

SHORT COURSE: OVERVIEW OF UNCONVENTIONAL GEOMECHANICS

Sunday, 20 June 2021; 13:00-21:00 UTC

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Cost \$250

Module 0. Introduction to Unconventional Geomechanics

- A few words about Oilfield Geomechanics
- What is geomechanics? Definitions, history, relevance

Modules 1–2. Principles of stress and strain- Field stress measurements

- Basic of stress-strain and Mohr circles- applications on natural fractures
- Effective stress concepts, role of pore pressure
- Field stress variations, structural effects.
- Stress determinations

Module 3. Pore pressure evaluation

- Basic concepts and causes of overpressure
- Pore pressure analysis – Eaton, Bowers', NCT, effective stress methods
- Challenges in unconventional, field examples.

Modules 4–5. Mechanical rock behavior

- Mechanical properties, elasticity plasticity, poroelasticity, viscoelasticity.
- Failure in rocks, failure criteria
- Influence of faults and fracture, anisotropy
- Laboratory testing, measurements, interpretation
- Use of logs for mechanical properties, calibration, correlations.

PART II: GEOMECHANICS FOR UNCONVENTIONALS

Modules 7-8. Hydraulic fracturing fundamentals

- Basic, objectives, parameters
- Frac containment, net pressure
- Injection testing, DFITs

- Perforating, Proppants – 100 mesh and proppant transport,
- Fracturing fluids
- Role of natural fractures. Injection zone selection

Module 9. Stress shadows - Multi-stage multi-well

- Mechanics of stress shadows
- Effect on multi stages and clusters
- Multi-well stress shadows
- Tip shear stresses, Modeling examples

Module 10. Rock fabric characterization

- Description and quantification of rock fabric attributes – cores
- Mechanical behavior, hydraulic behavior, testing in unconventional
- Stresses - critically stress fractures and hydraulic conductivity
- Geometry and spatial occurrence, DFN models.
- Examples of evaluation in unconventional plays

Module 11. Shale geomechanics

- Unconventional shale plays – shale types – challenges, critical issues
- Geological scenarios for completions
- Geomechanics of interfaces – HF interaction with interfaces, effect of fracture toughness
- Shale properties static and dynamics examples from different plays – elastic parameters, time dependency, frictional properties
- Shale and Shale like behavior – mineralogic content, shale and flow.
- Myths to debunk – brittleness, complexity, SRV and microseismic, sand volume per lateral length

Module 12. Hydraulic fractures (HFs) and natural fractures (NFs) - Operational effects

- HFs propagation with NFs – effect of NF orientation
- Dual HF propagating in a fractured media
- Pressure Diffusion – coupled effects – stimulation benefits
- Interaction HF – NF - crossing rules.

- Influence of NF characteristics – Dense vs sparse DFN, stress anisotropy, NF connectivity, parametric studies. Modeling examples.
- Influence of operational parameters, effects of fluid viscosity, injection rates – injection time,
- Influence of the stress field and insitu pore pressure on HF behavior.
- Microseismicity response with anisotropic stresses – dry and wet MS events. Effect of initial aperture of the NFs.

Module 13. Depletion – Refracs

- Depletion effects on HFs, depletion and in situ stresses.
- Parent -child evaluations, Cluster efficiency, drainage volumes
- Frac hits – types.
- Microseismic depletion delineation, Cube evaluations
- Refracturing – candidates, case histories, lessons.
- Geomechanics of refracs.
- Refracs economics, refrac activity, examples. Refracs methods, engineered refracs.

Module 14. Multi-well completions

- Zipper fracs, stress perturbations, induced shear around zipper fracs
- Interaction of HFs, overlapping HFs, models. Zipper fracs stress shadows.
- Effect of multiple well completion in fractured rock mass – sheared fabric – friction angle effect, geometry of zipper fracs. Effect on fabric stimulation.
- Sheared length, pressure diffusion.

Module 15. A word on HF monitoring and models (Extra session)

- Temperature Logs, strengths and weaknesses, procedures. Effect of wellbore and completion.
- RA logging procedures, strength and weaknesses, tracer applications
- Micro seismic monitoring – MS as a geomechanics issue. Events, field data, MS imaging, passive seismology, triggered or induced seismicity, array design, surface vs downhole, source mechanisms.
- Tiltmeters- direct fracture monitoring, measurements, patterns, cases.
- DAS/DTS Basics, production estimations, cluster efficiency, integrated analysis.