Training Course:

Fundamentals of Geomechanics for Drilling Optimization and Well Stimulation

Class Size: 5–10 participants
Duration: 5 days (40 academic hours)

STIM SERVICES
stimulate for performance

Course Overview:

This course provides a comprehensive introduction to applied geomechanics and its role in optimizing drilling, well construction, hydraulic fracturing, and field development.
Participants will develop a practical understanding of in-situ stresses, pore pressure prediction, rock mechanical properties, and laboratory rock testing, as well as the construction and application of Mechanical Earth Models (MEM) to address drilling and production challenges.
The program covers the complete geomechanical workflow - from core analysis and well log interpretation to one-dimensional (1D) and three-dimensional (3D) Mechanical Earth Models. Participants will learn how geomechanics is used to improve wellbore stability, predict abnormal pore pressure, optimize drilling fluids and bit selection, enhance hydraulic fracturing design, manage sand production, and support the development of unconventional and naturally fractured reservoirs.
Real field examples from Kazakhstan and international projects are used throughout the course to demonstrate practical applications of geomechanics during the entire life cycle of an oil and gas field.

Course Agenda:

Day 1 – Introduction to Geomechanics and Rock Mechanics
– Introduction to geomechanics and its applications in the oil and gas industry
– Origin of in-situ stresses and tectonic loading
– Methods for estimating and modeling the natural stress field
– Pore pressure generation mechanisms
– Pore pressure prediction methods
– Fundamentals of pore pressure modeling
– Introduction to rock mechanics

Day 2 – Core Geomechanics, In-Situ Stress and Mechanical Earth Models
Rock Mechanical Properties
– Compressive and tensile strength
– Stress tensor fundamentals
– Elastic behavior and elastic properties
– Young's Modulus and Poisson's Ratio
– Internal friction angle
– Cohesion
– Rock deformation
– Rock failure criteria
. Laboratory Rock Testing
– Uniaxial and triaxial compression testing
– Brazilian tensile testing
– Scratch testing
– Thick-walled cylinder testing
– Biot's coefficient determination
– Pore volume compressibility measurements
Log Calibration and Reservoir Characterization
– Sonic and dipole acoustic log calibration
– Reservoir stiffness evaluation
– Hydraulic fracture design parameters
– Fracture azimuth prediction
– Maximum horizontal stress orientation
– Fracture toughness determination using core analysis
Stress and Pore Pressure Analysis
– Regional and local stress regimes
– World Stress Map concepts
– Anderson fault classification
– Vertical and horizontal stresses
– Breakouts and drilling-induced tensile fractures
– Borehole image logs
– Formation integrity and leak-off testing
– Fracture gradient determination
– Pore pressure measurement and prediction
– Real-time pore pressure monitoring

Day 3 – 1D and 3D Mechanical Earth Models
Mechanical Earth Model Development
– Fundamentals of Mechanical Earth Models (MEM)
– Building 1D MEMs from well data
– Input data requirements and quality control
– Modeling elastic and strength properties
– Pore pressure and stress modeling
Advanced Geomechanical Modeling
– 3D Mechanical Earth Models
– Geomechanics throughout the field life cycle
– Mechanical anisotropy
– Applications of anisotropic rock behavior
– Structural geology and fault mechanics
– Influence of anisotropy on stress distribution

Day 4 – Wellbore Stability Analysis and Drilling Optimization
Wellbore Stability
– Wellbore stability principles
– Wellbore Stability Analysis (WSA)
– Geomechanical optimization of well construction
– International and Kazakhstan field case studies
Drilling Optimization
– Drill bit selection and optimization
– Drilling fluid design
– Modern lost circulation prevention and mitigation techniques
– Formation integrity testing
– Leak-off and injectivity testing
– Wellbore strengthening methods

Day 5 – Advanced Applications of Geomechanics
– Challenging Reservoirs
– Mechanical behavior of salt formations and shale
– Naturally fractured reservoirs
– Structural geology and fault analysis
– Geomechanics of unconventional reservoirs
Hydraulic Fracturing Optimization
– Geomechanical controls on fracture initiation and propagation
– Hydraulic fracturing optimization using Mechanical Earth Models
– Sand production prediction and mitigation
– Practical engineering calculations
– Course summary and discussion

Target Audience:

– Engineering Managers
– Drilling Engineers
– Reservoir Engineers
– Geomechanics Engineers
– Geologists & Geophysicists
– Petrophysicists
– Drilling Supervisors
– Wellsite Engineers
– Drilling and Production Technologists