N997: Applied Reservoir Engineering

Instructor(s): Jerry Hadwin

Format and Duration

Classroom - 5 Days
Virtual - 10 Sessions

Summary

This course aims to provide the practicing reservoir engineer with a range of analysis techniques and tools relevant to contemporary field development trends. Fundamental concepts will be discussed to ensure a solid foundation for understanding the applicability and limitations of the techniques presented. The learning will be supported and reinforced by examples and exercises throughout the course.

Business Impact: Participants will develop the skills to add value by **accurately assessing recoverable volumes**, **enhancing hydrocarbon recovery**, and developing more **robust reservoir simulation models.**

Learning Outcomes

Participants will learn to:

1. Develop a robust understanding of the key concepts underpinning the practice of reservoir engineering; encompassing rock and fluid properties, and the physics of multiphase flow in porous media.
2. Implement a range of analysis techniques to quantify recoverable volumes and productivity of oil, gas, and gas-condensate wells and reservoirs.
3. Expand traditional techniques to provide familiarity and understanding of more contemporary reservoir analysis for improved and enhanced recovery techniques, and resource-play reservoirs.
4. Determine the parameters for resource classification.
5. Assess and apply techniques to assess Reserves volumes.
6. Illustrate the appropriate uses of reservoir simulation and provide practical guidelines for planning reservoir modelling studies.

Training Method

This is a classroom or virtual classroom course comprising a mixture of lectures, worked examples, and practical exercises. A scientific calculator or laptop computer my be required.

Who Should Attend

The course is designed to provide practicing mid- to senior-level engineers with a fuller understanding of the basis and applicability of their engineering work and to introduce additional approaches to their reservoir analyses. Manages and team leaders could also benefit from exposure to applied reservoir engineering topics.

Course Content

- Fundamentals
  - Reservoir Description (reservoir architecture, porosity and permeability, distribution of properties)
  - Fluid Properties (sampling, composition, phase behaviour, PVT studies, EoS modelling and characterization)

- Fluid Distribution (pressure vs. depth, capillary pressure, wettability, contacts)
- Fluid Flow in Porous Media
  - Darcy's Law and Flow Potential (the 3 forces)
  - Diffusivity equation (steady state flow, transient flow, pseudosteady state flow)
  - Superposition
  - Relative Permeability
- Well Performance
  - Inflow Performance (radial flow, productivity index, skin, coning/cusping, horizontal wells, vertical lift)
  - Diffusivity equation (steady state, transient, and pseudo-steady state flow)
  - Well testing (objectives, test types, after-flow, flow regimes for different well types, analysis techniques, gas well testing)
  - Rate-time Analysis (RTA) Techniques
- Resource Estimates
  - Resource and Reserves Definitions (Reserves vs. resources, SPE / PRMS Classification, other classification systems, levels of uncertainty)
  - Probabilistic Estimates (proven, probable, possible, P90/P50/P10)
  - Estimation Techniques (volumetrics, analogues, recovery factors, well drainage limits, decline curve analysis, material balance, simulation)
- Drive Mechanisms & Evaluation Techniques
  - Oil Reservoirs (fluid expansion and introduction to material balance, alternative depletion mechanisms)
  - Material Balance applied to Oil Reservoirs
  - Immiscible Displacement (waterflood)
  - Fractured Reservoirs
  - Gas Reservoirs (dry / wet gas, difference in approach to development, alternative depletion mechanisms)
  - Material Balance applied to Gas Reservoirs
  - Gas-condensate Reservoirs (differences with dry/wet gas reservoir, alternative depletion mechanisms)
  - Material balance of gas-condensate reservoirs, and recovery factors
  - 'Resource Plays' (shale gas, tight oil and gas, analysis and performance prediction techniques)
- Improved/Enhanced Oil Recovery, IOR/EOR
  - IOR Categories (infill recovery, miscible gas injection, chemical floods, thermal techniques)
  - Screening and Analysis of Alternative Techniques
- Reservoir Simulation
  - Principles of Simulation (finite-difference, streamline, alternative simulator types, input data, well models, history matching)
  - Practice of Simulation (integration of disciplines, objectives, multi-scale modelling, reservoir modelling process, dealing with uncertainty)
  - Upscaling (levels of scale, representativeness, pseudo relative permeability)