DecisionSpace®
Natural Fracture Network

OVERVIEW
For unconventional reservoirs, natural fractures are generally poorly understood and hard to identify. This information is critical to defining a hydraulic fracture plan. Additionally, engineers have realized that in order for unconventional reservoirs to be considered economical, vast fracture networks must be present. Both natural and hydraulic fractures largely impact production performance in unconventional reservoir exploitation.

E&P companies require technology-based solutions to enhance production from naturally fractured reservoirs. Success is often dependent on their precise understanding of the pre-existing natural fracture network and the target information.

The following challenges relate to natural fracture network modeling:
» Honoring of natural fracture hard data such as bore-hole image interpretations
» Obtaining information about subsurface natural fractures
» Creating realistic fracture surfaces, not planar simplifications
» Enabling properties to vary within a fracture, and between different fractures and fracture-sets
» Incorporating secondary knowledge (e.g., seismic attributes) with the natural fracture network model
» Understanding the relationship between induced fractures and the natural fracture network
» Understanding the role natural fracture networks have in well productivity

Landmark’s DecisionSpace® Natural Fracture Network application gives companies the ability to fully characterize the multiple fracture systems in conventional and unconventional reservoirs. Insight into the density and orientation of the natural fractures allows them to determine the best strategies to induce hydraulic fractures and effectively stimulate the natural fractures to improve production.

BENEFITS
DecisionSpace® Natural Fracture Network delivers a stochastic natural fracture model that honors all existing data to help optimize well planning and stimulation through easier, faster, and more accurate modeling of natural fracture networks.

Comprehensive analysis of fracture network and log interpretations:
Honors all relevant well attributes, such as fracture location, length distribution, dip, and azimuth, while providing advanced stochastic simulation techniques.
» Curvilinear fractures – non-planar fractures can be modeled
» Varying fracture properties along and within individual fractures like aperture, porosity, permeability, et al.
» Uncover opportunities to test and model well planning scenarios and natural fracture network realizations

KEY VALUE
» Honors image log interpretation data at the wells
» Visual validator saves users time by allowing quality control and visualization of natural fracture network responses to varying parameters prior to generation of the model
» Supports planar and/or curvilinear fracture planes
Simulation decision support
Leverages all well data and uses secondary data, such as seismic attributes, or any other attribute that relates to fracture intensity, to guide fracture distribution for better simulation.

» Reduce uncertainty through improved characterization of the natural fracture network

DecisionSpace® Fracture Productivity Integration
Integrates with DecisionSpace® Fracture Productivity to improve production performance prediction in low permeability reservoirs.

» Improve results from flow simulation via an integrated model and unique unstructured gridding technology that adapts to the distribution of the fractures

FEATURES

Supports and honors both well data and outcrop data
Users can create natural fracture networks using well data (image log interpretations) and/or field data from outcrops or any other statistics that can be used including nearby wells, fields, and fault analyses. The simulation honors the exact location, dip and azimuth of the fracture picks along the wellbore and uses fracture statistics to simulate between the wells.

Stereonet analysis for identification of fracture families
Stereonet plot and histograms are available for data QC and for identification of fracture families and/or sets. Stereonet and histograms for dip and azimuth are interactive, making the QC process easier and faster. The user has the ability to create up to five fracture sets per interval and give different parameters to each set. In addition, intervals can be deactivated if no fracture information exists or if a fracture simulation is required.

Visual validator for QC and visualization
Users have the ability to preview an unconditional simulation of all fracture sets per interval to quality control varying input parameters they provided. Changes in the parameters are automatically visualized in the validator. This allows the user to assess the impact of the different parameters on the fracture simulation prior to running the simulation and thus save simulation time.
Supports planar and/or curvilinear fracture planes
When modeling natural fractures, users have the ability to control the fracture shape by using a smoothing parameter that allows for planar or curvilinear fracture modeling. Using a smoothing factor of one produces planar fracture planes, and a smoothing factor less than one produces curvilinear fracture planes allowing for a more realistic fracture geometry that can then be simulated.

Ability to constrain natural fracture network models with secondary data
Most of the time in unconventional plays, fracture data availability is limited and sparse. Using secondary data to constrain the fracture simulation helps to reduce uncertainty in fracture spacing and density. However, secondary data usage requires it be in a 3D grid and the property used needs to relate to fracture intensity.

Ability to model aperture, porosity and permeability for fractures
User has the ability to apply different distributions and/or constant values to simulate aperture, permeability and porosity properties in the natural fractures. Property values can be calculated per interval, giving the advantage of specifying different parameters per interval.
Seamless integration with DecisionSpace® Fracture Productivity
Natural fracture network models generated with DecisionSpace® Natural Fracture Network can be easily integrated with DecisionSpace® Fracture Productivity through OpenWorks database. DecisionSpace® Fracture Productivity can utilize as input 2D and 3D natural fracture network models and combine them with hydraulic fractures to generate an unstructured grid for flow simulation.

DecisionSpace® Natural Fracture Network provides easier, faster, and more accurate modeling of natural fracture networks to help optimize well planning and stimulation strategies.

Landmark offers solutions to help you deliver on your business strategies. For questions or to contact your Landmark representative, visit us at www.landmark.solutions.

SOFTWARE REQUIREMENTS
» Oracle 11.2.0.4
» OpenWorks 5000.10.3
» DecisionSpace® Base Plus

SUPPORTED OPERATING SYSTEMS
» Microsoft® Windows® 7 Enterprise 64-bit with SP1
» Microsoft® Windows® Server 2008 R2
» Red Hat® Enterprise Linux® (RHEL) 6.6 (64 bit)