Streamline Modeling for Waterflooding

Program Objectives

This 5-day course presents streamline simulation fundamentals and builds upon basic understanding of waterflooding & finite difference simulation. The course covers an overview of how streamline simulators work including numerical methods and saturation solvers, however emphasis will be placed on practical use of the streamline simulator. Participants will learn where, when, and how to apply streamline simulation for a robust solution, and when the solution becomes numerically inaccurate and unstable. Flowstream will be used by students for waterflood optimization and understanding throughout the course. We will demonstrate advantages and disadvantages of streamline simulation compared to traditional finite-difference simulation and how to combine streamline visualization with finite difference simulation. In addition, students are encouraged to present case studies for their own fields for general discussion during the class.

Course Outline

Day 1

- Streamline Simulation Concepts
  - Introduction
  - Reservoir Mechanisms
  - Solutions to Flow Equations
  - Streamline Simulation
  - Front-tracking
- Application of Streamline Methods
  - Robust Applications
  - Problem Applications
  - Unique Applications

Day 2

- Case Study: NWFB – Prudhoe (SPE 63152)
- Simulator Controls
  - Solvers
  - Gravity
  - Equilibration
  - Streamline Density
  - Saturation Mapping
  - Time Step Selection
  - Well Models
- Model Initialization
  - Front-tracking rel-perm input
  - Saturation Functions, & Capillary Pressure
  - PVT
  - Aquifers
  - Gridding & Layering

Day 3

- Class Exercise
  - Model Initialization
- Class Exercise
  - Rapid Initialization of Geo Model
- Workflow for Reservoir Management
  - Overview
  - Injector-Producer Connections
  - Rate Allocations
  - Injection-Well Ranking
  - Drainage Volumes

Day 4

- Running and Checking Streamline results
  - Schedule Section Development
  - Results & Output Files
  - Post-Processing Options
- Class Exercise
  - Start to finish building of Well Schedule
- Class Exercises
  - Infill Drilling
  - Pattern Balancing

Day 5

- Class Exercise
  - Model Building
  - History Matching
  - Viewing & Analysis
- Special Applications
  - Tracers
  - Temperature Tracking
  - Pre-processing
  - IOR Scale for MWAG
- Final Exam