waterflooding)
- **Advanced Wellbore Modelling** (complex multi-string completions, flow control devices, transient flow, gravity segregation)

Thermal & Heavy Oil

STARS™ simulates simple to highly complex thermal recovery processes, which require accurate modelling of steam distribution and conformance to provide insight into reservoir, wellbore and geomechanical caprock integrity issues. With STARS, engineers are able to design optimal well and field development plans while effectively managing steam conformance, production profiles, recovery and ultimately Net Present Value (NPV).

- Dynamic monitoring of temperature and pressure along the wellbore provides greater flexibility in steam trap control and prevents steam breakthrough

- Achieve smoother well control with the "soft" steam constraints which specify a range of values to operate within

- Define temperature dependence on permeability to simulate the effects of shale breakage at high temperatures

- Define temperature and compositional dependence on relative permeability curves for more accurate modelling of steam processes

- Utilize reactions to model the effects of asphaltene precipitation, flocculation, deposition, and other solid plugging that can occur at high reservoir temperatures

- Use the cyclic group control option to easily model and optimize Cyclic Steam Stimulation (CSS) processes

- Use CMOST™ AI to optimize operational and completion strategies
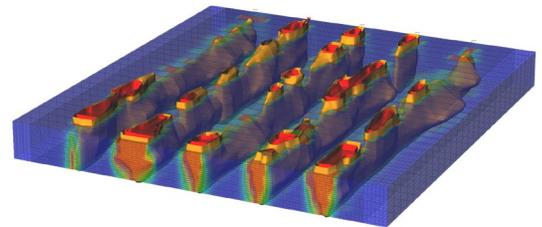
Multiple well pair SAGD model showing steam chamber conformance via temperature isosurfaces.

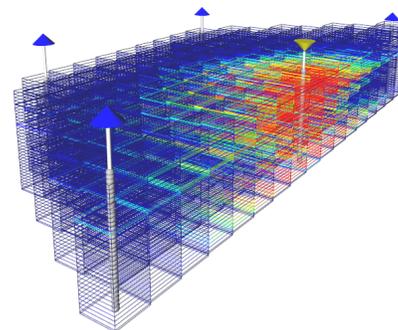## Complex Wellbore Modelling

FlexWell accurately and robustly models advanced well completions, including concentric wellbores, flow control devices (FCDs), and well geometry to maximize recovery and NPV.

- FlexWell accurately handles: multiple tubing streams, packers, cross flow, phase segregation and transient behaviour

- Model different FCDs using built-in correlations or generalized table input to optimize injection strategy

- Utilize electrical or steam heating options inside the wellbore to model the preheat stage

- Choose different density mixing rules and reaction mechanisms to capture emulsification of fluids inside FlexWell

- Simulate undulating wells through multiple layers and accurately follow trajectories

- Accurately model the effects of solid deposition inside the wellbore, including reduction of hydraulic diameter

- Specify initial fluid composition inside FlexWell to capture field conditions

Chemical Enhanced Oil Recovery (cEOR)

Design and evaluate the effectiveness of all cEOR processes. STARS is the only simulator that accounts for the complex phenomena required to accurately model processes such as Alkaline-Surfactant-Polymer (ASP) flooding, Low Salinity Water (LSW) injection, and foam flooding.

- Easily set-up various chemical processes (geochemistry, floods, and foam injection)
- Accurately model effects of IFT reduction in the reservoir via recurrent relative permeability interpolation
- Reaction kinetics for rate-temperature-concentration dependent processes allow for proper modelling of ASP floods
- Mechanistically model complex foam-flooding physics, or full-field enhanced LSW

Model ASP and low salinity waterflood processes

- Properly capture the formation and breaking of emulsions and foams by simulating it via reactions
- Model important fluid-reservoir rock chemical reactions (geochemical reactions) including aqueous electrolyte chemistry, precipitation/dissolution of minerals and ion exchange reactions with clays

Geomechanics

The rigorous, iteratively-coupled 3D geomechanics module accurately models subsidence, compaction and dilation behaviour that occurs during thermal or advanced process recovery methods.

- Model initiation and creation of hydraulic fractures, integrated with fluid flow and geomechanics
- Model porosity-dependent and solid-component-dependent geomechanical properties
- Simulate stress-induced phenomena, including sand production, near wellbore formation collapse and elastic or plastic deformation
- Set matrix permeability to be a function of stress or strain to match lab data

Enhancement Technologies (PET)

CMG's focus on all aspects of simulator performance maximizes hardware potential and provides software that runs large, complex simulation jobs in the shortest amount of time.

- Utilize different numerical tuning techniques to run simulations faster than ever before
  - Autotune-AI automatically applies numerical parameter settings to improve simulation runs by an average of 3x
- Apply Dynamic Grid (DynaGrid) amalgamation to significantly speed up simulation models, while maintaining accuracy in important regions of the reservoir
- CMG Cloud (Public & Private) meets on-demand needs, improves project delivery, improves hardware efficiency and uses the latest CMG software releases
- Maximize productivity by quickly loading results of large models using the standardized and compressed SR3 files

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Contact
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R&D Investment
CMG reinvests 20% annual revenue back into R&D, to further innovation and drive technology forward

Superior Software
CMG delivers easy to use software that provides the most accurate results

Dedicated Support
Experienced technical sales & support personnel, deliver high-quality, timely and personalized customer support

Relevant Training
CMG's industry renowned reservoir software training provides the skills to improve productivity and efficiency

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