N971: Advanced Reservoir Simulation for Conventional and Unconventional Reservoirs

Instructor(s): Jim Gilman

5 Days	Competence Level: Skilled
Classroom Course	

Summary

This class addresses advanced topics in reservoir simulation though lectures and hands-on exercises. Each topic will address both conventional and unconventional reservoirs. Topics include appropriate choice of grids, initialization methods, multi-phase flow assumptions, rock-fluid interactions and PVT formulations. Special considerations for dual-media (naturally fractured reservoirs) are also addressed.

Learning Outcomes

Participants will learn to:

1. Evaluate choices with regard to building grids for simulation.
2. Evaluate choices with regard to initializing dynamic models.
3. Evaluate choices with regard to modeling multiphase flow and rock-fluid interaction.
4. Evaluate choices for PVT approximations.
5. Evaluate dual-media modeling choices for naturally fractured reservoirs.

Duration and Training Method

Five days of classroom lectures interspersed with exercises and practical computer-based workshops using simulation software.

Who Should Attend

This course has been designed for engineers who wish to improve their understanding of practical methods for modeling fluid-flow in conventional and unconventional reservoirs.

Prerequisites and Linking Courses

A basic understanding of engineering and physical principles is required, as provided by course N987 (Applied Reservoir Engineering). A working knowledge of reservoir simulation is also necessary, as provided by course N950 (Applied Reservoir Simulation). Participants are expected to have a basic awareness of unconventional reservoirs, as presented in Basic Application level course N313 (Evaluating Resource Plays). Some experience in general reservoir engineering and simulation is highly recommended.

Course Content

This course addresses simulation concepts which approximate the physical principles that govern subsurface fluid flow and phase behavior in a variety of geologic environments. Course attendees should have a basic knowledge of reservoir engineering and familiarity with commercial reservoir simulators such as ECLIPSE. The course aims to address a number of advanced topics in simulation of both conventional and unconventional reservoirs. The key topics that are covered are outlined below. Not all topics will be addressed in detail because of limited available time. More times will be spend on those topics of most interest to the attendees.

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- Reservoir Simulation Grids
  - Honoring geology, phase fronts, fractures, and computational limitations
  - Upscaling from 3D Descriptions
  - Aquifer Approximations
  - The value of conceptual models
  - Local grid refinement considerations
  - Approximating stimulated and propped hydraulic fractures
- Fluid Physical Property Data (PVT data)
  - Two component vs Equations-of-State formulations
  - Choosing the number of components in equations-of-state
  - Bubble-point suppression in tight reservoirs
- Rock-Fluid
  - Relative Permeability and Capillary Pressure Assumptions
  - Pros and Con's of End-point scaling
- Modeling Hysteresis
  - Approximating Rock Compaction
  - Surface Tension Effects
  - Importance of Adsorption and diffusion
- Initialization (Initial Pressures, Saturations, and Compositions)
  - Honoring Initial Conditions in Complex Systems
  - Using end-Point scaling for initial saturation variability
  - Non-equilibrium initialization for unconventionals
- Well Completion and Rate/Pressure Data
  - Simulator assumptions for well connections calculations
- Well connections in horizontal wells and hydraulic fractures
  - Matching pressure in unconventional reservoirs
  - Incorporating Special Data Types (e.g. ptt, PLT, RFT, tracer)
- Advancing the Simulator through Time
  - Linear and Non-linear Convergence Criteria
  - Making your model run better – data issues and stability
  - General Black-oil Tuning Recommendations for Fully Implicit Method
  - Tuning Implications of Parallel Processing
  - Numerical Effects of Pinch-Outs, Local Grid Refinement and Irregular Grids
- Dual Media Modeling of Naturally Fractured Conventional and Unconventional Reservoirs
  - Characterization of Fractured Reservoirs for Simulation
  - Alternative Models to Represent Multi Scale Transport
  - Transfer Function Choices and Adjustments
  - Numerical Issues and Run-time Optimization
  - Modeling stimulated and propped natural fractures in unconventionals