



Reservoir Simulation, Fundamentals and Applications

Course Description

This training provides detailed discussions, and hands-on training for building reservoir simulation models. This training course will provide fundamental knowledge of reservoir simulation workflows, static model grid construction methodology, reservoir model initialization, history matching and forecast. Different types of reservoir simulation models will be wide discussed based on use, main objective, and expected time frame. Novel workflows and guidelines for model initialization and history matching will be presented. Framework to identify sweet spot for new production and injection wells will be discussed as well.

The course will be supplemented by practical class examples, group exercises and interactive group discussion designed to consolidate and reinforce learning, identify and offering solutions to specific problems associated with reservoir simulation.

In addition to the core case studies built specifically to drive home the techniques and tools taught during the training sessions, other cases will be analyzed from real reservoir simulation problems, reservoir modeling, and reservoir management as the workshop proceeds.

Who Should Attend?

This course is designed for petroleum production, reservoir, project engineers; assets managers; operation managers; project managers from oil and gas, and government regulatory authorities; joint venture oil and gas operators; joint venture non-operators, and others

What You Will Gain:

- Understanding the importance of fluid and rock interaction modeling on reservoir simulation
- Understanding the types of reservoir simulation models, their uses, and limitations
- Learning how to perform the reservoir model initialization
- Learning key history matching guidelines
- Learning when use black oil and compositional models in reservoir simulation studies
- Understanding the main forecast constrains (wells/reservoir) during the prediction phase
- Understanding how simulators solve the system of equations
- Learning how the static modeling in generated and how petrophysical properties and geological facies are distributed
- Understand the type of aquifers models and theirs use in reservoir simulation
- Understanding the structure of a reservoir simulation file (For instance, the eclipse .data file).



Training Methodology

The training will combine lectures (30%) with workshop/ presentations (30%), interactive class exercises and case studies (20%), case studies and general discussions (20%).

Course Content

Day 1: Introduction to Reservoir simulation. PVT modeling

- Why reservoir simulation?
- Reservoir simulation role in reservoir management
- Type of numerical models (1D, 2D, 3D, sector models, Full field)
- PVT properties modeling, Fluid sampling, PVT experiments, Constant composition expiation (CCE), Differential test, Constant Volume Depletion (CVD), Separator Test, Guidelines for separator test selection.
- Main PVT correlation, uses and limitations
- Black Oil versus Compositional model, Equation of State (EoS), types of equations of state, Guidelines for tuning EoS.
- Grouping and splitting components methodologies
- Impact of wrong fluid characterization on reservoir modeling, history and predictions
- Data acquisition plan considerations
- Practical examples, Field case studies and Group exercises

Day 2: Rock and fluid interaction modeling

- Special Core Analysis
- Relative permeability, relative permeability laboratory experiments, relative permeability correlations.
- Capillary pressure, Leverett J function
- Reservoir wettability
- Types of reservoir rock
- End points relative permeability analysis per rock type
- Modeling K_r and P_c using a commercial simulator. Main keywords

Day 3: Reservoir model construction. Numerical simulation concepts

- Building the reservoir model
- Reservoir model construction workflow
- Petrophysical Property and facies distribution
- Gridding in Reservoir Simulation
 - Structured grids
 - Unstructured Grids
 - Grid Refinement
- Reservoir simulation concepts



- Numerical solution of single-phase and multi-phase flow equations
- Black oil and compositional reservoir simulation
- Numerical methods for fluid flow in porous media system of equations
- Implicit pressure explicit saturation (IMPES) formulation

Day 4: Reservoir simulation initialization

- Model Initialization workflow
- Grid definition, Grid Orientation effect
- Reservoir compartmentalization analysis
- Aquifer Modeling
- Use of Streamline Simulation for model initialization
- Eclipse simulator Approach, Data structure Analysis

Day 5: History match and forecast. Reduced order reservoir modeling overview

- Data preparation
- History Matching main workflows
- History matching examples/case studies
- Manual versus automated history matching
- Prediction workflows
- Predictions variables (wells, group, field), examples/case studies
- Sensitivity analysis
- Reduced order reservoir modeling. Capacitance resistance model (CRM) and Streamline simulation applications
- Practical examples, Field case studies and interactive class exercises