Baker Hughes geomechanics experts optimize your results with comprehensive, robust geomechanical models that help alleviate problems related to drilling, completion, and production in your reservoirs and overlying formations. Our professionals focus on the entire life of a field, with applications that include wellbore instability, sand production, optimizing production from fractured reservoirs, fault reactivation/leakage, and reservoir compaction to make reliable predictions about field behavior.

**Applications**
- Exploration and development
- Unconventional
- Heavy oil
- Deepwater
- Compaction and subsidence modeling
- Fractured reservoirs
- Wellbore stability monitoring

**Features and benefits**
- Full wellbore stability analysis
  - Minimize nonproductive time
  - Provide better understanding for optimal results
- Field-specific geomechanics evaluation
  - Reduce uncertainty and costs
- Experienced geomechanics engineers
  - Ensures high-quality models and smarter solutions

Improve reservoir planning through precise geomechanical workflows

Our geomechanical workflows demand rigorous input to obtain detailed knowledge of the orientations and magnitudes of the three principle stresses—vertical stress ($S_v$), minimum horizontal stress ($S_{hmin}$), and the maximum horizontal stress ($S_{hmax}$) as well as formation pore pressure ($P_p$), and rock mechanical properties. We do this by integrating geologic, geophysical, and petrophysical information with drilling and production engineering experiences. The full stress tensor is determined as a function of depth using least principal stress values ($S_3$) inferred from available leakoff tests (LOT/XLOT) and/or minifracs, and vertical stress data from density logs. Mechanical rock properties are derived from well-log data and calibrated with laboratory rock mechanical tests, when available.

**GEOMECHANICAL DATA SOURCES**

<table>
<thead>
<tr>
<th>Measure</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>$S_v$</td>
<td>Vertical Stress</td>
</tr>
<tr>
<td>$P_p$</td>
<td>Pore Pressure</td>
</tr>
<tr>
<td>$S_{hmax}$</td>
<td>Least Principal Stress</td>
</tr>
<tr>
<td>$S_{hmax}$</td>
<td>Stress Magnitude</td>
</tr>
<tr>
<td>$S_{hmax}$</td>
<td>Stress Orientation</td>
</tr>
<tr>
<td>Rock Strength</td>
<td>Core test, logs, cuttings, analysis of wellbore failure</td>
</tr>
<tr>
<td>$S_{hmax}$</td>
<td>Core test, logs, cuttings, analysis of wellbore failure</td>
</tr>
<tr>
<td>$S_{hmax}$</td>
<td>Core test, logs, cuttings, analysis of wellbore failure</td>
</tr>
</tbody>
</table>

**Typical output from GMI•PressCheck**

To constrain the maximum horizontal stress orientation and magnitude, our GMI•SFIB™ software program computes stresses that are consistent with the strength of the Earth’s crust as well as the existence of breakouts and drilling-induced tensile fractures in your wells. By creating these models, our geomechanics experts can make effective forecasts of stress magnitudes and effective rock strengths (i.e., rock strength including chemical, thermal, and weak bedding effects). Our geomechanics experts use these
techniques to improve wellbore stability, increase production, and avoid many potentially costly failures.

**Increase production capabilities with accurate pore-pressure evaluation**

Baker Hughes evaluates formation pore pressure using the GMI•PressCheck™ program, which considers formation pressure measurements, normal compaction trends, effective stress ratios, and wellbore drilling events to calibrate the calculations. The program can also account for buoyancy and centroid effects in permeable formations. The formation pressure is calibrated again during the stress determination from borehole failure analysis (i.e., breakout and tensile cracks). The result is a more accurate pore pressure profile that will help you avoid kicks and losses.

**Leverage existing drilling experience**

Baker Hughes geomechanics experts review daily drilling reports for each offset well in the study, looking for events that relate to wellbore instability. In addition, we use pressure-while-drilling data, mud logs, MWD data, hydraulics reports, daily geological reports, and other real-time data when available to deliver a geomechanical model consistent with previous drilling history.

**Make the right decisions through quantitative risk analysis**

Our quantitative risk assessment calculation is a key element of our geomechanical modeling service, providing estimates of uncertainty in predictions and identifying the input parameters most responsible for the uncertainties. This knowledge allows our geomechanics experts to recommend appropriate measurements and analyses that will most efficiently reduce the uncertainties to manageable levels.

To find out how our geomechanics experts can help reduce the risk of unexpected drilling costs, improve production, and boost overall recovery, contact your Baker Hughes representative or visit us online at www.bakerhughes.com/geomechanics-consulting

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