



Society of Petroleum Engineers

**SPE Training Course in conjunction with
SPE Workshop: Maximise Asset Value Through Geomechanics**

Geomechanics in Wellbore Stability

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TENTATIVE DAILY ACTIVITIES AGENDA

Day 1	Topic	Venue
0800 – 0900	Registration and Welcome Coffee and Tea	To be confirmed
0900 – 1030	<p>Session 1 - Rock Mechanics Fundamentals</p> <p>A brief overview of the course covering the various aspects of developing a 1-D mechanical earth model development from log, lab and field data will be given. The various applications of rock mechanics/geomechanics application to oil field problems, and the sources of information varying from the most common logs such as sonic, density, etc., to core data generated from laboratory tests to field and empirical data will also be covered. The session will also highlight the importance of calibrating model parameters to field events, and the fundamentals of (rock) mechanics, such as normal and shear stresses on a plane, 1-D, 2-D and 3-D stresses, and principal stresses. Participants will learn how to calculate principal stresses from normal and shear stresses and vice-versa using Mohr's circle, while learning about the concept of effective stress and the various rock properties (elastic and failure parameters). This session will cover:</p> <ul style="list-style-type: none"> • Course introduction and application of rock mechanics to oil field industry • Normal, shear and principal stresses • Mohr's circle and its use • Stress and strain, elastic rock properties • Rock properties from lab, log and empirical correlations 	To be confirmed
1030 – 1045	Coffee Break & Discussion	To be confirmed
1045 – 1200	<p>Session 2 - In-situ Stresses and their Determination</p> <p>This session will describe how to estimate overburden (vertical) and horizontal stresses from logs. Minimum horizontal stress estimation from overburden stress, pore pressure and rock elastic parameters, such as Poisson's ratio and Young's modulus (applying tectonic strains for complex lithology and boundary conditions) will also be presented. Determination of the rock elastic properties from sonic and density logs, and minimum horizontal stress calibration to closure stress obtained from field tests such as extended leak-off tests, and mini-fracs will be discussed. Finally, the model calibration to drilling events such as tight holes, lost circulation, breathing and ballooning, and more will also be covered. This session will cover:</p> <ul style="list-style-type: none"> • Vertical overburden stress and its estimation • Horizontal stresses and their estimation • Stress anisotropy, image logs, caliper logs • Stress calibration, Leak-off tests, Formation Integrity tests, drilling events • Effect of pore pressure and rock properties on minimum horizontal stress • Stress regimes (normal, strike-slip and thrust faulting) 	To be confirmed
1200 – 1330	Networking Lunch	To be confirmed

1330 – 1515	<p>Session 3 - Near Wellbore Stresses and Rock Failure</p> <p>This session will address near wellbore stresses resulting from drilling a borehole in an in-situ stress field. It describes the near wellbore stresses and how to estimate them from the existing or in-situ stresses. Impact of mud weight, hole inclination and azimuth, pore pressure, mud cake, and more on the near wellbore stress will be covered. Equations to calculate near wellbore stresses for a general borehole orientation with respect to in-situ stress directions will be provided. Shear and tensile failure modes will be explained and shown from equations for simple cases of wellbore orientation. Signs of rock shear and tensile failure and wellbore instability from drilling events/reports and logs (caliper, image, etc.) will be discussed. Relevant examples from case studies will be shared. This session will cover:</p> <ul style="list-style-type: none"> • Hoop, axial and radial stresses • Effects of wellbore inclination on hoop stress • Shear failure and various shear rock failure criteria • Tensile failure of rock • Safe mud weight window 	To be confirmed
1515 – 1530	Coffee Break & Discussion	To be confirmed
1530 – 1700	<p>Session 4 - Wellbore Stability</p> <p>This session will cover the impact of rock strength, hole inclination and azimuth, in-situ stresses, pore pressure and mud density on borehole collapse and fracture gradient (tensile failure limit). Filter cake efficiency on tensile failure will also be reviewed. Discussion will also cover the concept of narrow mud weight window and mitigative measures to drill through such formations, the depletion (and injection) effect(s) on safe mud weight window, the concept of partial borehole collapse (breakout), and stress caging (borehole strengthening). Relevant examples from case histories will also be presented. This session will cover:</p> <ul style="list-style-type: none"> • Effects of rock strength, well inclination and azimuth on safe mud weight • Effects of filter cake, mud density, etc. on stability • Narrow margin drilling, effect of water depth, etc. • Effects of depletion on stability and mud safe weight window 	To be confirmed