N738: Applied Drilling Engineering Optimization

Instructor(s): Robello Samuel

Format and Duration
Classroom - 2 Days

Summary

This course covers a comprehensive range of topics essential for developing a solid understanding of drilling optimization. Participants will explore techniques of optimization, including basic concepts and various optimization methods. Key areas of focus will include hydraulic optimization, different nozzle selection criteria, and the impact of diamond and roller cone bit weight on drilling performance. Additionally, the course will address rotary speed drilling optimization and hydraulic optimization with special downhole tools.Participants will engage in studying algorithms and optimization techniques utilized in the various stages of drilling and well completion operations. The course is designed to present different optimization methods and expose participants to a variety of problems, equipping them with the skills to solve these challenges successfully.

Business Impact: Participants will gain practical skills in drilling optimization that directly reduce non-productive time (NPT), improve rate of penetration (ROP), and extend the life of bits and downhole tools. By applying real-time analysis and planning strategies, they will be able to lower operational costs, enhance drilling efficiency, and deliver wells faster—positively impacting production timelines and overall project economics.

As part of the training, participants will receive the "Applied Drilling Engineering Optimization" color book (400 pages) authored by Dr. Robello Samuel, which serves as a valuable resource for further learning and reference.

Learning Outcomes

Participants will learn to:

1. Identify and analyze the key constraints and variables affecting drilling operations, demonstrating an understanding of their impact on optimization.
2. Formulate the essentials of an optimized drilling program, integrating concepts of optimum drilling philosophy and effective well planning.
3. Evaluate and apply effective well planning strategies, including offset analysis and the use of drilling parameter records to mitigate non-productive time events.
4. Assess and apply various wellpath optimization techniques, including the minimum energy method and the influence of bit and BHA on wellpath efficiency.
5. Implement strategies for optimizing drilling fluids, including selection criteria and the effects of mud on drilling rates and overall performance.
6. Utilize real-time data monitoring and analysis techniques to detect wellbore problems and optimize drilling parameters effectively.

Training Method

This is a classroom course comprising a mixture of lectures, discussions, case studies, and practical exercises.

N738: Applied Drilling Engineering Optimization

Instructor(s): Robello Samuel

Format and Duration
Classroom - 2 Days

Who Should Attend

This course is designed for drilling engineers, well operations personnel, rig supervisors, drilling supervisors and designers, and manufacturers who wish to gain a deeper understanding of drilling optimization and its applications in drilling operations.

Course Content

- Optimization Overview
    - Drilling Constraints
    - Drilling Variables
    - Optimized Drilling
    - Optimized Drilling Program Essentials
    - Optimum Drilling Philosophy
- Well Planning: Key in Drilling Optimization
    - Typical Well Planning Guide
    - Information Needed for Effective Well Planning
    - Offset Analysis
- Bits, BHA and Drill Pipe
    - Bit records
    - BHA Records
- Drilling parameter records
- Wellbore problems and non productive time events
- Stick diagrams
    - Important Issues in Well Planning
    - Post Well Analysis
    - Modeling and Analysis
- Drilling Rig- Major Factor in Drilling Optimization
    - Rig Selection
    - Rig Types
    - Dual activity and Dual Derrick Rigs
    - Rig Power Generation
    - Data Acquisition and Monitoring Syste
- Wellpath Optimization
    - Special profiles
    - Minimum Energy Method
    - Length Optimization
    - Number of Wells
    - Friction Factor
    - Influence of bit and BHA on Wellpath
    - Rig Limitations – Top Drive Torque, Hook Load and Rig Power
    - Side Forces and Casing Wear
    - Hand-on exercise

N738: Applied Drilling Engineering Optimization

Instructor(s): Robello Samuel

Format and Duration
Classroom - 2 Days

- Drilling Fluid Optimization
    - Drilling Fluids Function
    - Selection Criteria
    - Consideration of Mud Program Optimization
    - Effect of Mud on Drilling Rate
    - Monitoring Weighted Nondispersed Muds
- Hydraulic Optimization
    - Classical method
    - Trip Speed Optimization
    - Bit Hydraulics Optimization
        - Design Optimization
        - Nozzle Selection - Classical method
        - Graphical method
        - Optimization with split flows
        - Optimization with Restricted sub
        - Optimization with motor
    - Flow rate optimization
    - Well Control
    - Cuttings Transport Optimization
    - Hole Size, BHA and Drillstring Size
    - Hydraulics Optimization with Managed Pressure Drilling Techniques
    - Hands-on exercise
- Conventional Managed Pressure Drilling
- Dual Gradient Drilling
- Riserless Mud Recovery
- Controlled Mud Level
- Drilling Parameters Optimization
    - Specific Energy
    - Power Graph Analysis
    - WOB, N, ROP optimization
    - Displacement and Force Optimization
    - Hand-on exercise
- Shale Stabilization – Optimization
    - Causes of Shale Problems
    - Diagnosing Shale Problems
    - Mud Design for Shale Stabilization
    - Drilling Problems
    - Tests
- Real-time Optimization
    - Database, data storing and mining
    - Real-time monitoring
    - Real-time Optimization
    - Friction Factor Calibration

- - Wellbore Problems Detection with Real-time Data
- Influx
- Stuck Pipe
  - Hands-on exercise
- Wellbore Stability
- Vibration
- Inadequate Hole Cleaning
- Well Cost Optimization
  - Neural network
- Support Vector Machine
- Casing Cost Optimization
  - Hands-on exercise
- Wellbore Size Optimization
  - Lean Profile
  - Under-Reaming
  - Influence of Casing Program
- Flat Time Optimization
  - Jetted Conductor Soaking Time
  - Casing Running
  - Pressure Test (Positive and In-Flow Tests)
  - Connection Time
  - Breaking Circulation
  - Formation Integrity Test (FIT), Leak Off Tests (LOT) and Extended Leak Off Tests (XLOT)
  - Cement Plugs Setting
  - Hands-on exercise