N936: Reservoir Engineering Principles and Practice

Instructor(s): Alun Griffiths

5 Days	Competence Level: Skilled
Classroom Course	
Computer Usage	

Summary

This course applies the physical principles that govern subsurface fluid flow and phase behaviour to the prediction of reservoir and well performance. It describes methods for: reserve estimation; analyzing fluid flow in porous media; interpreting well and reservoir performance; assessing the performance of primary and secondary recovery processes. New technologies are described where appropriate. Participants are encouraged to bring short case studies to discuss informally in class.

Learning Outcomes

Participants will learn to:

1. Estimate “in place” and “recoverable” volumes of petroleum, and categorise them using industry-standard definitions.
2. Develop production forecasts for oil and gas fields using decline curves derived for wells and/or reservoirs, taking into account rate constraints.
3. Estimate the inflow performance of fractured, horizontal, solution gas drive and gas wells by extending the semi-steady state solution of the radial flow equation.
4. Characterise the principles of pressure transient and rate transient analysis
5. Appraise the results from laboratory PVT experiments to reservoir engineering calculations.
6. Estimate aquifer influx into oil and gas reservoirs undergoing depletion, and incorporate this in the prediction of reservoir performance.
7. Predict the behaviour of an oil reservoir producing under solution gas drive.
8. Predict the behaviour of both homogeneous and layered reservoirs using fractional flow theory.
9. Characterise the basic principles behind numerical reservoir simulation and streamline simulation.
10. Simple analytical models for fractured reservoirs.

Duration and Training Method

This is a five-day course comprising of lectures, exercises and class discussions. Participants are required to bring along their own PC laptops running Excel.

Who Should Attend

Mid-level engineers seeking to consolidate their understanding of analytical reservoir engineering methods or more senior engineers who require a refresher in this area.

Prerequisites and Linking Courses

Participants should be competent in algebraic manipulation and the use of Excel. A basic understanding of reservoir engineering and physical principles is required, as provided by course N933 (Basic Petroleum Engineering). Some experience in general reservoir engineering is also recommended. Other courses that relate to reservoir performance include N942 (Gas Condensate Reservoir Engineering including HPHT) and N923 (Fractured Reservoir Characterisation and Modelling).

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Course Content

Day 1: Reserves and production forecasting

- Volumetric calculations
- Reserves classification
- Probabilistic and deterministic reserves
- Decline curves
- The components of a production profile
- Production forecasting using decline curves

Day 2: The radial flow equation

- Solutions of practical interest
- Inflow performance
- Pressure transient analysis
- Introduction to rate transient analysis

Day 3: Phase behaviour

- The “Black Oil” model
- PVT sampling
- Laboratory analysis
- Flash calculations
- Introduction to Equation-of-State
- Oil and gas PVT correlations

Day 4: Material balance

- The Material Balance equation
- Drive indices
- Aquifer models
- The “Extended Black Oil” model
- GOR prediction
- Introduction to Tank Models

Day 5: Immiscible displacement

- Relative permeability and capillary pressure
- Preparation of relative permeability data
- Fractional flow theory
- Displacement models
- Introduction to numerical models
- Fractured reservoirs