



## **Practical Drilling Geomechanics**

### **A practical Course for the Drilling Engineers**

**Instructor: Dr. Saleh  
Drill-Sense International**

### **Course Objectives**

This course will address the basic steps required by the well construction team (drillers, engineers, geoscientists) to develop a robust well plan from basic data available from seismic and offset wells. This course is focused on the fundamentals

1. Describe the stresses in the earth before we drill a borehole
2. Describe the stresses in the earth after we drill a borehole
3. Describe how a rock fails when we drill it
4. Understand the features of an extended leak off test
5. Explain the geometry of borehole shear and tensile failures and how to detect them on lateral log images
6. Understand how a mud weight window is calculated
7. Understand the differences in borehole stability in deviated wells from vertical wells
8. Describe the basic components of the Mechanical Earth Model and how the input data is derived
9. Describe the different types of cavings and how this analysis can define wellbore stress environment and uses in real time modeling calibration
10. Detect the common wellbore instability mechanisms from surface and downhole signatures and offset well data
11. Propose remedial actions for the common instability mechanisms that occur at the wellsite

### **Who should attend?**

Anyone who is connected with well construction from the planning phase to post mortem including drillers, engineers, geologists, geophysicists, and environmental engineers.

### **Instructor:**

Dr. Saad Saleh, Drill-Sense International (Vita Attached)

### **Course Content:**

<b>Day</b>	<b>Topics</b>
<b>1</b>	<b>Fundamentals of Rock Mechanics</b> <ul style="list-style-type: none"><li>• Introduction and concepts</li><li>• Wellbore stability planning perspective</li><li>• Data requirements for a geomechanic model building</li><li>• Components of a geomechanic model</li><li>• In situ stresses</li><li>• Effective stresses</li><li>• Compaction</li></ul>

- Overburden
- Minimum horizontal stress
- Maximum horizontal stress
- Geologic control on in situ stresses
- In situ stress measurements

## **2 Rock/wellbore Failure Theories**

- Definitions
- Rock strength
- Size effect and scaling rock properties
- Effect of moisture on strength
- Rock anisotropy
- Rock strength from logs
- Rock strength from drilling data
- Dynamic and static rock properties correlations
- Tensile failure
- Effect of drilling fluids on rock strength
- Constructing a failure envelope

## **3 Wellbore Stability Analysis**

- The linear elastic model
- Wellbore stability in vertical wells
- Wellbore stability in inclined wells

## **4 Practical Wellbore Stability Monitoring**

- Identification of wellbore failure mechanisms from wellbore images
- Real time wellbore stability diagnosis
- Caving analysis
- Practical Guidelines to remedy wellbore stability

## **5 Class Problems and Project**

- Wellbore stability Planning and building an MEM
- Pre drill phase
- Real time verification and modeling
- Post drill evaluation
- Team project

## The Instructor



**Saad T. Saleh, Ph.D.**

Drill-Sense International  
5721 South Yampa Street  
Centennial, CO 80015  
saleh@drill-sense.com

Dr. Saleh holds a Ph.D. and MS degrees in Petroleum Engineering from the Colorado School of Mines. He has over 20 years of professional drilling experience in industry and 6 years in academia. Dr. Saleh is a specialist in real time geopressure, wellbore stability, and drilling analysis. Dr. Saleh is highly experienced in drilling technology frontiers (HPHT deepwater, sub salt drilling to name few) in many parts of the world including Latin America, Gulf Coast, North Sea, Canadian Shelf, and the Far East. Dr. Saleh has been involved in training and mentoring drilling engineers and drilling operation personnel on geopressures prediction, wellbore stability analysis, drilling fluid solids control, and drilling fluids optimization.

Currently, Dr. Saleh is the President of Drill-Sense International, a consulting firm which specializes in advancing real time drilling technologies, training in all aspects of Petroleum Engineering with emphasis on drilling training, as well as providing expert advice to the global drilling industry on drilling diagnostics, optimization, well planning, and real time drilling surveillance. Dr. Saleh is serving as a Global Advisor for Knowledge Systems in Houston as well as other service providers and operators. Dr. Saleh literally wrote the book for drilling best practices in the deepwater Gulf of Mexico subsalt wells, best practices for geopressure predictions in deepwater for many parts of the world including the Gulf of Mexico, Nile Delta, and others. At the present time, Dr. Saleh is heavily involved in

Recently, Dr. Saleh was a Senior Drilling Fluid Specialist with Saudi Aramco (from 2005 to 2007). Dr. Saleh championed the introduction of the Saudi Aramco's Real Time Drilling Operation Center (RTOC), drilling rate optimizations and other strategic projects.

Prior to Aramco, Dr. Saleh was the Principal Geopressure advisor/consultant for Knowledge Systems (6 years from 2000 to 2005) in Houston, Texas. With over 2000 wells analyzed world wide, Dr. Saleh has gained extensive experience in the field of geopressure and wellbore stability analysis which covered Latin America, U.S. Gulf Coast, East Canadian Shelf, North Sea, and the Mediterranean Nile Delta. During his tenure with Knowledge Systems, he has served as the Knowledge Systems' project manager, a wellsite geopressure/wellbore stability Consultant, a Trainer, and a specialist to audit internal drilling work processes with special focus on geopressure and geomechanics aspects.

Prior to joining Knowledge Systems, Dr. Saleh served as Drilling Advisor for PDVSA-Intevep (3.5 years from 1997 to 2000), Assistant Professor at the Colorado School of Mines (4 years



from 1994 to 1997) and the University of Alaska (2 years from 1988 to 1990), and a Drilling Engineer for BP Exploration in Alaska (4 years from 1990 to 1994) and Northern Petroleum (2 years from 1977 to 1979).

In his career, Dr. Saleh has worked as a Drilling Engineer, Special Projects Engineer, Project Leader, Assistant Professor, Drilling Technology Advisor and Mentor. Dr. Saleh worked in drilling operations/rig supervision, well planning for deepwater HPHT wells, rig site and real-time advisor for drilling extremely difficult wells (subsalt), well productivity enhancement, and pioneered new technologies in bits for hard drilling, cementing in horizontal and highly deviated wells, drilling vibration minimization, foam diversion, foam application for production systems, and advanced enhanced oil recovery concepts. Dr. Saleh worked as an advisor to the United States Sandia National Laboratory to develop models for buckling of tubular, minimize water hammering effects, casing failure under salt loading, and other drilling problems. In addition, Dr. Saleh served as a Drilling Editor for the SPE Drilling Magazine. Dr. Saleh developed from scratch several state-of-the-art research laboratories for foam, formation damage, flow loop, and gas well testing simulator. Dr. Saleh has written several technical manuals for academic and industry teaching and published over 24 papers in drilling, formation damage, production, and reservoir engineering.