OilFieldGeomechanics

2015 Training Course Offerings

OilField Geomechanics offers a wide-range of the geomechanics-related training including: 1) Geomechanics for Unconventional Plays; 2) Basic Geomechanics for the Oilfield; 3) Pore Pressure Estimation; 4) Wellbore Stability Analysis; 5) Sanding and Sand Production Analysis; and 6) Hydraulic Fracturing Basics. The focus of these courses is geomechanics, specifically, the role of stress, pore pressure, temperature, and mechanical properties, and its applications to common oilfield applications.

From the courses, the attendee will fully understand the basics of geomechanics and be familiar with the geomechanical issues for common petroleum and unconventional resource applications. Additionally, the attendee will be able to specify and QC a geomechanics program for the given course topic.

All the courses are taught in English; however, Spanish-language versions of the courses are available on a by-request basis.

Who Should Attend:
The courses are oriented and intended for geoscientists, reservoir engineers, drilling engineers, and completions engineers with little or no background in geomechanics and currently working with or experiencing geomechanical challenges.

About The Instructors
The primary instructor for the course will be Dr. Neal Nagel. Dr. Nagel has 26 years of industry experience and has provided geomechanics consulting and training since 2009.Neal is currently the Chief Engineer and co-founder of OilField Geomechanics LLC. He previously worked for 20 years with ConocoPhillips as a world-wide geomechanics specialist. He has taught extensively over his career as well as given many invited presentations – including serving as an SPE Distinguished Lecturer in 2004 and giving a keynote presentation at the 2014 SPE Hydraulic Fracturing Technical Conference. Among other industry activities, he was chief editor of the 2010 SPE Monograph on Solids Injection and has written more than 50 peer-reviewed and conference papers, including more than 20 related to unconventional play geomechanics.

The second instructor will be Dr. Marisela Sanchez-Nagel. Dr. Sanchez-Nagel is president and principal engineer at OilField Geomechanics LLC. She has more than 23 years of industry experience having worked for Intevep, the technology arm of PDVSA in Venezuela; as President of Global GeoSolutions, an independent geomechanics consulting company in Latin America; for GMI; and as General Manager and President of Itasca Houston from 2007 to 2014. Dr. Sanchez-Nagel was a 2012-2013 SPE Distinguished Lecturer, has worked in many geomechanical projects around the world, and has presented at numerous geomechanics schools throughout North and South America.

2-Day Basics of Pore Pressure Estimation Course

This course is intended for asset team members interested in pore pressure and pore pressure estimation. This course serves as an introduction to pore pressure estimation; however, a more advanced course is recommended for active pore pressure estimation practitioners. In addition, the course is not software-centric and no specific pore pressure software training is addresses.

The course begin with a quick review of the elementary components of geomechanics (i.e., stress/strain, pressure, and mechanical rock properties) in order to provide a foundation for pore pressure estimation. This is followed by a review and discussion of the mechanisms for overpressuring. The course concludes with a detailed presentation of pore pressure estimation techniques (with detailed examples) and the development of a pore pressure estimation workflow (including the important of pressure calibration).

I. Basic Geomechanics: Principles of Stress/Strain and Mechanical Behavior

A) Basics of stress/strain; B) Effective stress concepts and the importance of pore pressure; C) Stress field variations and structural effects; D) Mechanical properties (elasticity and other stress-strain behavior); E) Failure and beyond; and F) Laboratory vs. log vs. field data.

II. Introduction of Abnormal Pressures

A) Basic concepts and definitions; B) Importance of good pressure estimates; and C) Application of pressure estimates in oilfield applications.

III. Pore Pressure and Fracture Gradient Theories

A) Absolute pressure vs. gradients; B) Normal and hydrostatic pressure; C) Fracture gradient; D) Well design implications; and E) Well control issues.

IV. Causes of Overpressuring

A) Concept of under compaction (compaction disequilibrium); B) Fluid density effects; C) Hydrocarbon cracking and diagenetic effects; and D) Artesian pressures.

V. Pore Pressure Estimation

A) Selecting shale points; B) Normal compaction trend line; C) Eaton pore pressure estimations; and D) Estimation calibration.

VI. Pore Pressure Workflows and Case Histories

A) Key input data; B) Critical decisions and assumptions; C) NCTL workflow; and D) Pressure prediction examples.

5-Day (3-Day) Geomechanics for Unconventional Plays Course

Geared mainly for Unconventional Play asset teams, the course covers the necessary basics of geomechanics, an introduction to the importance and challenges of Unconventionals, the basics of hydraulic fracturing (as a baseline to compare and contrast with Unconventionals), and an extended review and discussion of the geomechanical challenges (e.g., SRV, 'brittleness', 'complexity') for Unconventionals. The 3-day version is compressed (less exercises) from the 5-day version.

Part 1. GEOMECHANICS FOR PETROLEUM APPLICATIONS (2-DAYS)

I. Principles of Stress and Strain
A) Basics of stress/strain and Mohr circles; B) Effective stress concepts and the importance of pore pressure; C) Stress field variations and structural effects; D) Stress measurements and analysis; and E) examples and exercises

II. Pore Pressure Evaluation
A) Basic concepts and causes of over pressure; B) Analysis concepts: NCT, Bowers, Centroid-Effect; C) Analysis workflow; and D) examples, and exercises

III. Mechanical Rock Behavior
A) Mechanical properties (elasticity and other stress-strain behavior); B) Failure and beyond; C) Influence of faults and fractures; D) Laboratory vs. log vs. field data; and E) Examples and exercises

IV. Geomechanical Modeling and Workflow
A) Concepts and tools; B) 1D/2D modeling and 3D modeling; and C) Example geomechanics workflow

V. Review of Main Petroleum Geomechanics Applications
A) Wellbore stability; B) Sanding; C) Solids (cuttings) injection; and E) Monitoring/Field/lab testing……

Part 2. GEOMECHANICS FOR UNCONVENTIONAL APPLICATIONS (3-DAYS)

VI. Introduction to Unconventional Developments
A) On the importance of Unconventionals world-wide; B) Common play characteristics; and C) Challenges in general and challenges from a geomechanics point-of-view

VII. Shale and Shale-Like Properties and Behavior
A) What is shale?; B) Shale properties; and C) Shale types; 'Brittle' vs. ductile behavior

VIII. Naturally Fractured Reservoirs (NFRs)
A) Concepts, characterization, and modeling; B) Discrete Fracture Network (DFN) issues; C) NFR mechanical behavior; and D) Influences on: drilling, stimulation, and production

IX. Microseismicity
A) Basics; and B) Integration for Interpretation

X. Unconventional Reservoir Quality Evaluations
A) Basic concepts; and B) TOC, porosity/permeability, natural fractures, pressure, stresses and mechanical properties as quality indicators

XI. Hydraulic Fracturing–Basics and Conventional Modeling
A) Basics; B) Models and design; C) Frac QC; D) Conventional models in unconventional developments: and E) Workflow and examples

XII. Unconventional Completions: Critical Geomechanical Aspects
A) Geomechanics of shale plays; modeling and shale completions; B) Stress shadows, stage spacing, and stress rotations; C) SRV and 'Brittleness'; D) Landing location and perforation strategies; E) Workflow and key issues from published work and numerical simulations; and F) Bakken, Haynesville, Marcellus, Eagle Ford, examples.

3-Day Basics of Geomechanics for the Oilfield Course

This course is intended for anyone interested in oilfield geomechanics that has had limited or no previous exposure to geomechanics. The primary audience includes geologists, geophysicists, petrophysicists, reservoir engineers, and completion engineers.

The focus of the course is not only the elementary components of geomechanics (i.e., stress/strain, pressure, and mechanical rock properties) but also laboratory testing recommendations, geomechanics workflows, data acquisition and common geomechanics-related oilfield applications. In addition, a primary objective of the course is that attendees be able to specify and quality control a geomechanics data acquisition and laboratory test program. Examples and exercises are employed to provide a hands-on application of the principal and concepts presented.

I. Principles of Stress and Strain

A) Basics of stress/strain and Mohr circles; B) Effective stress concepts and the importance of pore pressure; C) Stress field variations and structural effects; D) Stress measurements and analysis; and E) examples and exercises

II. Pore Pressure in Geomechanics

A) Basic concepts and causes of over pressure; B) Analysis concepts: NCT, Bowers, Centroid-Effect; C) Analysis workflow; and D) examples, and exercises

III. Mechanical Rock Behavior

A) Mechanical properties (elasticity and other stress-strain behavior); B) Failure and beyond; C) Influence of faults and fractures; D) Laboratory vs. log vs. field data; and E) Examples and exercises

IV. Geomechanical Modeling and Workflows

Concepts and tools; B) 1D/2D modeling and 3D modeling; and C) Example geomechanics workflow

V. Review of Common Petroleum Geomechanics Applications

A) Wellbore stability; B) Sanding; C) Solids (cuttings) injection; and E) Monitoring/Field/lab testing……

3-Day Wellbore Stability Course

No area in the oilfield has had a greater financial impact from geomechanics than wellbore stability and drilling operations. This course is focused on the mechanical stability of a wellbore and, by default, reducing or eliminating stability-related non-productive time (NPT). The course is intended for anyone interested in drilling and well operations but is especially intended for both new-hire and experienced drilling engineers.

The course begins with a review of the elementary components of geomechanics (i.e., stress/strain, pressure, and mechanical rock properties) and then moves on to the details of the stresses around a wellbore. It is these stresses, acting around the wellbore, that lead to well failure. From this foundation, the important parameters that impact wellbore stability (e.g., well trajectory, pressure, and time dependence) are presented. Then, leakoff testing and wellbore strengthening are reviewed in detail, and a detailed wellbore stability workflow presented. The course concludes with instructive case histories.

I. Basic Geomechanics: Principles of Stress/Strain and Mechanical Behavior

A) Basics of stress/strain; B) Effective stress concepts and the importance of pore pressure; C) Stress field variations and structural effects; D) Mechanical properties (elasticity and other stress-strain behavior); E) Failure and beyond; and F) Laboratory vs. log vs. field data.

II. Importance of Pore Pressure

A) Basic concepts and causes of over pressure; B) Analysis concepts: NCT, Bowers, Centroid-Effect; and C) Analysis workflow.

III. Stress Around A Wellbore

A) Kirsch elastic wellbore stresses; B) Definition of hoop/tangential stresses; C) Influence of stress regime; D) Influence of wellbore trajectory; and E) Evaluation of affected volume.

IV. Key Impacts on Wellbore Stability

A) Review of critical drivers; B) Importance of stress and pressure; and C) Time-dependent effects.

V. Shales and Salts

A) Key geomechanical effects for shales and salt; B) Mud systems and stability; and C) Time-dependent and thermal effects.

VI. Leakoff Tests (LOTs) and Wellbore Strengthening

A) Review of common stress tests; B) Comparison/contrast between LOTs, FITs, and XLOTs; C) Proper testing procedures; and D) Wellbore strengthening mechanics, implementation, and expectations.

VII. Data Collection and Workflows

A) Key data for WBS analyses; B) Where to obtain the data; and C) Analysis workflow.

VIII. Case Histories

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3-Day Basics of Hydraulic Fracturing Course

Hydraulic fracturing, first developed more than 67 years ago in the Hugoton Field, is one of the most important and enduring of all oilfield technologies. This course is intended for asset team members and new-hire completions engineers actively involved in hydraulic fracturing operations.

The course begins with a review of the elementary components of geomechanics (i.e., stress/strain, pressure, and mechanical rock properties) as a foundation for understanding the mechanics of hydraulic fracturing. Then the goal and application of hydraulic fracturing are presented. Hydraulic fracture propagation, geometry and modeling are presented followed by a review of proppants and fluids. From these, the pump schedule is explained and developed. The course concludes with a review of quality control procedures and key aspects of hydraulic fracturing from horizontal and/or multi-well horizontals.

I. Basic Geomechanics: Principles of Stress/Strain and Mechanical Behavior

A) Basics of stress/strain; B) Effective stress concepts and the importance of pore pressure; C) Stress field variations and structural effects; D) Mechanical properties (elasticity and other stress-strain behavior); E) Failure and beyond; and F) Laboratory vs. log vs. field data.

II. Hydraulic Fracturing Basics: Goals and Economics

A) Principal goals of hydraulic fracturing; B) Types of hydraulic fracturing; and; C) Hydraulic fracturing production and economics.

III. Fracture Geometry

A) Role of stress, modulus and fluid leakoff; B) Role of pump rate and viscosity; and C) Modeling geometry.

IV. Fracturing Materials

A) Review of fluids; B) Review of proppants; and C) Selection criteria.

V. Treatment Schedule Design

A) Key Inputs; B) Sources of data; and C) Effects of treatment schedule on fracturing.

VI. Execution and Quality Control

A) Execution planning; B) QC procedures and key elements; and C) Gotcha's.

VII. Perforating, Horizontal Wells, and Multi-Well Stimulations

A) Types of perforating; B) Perforating design (e.g., limited entry); C) Hydraulic fracturing from horizontal wells; and D) Multi-well hydraulic fracturing issues (e.g., Zipper fracs).

3-Day Basics of Sanding and Sand Production Course

Sanding and sand production are common problems in the Gulf of Mexico; however, the importance of sanding analyses reaches to oil and gas fields around the globe that produce from weak sand formations. The focus of the course is on understanding and predicting the onset of sand production as well as the potential for estimating produced sand volumes. The course is intended for anyone working weak or unconsolidated reservoirs but especially completion engineers designing completions is such reservoirs.

The elementary components of geomechanics (i.e., stress/strain, pressure, and mechanical rock properties) are first presented, followed by an introduction to the challenges of sand production as well as the potential for Sand Management (the planned production and disposal of surface-produced sand). The geomechanics of sand production are then presented as are both analytical and numerical models for the onset of sanding. In addition, the important aspects (and limitations) of volumetric sand analyses are presented. The course concludes with review of case histories and steps to integrate sanding issues into well operations.

I. Basic Geomechanics: Principles of Stress/Strain and Mechanical Behavior

A) Basics of stress/strain; B) Effective stress concepts and the importance of pore pressure; C) Stress field variations and structural effects; D) Mechanical properties (elasticity and other stress-strain behavior); E) Failure and beyond; and F) Laboratory vs. log vs. field data.

II. Introduction to Sand Production

A) Basic concepts and causes of sand production; B) Impact and safety issues; and C) Concept of Sand Management and sand disposal.

III. Sand Production Mechanisms

A) Causes of sand production; B) Impact of water breakthrough; C) Influence of well completion; and D) Operational effects.

IV. Sand Production Modeling

A) Onset versus volumetric predictions; B) Analytical models; C) Laboratory testing; and D) Volumetric sand modeling.

V. Sand Production Integration and Case Histories

A) Integrating the key field and operational aspects; B) Design options and risk assessment; and C) Case histories.