Baker Hughes geomechanics experts evaluate geomechanical constraints and wellbore mechanics to enhance fracture designs that will maximize reservoir contact and production. We provide guidelines on lowering breakdown pressures, optimizing perforation orientations and placements, and the proper wellbore placements to minimize near-wellbore fracture complexity.

**Improve hydraulic fracturing designs**

Through rigorous geomechanical characterizations, we can improve propped hydraulic fracture characteristics to achieve optimal productivity and net present value (NPV). Using the Baker Hughes MFrac™ and MShale™ design and evaluation simulator suites, our experts optimize fluid volume and proppant mass at different pumping schedules to achieve the best fracture dimensions and conductivity. Additionally, the MProd™ production simulation module can forecast pre- and post-fracture well productivities.

Using designed hydraulic fracture geometry and conductivity data, Baker Hughes will perform single-well simulation to predict multiphase flow profiles from the complex reservoir. Once calibrated, this model can be conveniently used to perform different scenario analyses and production forecasts.

**Characterize geomechanical parameters for hydraulic fracturing applications**

We offer a service that can predict static mechanical properties directly from log and petrophysical data. This logging of mechanical properties uses a rock physics-based program to provide a more accurate prediction than those determined by empirical correlations, especially in the absence of any core measurements for calibration.

By accurately profiling the modulus of elasticity and minimum horizontal stress, you can determine the stress contrast between the pay zone and the bounding...
layers, which has the most impact on fracture containment. After the fracture height is estimated, you can design the appropriate treatment size for a desired fracture length by incorporating proper characterization of the permeability and stiffness. Additionally, by controlling the alignment of the wellbore with respect to the principal stress direction, induced fracture types (transverse versus longitudinal; horizontal versus vertical) can be ascertained and near-wellbore fracture complexities can be minimized.

Assess geological hazards
Baker Hughes can identify potential geological hazards and compute the critical pore pressure needed to reactivate a fault during hydraulic fracturing operations. The injection of fluid at high pressure can cause pore pressure rise in the vicinity of the wellbore. If such pressure is communicated with a nearby fault, the fault could be reactivated. A reactivated fault generally has the permeability to allow fluid movement, and can be detrimental to fracturing operations. If the fault is intersected by the wellbore and the pressure communication is behind the pipe, the shear movement of the fault can result in casing collapse.

Determine the effects of shear slippage on fractures
Baker Hughes uses the natural fracture characteristics in combination with the in situ stress model to establish critically stressed fracture (CSF) sets under current-day stress state. This information provides the basis for well placement (sweet spotting) and the level of pressure disturbance needed to shear-stimulate those favorably oriented fractures.

CSFs, either at its native state or induced through fluid pressurization, are hydraulically conductive. If connected, these fractures provide the necessary pathways to the wellbore. Slickwater fracturing, which is widely practiced in low permeability shale gas plays, uses the CSF concept. The idea is to inject an optimal amount of water to raise fluid pressure to a level that reactivates clusters of favorably oriented natural-fracture sets. The shape and extent of the connected stimulated networks depend on the in situ stress state and the distribution and characteristics of the natural fractures. The proper identification and characterization of the CSF sets allows for targeted completions, which make for the most efficient use of fracturing resources.

Leverage our expertise to ensure your success
Baker Hughes has a rigorous process for geomechanical modeling, and we use extensive regional geomechanical knowledge to ensure an accurate, robust design for your hydraulic fracturing applications. To find out how our geomechanics experts can improve your hydraulic fracturing stimulation, contact your Baker Hughes representative or visit www.bakerhughes.com/geomechanics-consulting

MFrac designed hydraulic fracture with color shades representing width profiles and fracture conductivity