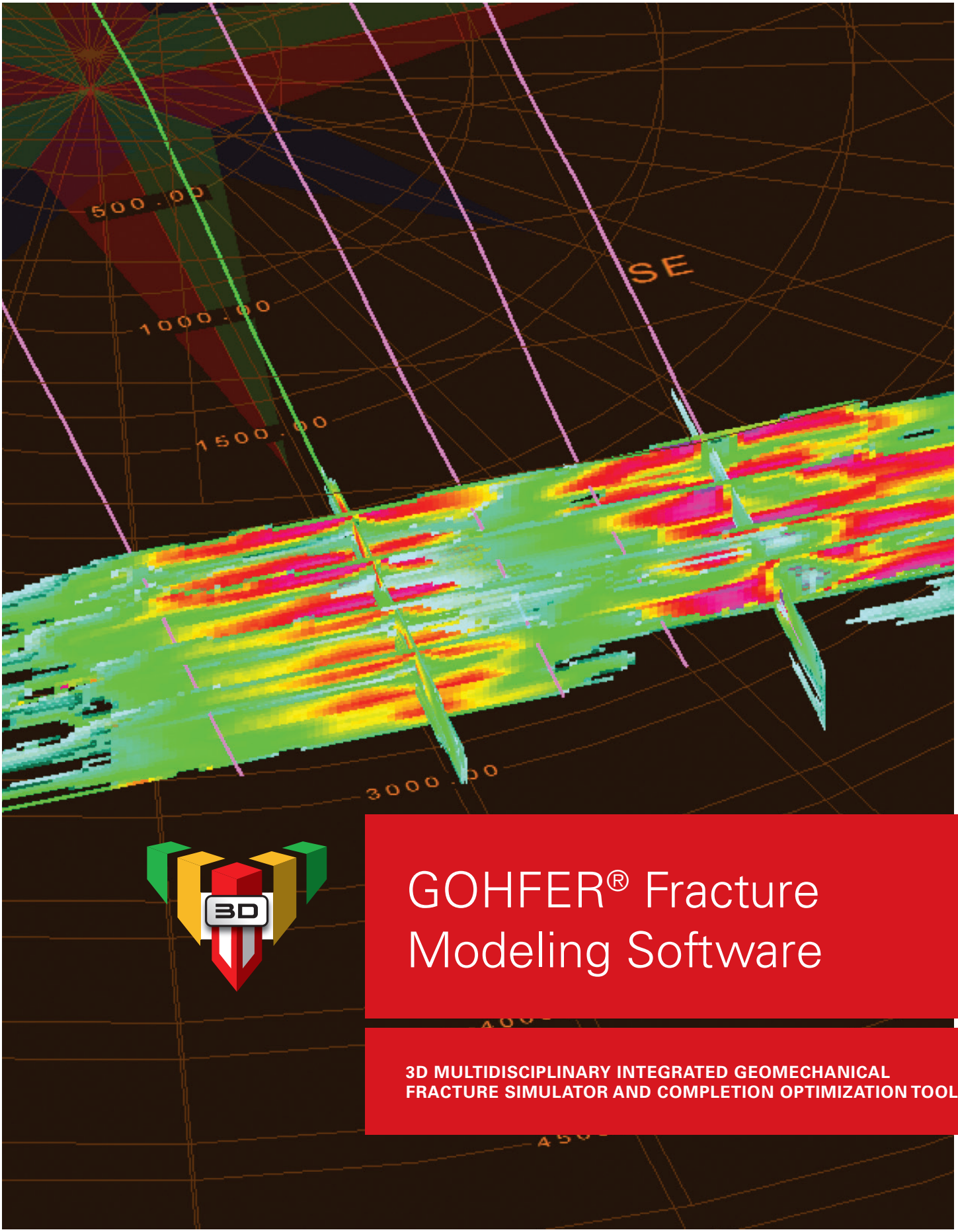

GOHFER® Fracture Modeling Software

3D MULTIDISCIPLINARY INTEGRATED GEOMECHANICAL FRACTURE SIMULATOR AND COMPLETION OPTIMIZATION TOOL

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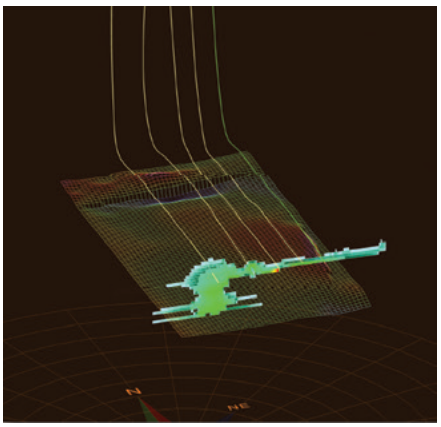
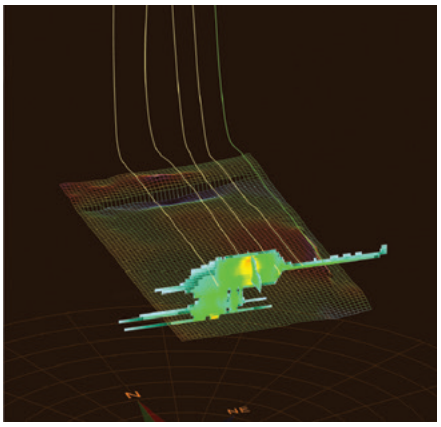
Evolution of Fracture Geometry with Offset Depletion

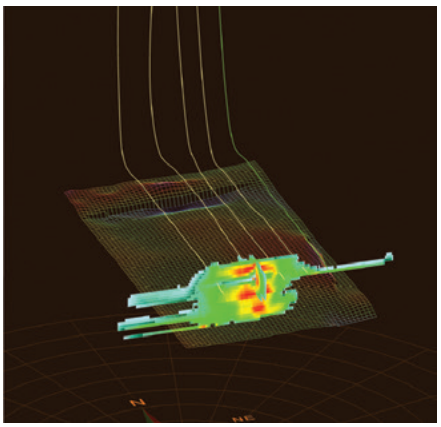
With over 30 years of development, the Grid Oriented Hydraulic Fracture Extension Replicator (GOHFER®) software package has proven to be the leading integrated well design and optimization package. Recognized as the chief hydraulic fracture simulator in the industry, GOHFER software computes input from all disciplines of petroleum engineering, including petrophysics, geology, geophysics, drilling, reservoir and completions. A GOHFER software project integrates all these disciplines, and leads to a coherent and consistent three-dimensional (3D) reservoir and geomechanical model for both unconventional and conventional reservoirs. GOHFER software is the most powerful, comprehensive tool available in the petroleum industry for the design, analysis and optimization of hydraulic fracture and acid fracture stimulation treatments.



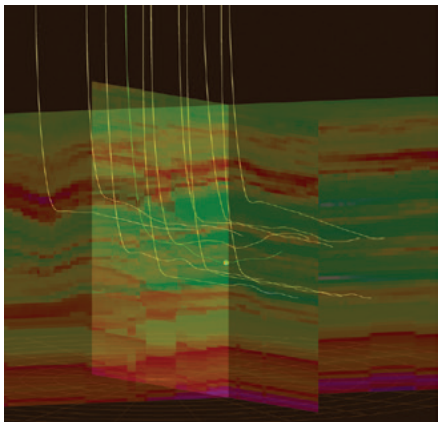
Early pad fluid hits offset depleted well, prior to significant geometry being developed at the treatment well.



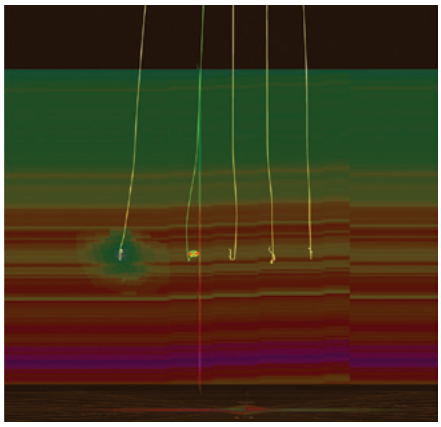
Fracturing begins to develop at the treatment well after pressurizing the depleted area.



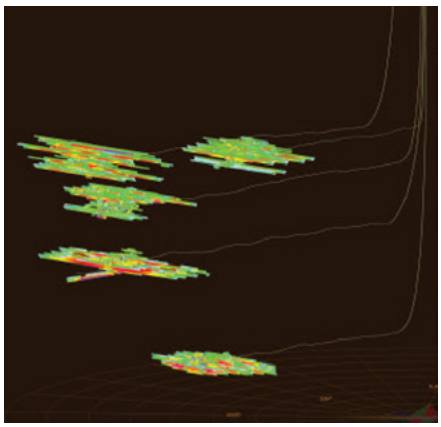
Fracture height and concentration develop at the new treatment well near the end of the job.



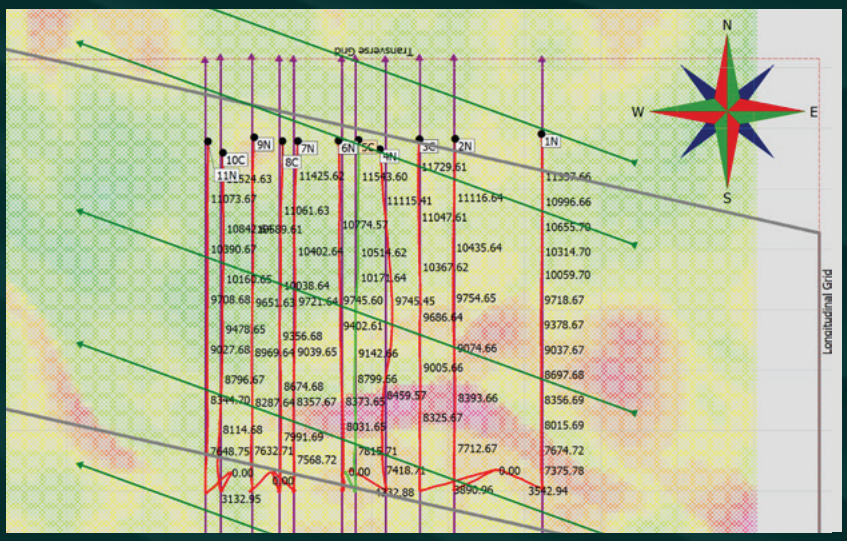
This shows full 3D geomechanical earth model input with structure.



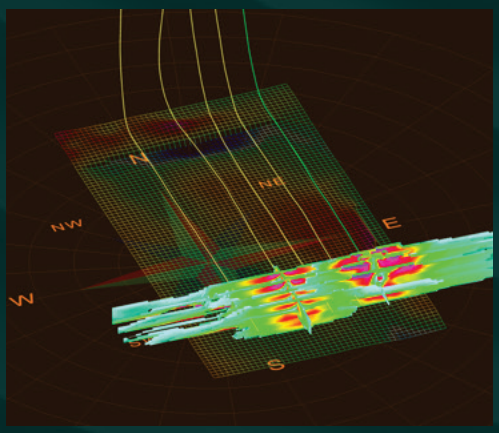
This illustration depicts the offset well depletion effect on total stress (note that there is one fault displayed in this section).



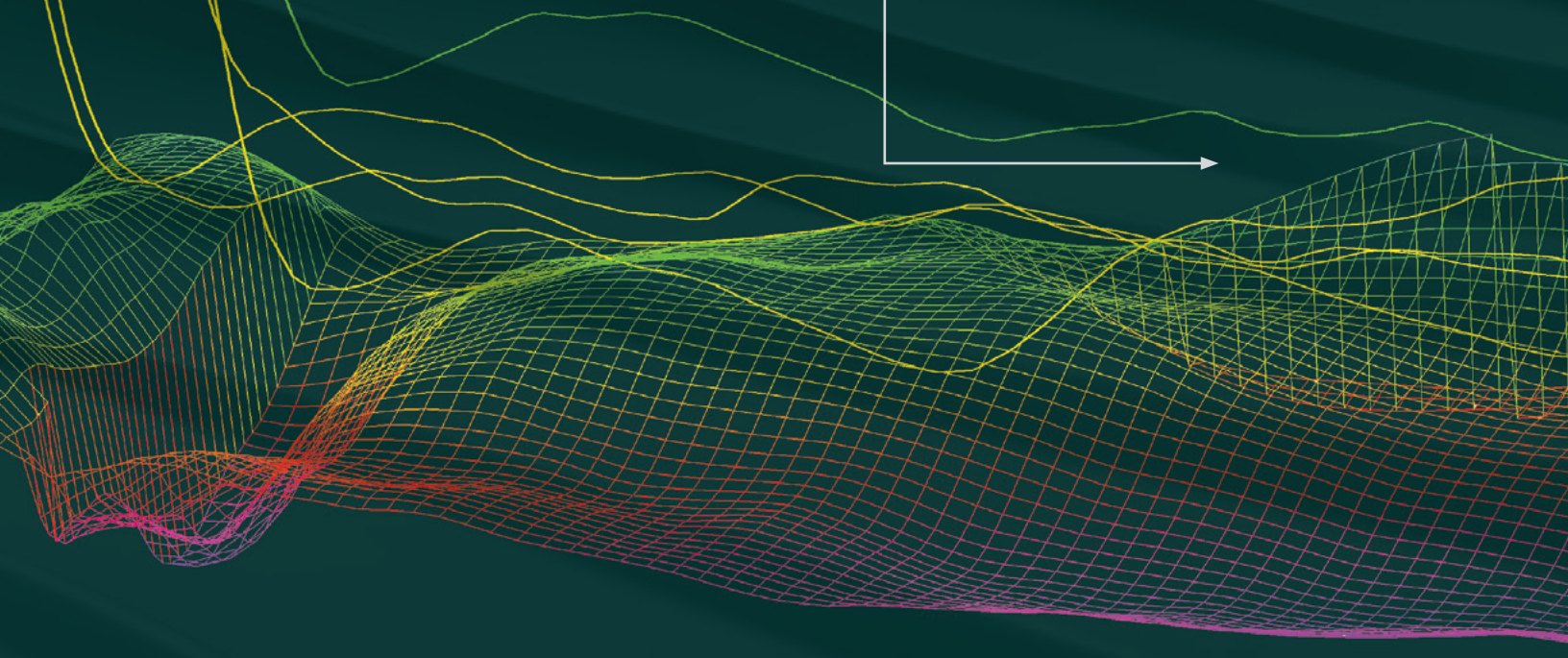
This image shows the ability to model any number of well layers, wells and stages with GOHFER® fracture modeling software.

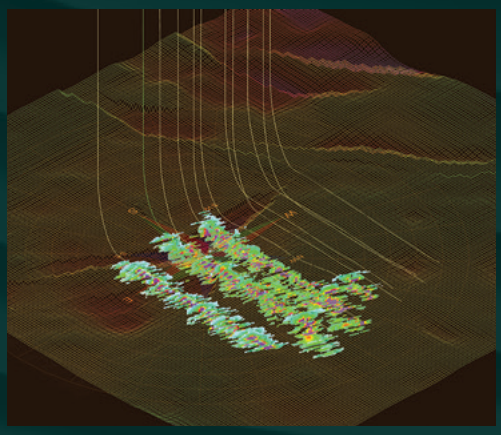


Any layer in the 3D space can be displayed as a map view.

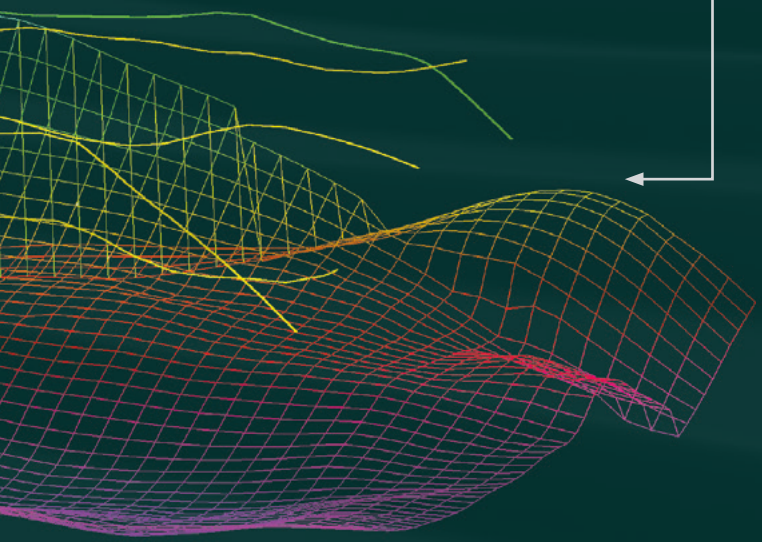


Interference (zipper frac) between wells 1 and 4 causes fracture asymmetry.





Both longitudinal and transverse, asymmetric and off-angle fractures are simulated in simultaneous development and interaction.



INDUSTRY EXCELLENCE

"58% of operators choose GOHFER® software for their hydraulic fracturing simulation needs, which is more than twice as much as its closest competitor. GOHFER software is also considered to be the most accurate frac modeling software package by almost a 4:1 margin over its closest competition."

– 2017 HYDRAULIC FRACTURING SUPPLIER PERFORMANCE REPORT FROM KIMBERLITE INTERNATIONAL OILFIELD RESEARCH

Multidisciplinary Integration with GOHFER® Fracture Modeling Software

3D MULTI-WELL ANALYSIS

- Multiple wells, including vertical and horizontal wells, in the same model
- Geosteering of laterals and engineered completions
- Ability to easily overlay and display on top of true vertical depth (TVD) grid with perforation locations
- Fully 3D wellbore directional survey
- Wellbore breakdown pressure and orientation calculations along the entire wellbore

PETROPHYSICS

- Direct importing of digital log, geologic model and core data to build grid and stress profile
- Full 3D geomechanical earth model input
- Optional input of 2D surface map with reference well logs
- Built-in correlations for synthetic mechanical rock properties and gas identification
- Ability to generate unique relationships and correlations
- Auto log assistant features

COMPLEX 3D GRID ANALYSIS

- Allows for vertical and lateral variations in grid properties
- Multilayer completion, zipper-frac and offset depletion effects
- Multiple perforated intervals and limited entry design
- Allows complex 3D geologic structures in longitudinal and transverse directions to simulate fracture growth in complex folded and faulted regions
- Fluid composition, proppant concentration, shear, leakoff, width, pressure, viscosity and other state variables defined at each grid block
- Adjustable vertical to horizontal anisotropy

TRANSVERSE FRACTURES

- Variable multi-well inter/intra-stage fracture stress shadow interference factor calculated as a function of distance between the fractures
- Multi-well/multi-stage/multi-cluster modeling capabilities for plug-and-perf or ball-drop simulations
- Model crossflow during pumping and after shut-in, up to closure
- Fully rotating 3D view of all output variables updated live during model run for all wells
- Fracture orientation determined by stress azimuth, independent of well direction

PRESSURE DIAGNOSTICS

- Step rate analysis for pipe and near-wellbore friction, along with the number of effective perforations open and frac extension pressure
- DFIT™ analysis, including determination of closure pressure, net extension pressure, efficiency, the presence and stress state of natural fractures, the dominant leakoff magnitude and mechanism, and the reservoir flow capacity
- Wellbore blowdown analysis to estimate tortuosity for a more accurate instantaneous shut-in pressure (ISIP)
- Permeability estimate from G function

PRODUCTION

- Handles cleanup, multiphase non-Darcy flow and stress (proppant-crushing) effects
- Correctly handles production interference of multiple transverse fractures on horizontal wells and allows for the optimization of fracture spacing in unconventional reservoir development
- Outputs stimulation efficiency details, including all accountable damage components, remaining effective frac conductivity, flow control device (FCD), infinite conductivity effective length, and net present value (NPV) of design

PRODUCTION ANALYSIS

- Uses actual production data to analyze post-frac performance and assess stimulation effectiveness
- Includes rate-transient type curve analysis, decline curve analysis, production forecasting to ultimate recovery, and flow regime identification
- Determines fracture spacing and effective well spacing for horizontal wells, along with the fraction of the producing lateral

PROPPANT DATABASE

- Includes a unique proppant database of materials that have been studied extensively under actual field conditions of stress, time and temperature
- New proppants continually added
- Generic proppant correlations to enter a user-defined proppant

FLUID DATABASE

- Robust set of fluids from major service companies, which includes brines, acid, foam, crosslinked, high-concentration friction-reducer (FR) and linear fluid rheologies
- Ability to match laboratory rheology data in order to build unique user database

GOHFER SOFTWARE ADVANTAGES

- Shear/slip decoupled fracture geometry
- Vertical and horizontal anisotropy in propagation and transport solutions
- Temporally and spatially variable leakoffs
- Non-uniform solid and liquid velocities and fluid transmissibility in the fracture
- Iteratively coupled fluid pressure/proppant concentration distribution in the fracture
- Internally calculated and geologically consistent in-situ stress
- Handles impact of secondary fracture systems on fluid leakoff/proppant transport
- Carreau fluid rheology model
- Multistage horizontal well modeling for simultaneous longitudinal and transverse fracs
- Production analysis, including rate-transient type curve, decline curve analysis and production forecasting
- Variable inter/intra-stage fracture stress shadow interference factor
- Comprehensive log analysis package
- Limited entry design
- Complete pressure diagnostic analysis package
- Unique fracture conductivity and post-frac production model
- Accurately models fracturing results as verified by tracer logs and microseismic surveys
- Fracture acidizing and acid conductivity model
- Multiple wells, including vertical and horizontal wells, in the same model
- Fracture stress-shadow interference between each fracture and stage on each well
- Multilayer completion, zipper-frac and offset depletion effects
- Full 3D geomechanical earth model input (from Petrel GSLIB file)
- Optional input of 2D surface map with reference well logs
- Geosteering of laterals and engineered completions
- Full processing of log or "core" from 3D earth model
- Timing can be simulated of zipper fracs between wells or stages, allowing closure and relaxation of induced pore pressure and strain
- Time-dependent evolution of pore pressure and coupled stress fields can be modeled
- Pore pressure depletion in offset wells significantly affects treatment of infill wells
- Effectiveness of "protection fracs" and injection into existing wells can be evaluated
- GOHFER software supports output of fracture geometry and conductivity profiles for all fracture planes, on all wells, in CMG and Triplets file formats
- Microseismic event locations can be imported and displayed on 3D outputs, along with generated fracture geometries

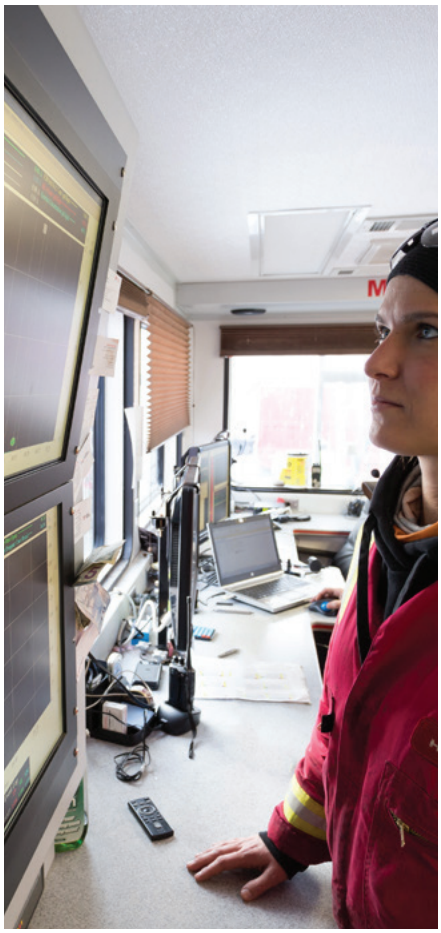
SYSTEM REQUIREMENTS

Operating System: Windows 10 recommended

- GOHFER 3D – Windows 10/8/7
- Sentinel Run-Time Environment – Windows 10/8/7, Windows Server 2003 R2/2008R2

Processor/Memory:
Minimum quad core processor recommended. Utilizes multi-threading and will benefit from multiple processors. Non-geologic model projects 8GB RAM recommended as a minimum. Geologic model projects > 16GB ram recommended.

Video Card:
Minimum 512K memory video card. Recommend 2GB video memory. Main recommendation is that the card has its own memory rather than sharing main memory.



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