Modelling Hydraulically Fractured Wells: A Multi-Fidelity Approach
Geomechanics for Unconventional Reservoirs

Well Placement

Hydraulic Fracture Design

Natural Fractures

Reservoir Anisotropy & Heterogeneity

Global & Local Stress Regimes

Stress Changes

Compaction Subsidence
CMG’s Hydraulic Fracture Modelling Workflow

Low Fidelity
Compaction/Dilation Curves
Practical & Fast

Medium Fidelity
Geomechanics-based Fracturing
Accurate Geomechanics-based solution

High Fidelity
Geomechanics-based Fracturing with Node Splitting
Accurate Fracture Creation & Growth
Low Fidelity
Dilation/Compaction Table

![Graph showing the relationship between pressure (psi) and log of transmissibility across different regions: Elastic/Unstimulated Region, Stimulated Region, and Propped Region.](image-url)
Transmissibility & Water Saturation vs. Time

Water Saturation

Transmissibility
Modelling of Frac Hits

- Cross-well communication event during hydraulic fracture treatment
- Loss of production [average – 30% lower production]
Where Do Frac Hits Occur?

- **Minimum Principal Stress Direction**
- **Parent Well**
- **Child Well**
- **Depleted Zone**
- **Monitor Point**
Case Study

Model Description

• 600 ft Well Spacing
• 50 ft Fracture Spacing
• 3 years of parent well production
Case Study: Creation of Parent Well Fractures

Permeability I – After Parent Fractures

0.0002 – 200mD
Case Study: Depletion of Parent Well

Permeability I – After Parent Depletion

0.0002 - 25mD
Case Study: Depletion of Parent Well

Effective Stress – After Parent Depletion

1100 to 2650 psi
Case Study: Creation of Child Fractures

Permeability I – After Child Fractures

0.0002

25mD
Case Study

*Parent Well Bottomhole Pressure*

*Child Well Water Rate*

*Parent Well Water Rate*

*Child Well Fracture*
High Fidelity
CMG’s Hydraulic Fracturing Tool

- **Predicts** hydraulic fracture initiation and propagation
- **Integrates** geomechanical fracture model to CMG simulators enabling engineers to **design and optimize** well completions
- **Visualizes & analyzes** hydraulic fractures
CMG’s Hydraulic Fracturing Tool

- Model **fracture growth in complex geologies** - estimate hydraulic fracture half length, aperture, and height (3D)

- Calculate 2D plane strain or full 3D to **create hydraulic fractures**
Coupling Between Reservoir Flow & Geomechanics

GeoGrid Fracture Width (ft)

Flow Grid Fracture Permeability (mD)
Capture Stress Shadowing between Fracture Stages
CMG’s Unconventional Reservoir Workflow

- Model entire unconventional reservoir life cycle with ONE tool
- Fully coupled Geomechanics to reservoir fluid flow model
CMG’s Vision:
To be the leading developer and supplier of dynamic reservoir technologies in the WORLD

For more information, please contact sales@cmgl.ca