N986: Reservoir and Production Engineering of Resource Plays

Format and Duration
Classroom - 2 Days

Instructor(s): Erdal Ozkan

Summary

The course addresses the engineering challenges of ultra-tight reservoirs from a multidisciplinary perspective by connecting the well and reservoir performances with geological, geochemical, petrophysical, and geomechanical characteristics of these reservoirs. Topics include geological and geo-mechanical controls; design principles of completing and hydraulically fracturing horizontal wells; properties and effects of tectonic and maturation-induced fractures; governing flow regimes and their relation to geological and petrophysical characteristics; and pressure and rate analysis of tight reservoirs. Hydrocarbon phase behavior as a function of petrophysical heterogeneity; advective and diffusive flows; desorption, and hindered transport in tight matrix; contributions of hydraulic and natural fractures; the stimulated reservoir volume concept; and interactions of flow between fractures and matrix within the context of dual-porosity and anomalous modeling are discussed. Pressure-transient, rate-transient, decline-curve, and transient-productivity analyses are also covered. This course will provide engineers and geoscientists with a truly unconventional understanding and the skills necessary for developing innovative methods of recovering the next percentage point from unconventional plays.

Learning Outcomes

Participants will learn to:

1. Think outside the box of conventional geoscience and engineering wisdom.
2. Assess flow mechanisms governing production from unconventional reservoirs.
3. Evaluate the underlying geological and petrophysical characteristics of flow regimes and production characteristics.
4. Evaluate the requirements and challenges of rock and fluid characterization.
5. Assess multidisciplinary unconventional concepts to explain flow in unconventional reservoirs.
6. Judge the applicability of commercial/conventional models and software.
7. Relate well productivity to unconventional reservoir properties.
8. Evaluate phase behavior in nanoporous media.
9. Assess the applications of dual porosity and anomalous diffusion models.
10. Apply unconventional interpretations of nanoporous reservoir performances.

Training Method

A two-day classroom course comprising lectures with worked examples and discussions. Field applications, guidelines and recommendations, and critical evaluation of available tools will also be provided.

Who Should Attend

This advanced course is intended for mid- to senior- level engineers and geoscientists with a fundamental understanding of reservoirs. Engineering and geoscience managers could also find the exposure to advanced reservoir engineering topics beneficial.

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Course Content

This course explores production from ultra-tight reservoirs and explains what makes these reservoirs unconventional from a reservoir engineering viewpoint, as well as the perspective of geoscientists. Among the topics covered:

- Impacts of unconventional geological, geochemical, and geo-mechanical characteristics
- Well completions, with an emphasis on hydraulic fracturing and fractured horizontal wells
- Darcy flow, diffusive flow, and desorption in a tight matrix
- Contributions of hydraulic and natural fractures
- The stimulated reservoir volume concept
- Interactions of flow between fractures and matrix, within the context of dual-porosity and anomalous modeling
- Phase behavior in heterogeneous, nano-porous reservoirs
- Various methods of modeling unconventional wells, matching history and forecasting future production.

Course Agenda

1. Fundamentals

- Unconventional vs. conventional reservoirs
- Geological, geochemical, and petrophysical characteristics of unconventional reservoirs
- Permeability, micro- and nano-porosity, natural fractures
- Origins and scales of natural fractures in shale
- Measurement and characterization challenges

2. Flow in Nano-Pore Formations

- Darcy and diffusive flow in mixed-porosity systems
- Effect of confinement, capillary-pressure, and surface forces
- Phase envelope shift, bubble-point suppression, capillary condensation
- Flow mechanisms and flow regimes in nano-pore systems
- Flow in fractured porous media
- Objectives of fracturing in unconventional vs. conventional reservoirs

3. Modeling Aspects

- Flow toward multiple-fractured horizontal wells
- Stimulated reservoir volume, drainage area, well spacing
- Effect of hydraulic and natural fractures
- Effects of matrix and natural-fracture characteristics
- Effect of stress-dependent natural-fractures
- Modeling micro-fractures

- Dual-mechanism, dual-porosity flow
- Differences between shale-gas and liquids-rich flow systems
- Anomalous diffusion

4. Interpretation of Rate and Pressure Data

- General considerations of transient flow in tight formations
- Effects of stimulated reservoir volume
- Implications of straight-line and type-curve analysis
- Critiques of decline-curve analysis

5. Discussion of Unconventional Reservoir Potential

- Unconventional-reservoir potential assessment
- Transient vs. stabilized productivities
- Economic vs. physical depletion
- EOR potential in unconventional plays