



Integrated System Modeling and Production Optimization, Intermediate Level

Course Description

The Integrated System Modelling (ISM) and Production optimization course builds your competence, confidence, and credibility through a strong theoretical framework as well as practical exercises that help you to gain knowledge in the area of field development plan and production optimization.

The training course will provide knowledge of the Integrated production system (IPS) components from the inflow performance, flow across the completion, tubing string, surface choke, surface flow lines, and separators. The different types of coupling the sub-surface and surface models will be explained and all possible scenarios properly development. The benefits of using IPS as a powerful tool for reservoir management will be also extensively explain trough case studies and SPE papers. Participants will learn how to integrate these different models together and run them all as a piece using commercial software applications (several approaches). Novel workflows for thoroughly evaluating, analyzing and optimizing performance of oil and gas field/well production system components to achieve target rates at the different states of the well/field life (early-, mid- and later-life) will also be presented.

Participants will also gain the knowledge and skills to identify typical production bottlenecks, resolve and optimize it, and perform forecasting to get a better insight for future performance of the integrated production model. Different scenarios will be reviewed and discussed to understand the applications and limitations of integrated production modeling as a key tool for production optimization.

The course will be supplemented by practical class project example problems, group exercises and interactive group discussion designed to consolidate and reinforce learning and identify and offer solutions to specific problems associated with IPS of oil and gas fields. 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 drawn from integrated asset modeling and optimization value chain as the workshop proceeds.



Who Should Attend?

This course is designed for petroleum, production, facility and project engineers, integrated study members, assets managers, reservoir managers, facility engineers, facility managers, project managers, and others.

What You Will Gain:

- Understanding the benefits of integrating of the sub-surface and surface models.
- Learning how to model the interactions between the reservoir deliverability and the wellbore completion (IPR/VLP).
- Understanding the benefits of Digital Oil Fields over the IPS process and decision making.
- Learning about methods for generating integrated asset modeling (IPS) to improve the processes of fluid flow performance forecasting and scenarios analysis.
- Understanding how production data is used into integrated production system (IPS) during a history matching process.
- Improving IPS management using single and multi-objective optimization methods
- Optimizing the production system to produce the objective flow rate economically.
- Performing evaluations of production systems to identify different types of formation damage and ways to accelerate oil recovery.
- Understanding the value of data and information for the decision-making process
- Using case studies, hands on exercises and interactive group discussion to identify and offer solutions to specific problems associated with integrated asset modeling and optimization.

Training Methodology

The training course will combine lectures (30%) with workshop/work presentations (30%), interactive practical exercises and case studies (20%), supported by video material, software and general discussions (20%)

Course Content

Introduction to integrated system modeling (ISM) & optimization

- Why is important to couple surface-subsurface models?
- Operational Models
- ISM/IPM Commercial tools



- IPS General Workflow. Step by Step procedure to connect sub-surface and surface systems
- Value creation opportunities – Identifying the value of IPM

Nodal Analysis (IPR)

- Introduction to nodal analysis
- Reservoir inflow performance (IPR) modeling
 - Flow regimes: steady state, transient flow, pseudo-steady state
 - Inflow Performance Relationship (IPR)
 - Reservoir models; Darcy, Vogel, Forchheimer, Multilayer, others.
 - Types of well architecture
 - Example Problem: IPR calculations and sensitivity analysis

Nodal Analysis (VLP)

- Pressure drop across a perforated interval
- Fluid flow modeling in pipes and restrictions
 - Flow regimes, single and multiphase flow correlations
 - Pressure losses per tubing unit length as a result of gravity, friction and acceleration
- Heat flow modeling
 - Fundamentals of heat transfer applied to wellbores
 - Wellbore enthalpy model, wellbore heat transfer coefficient, fluid heat capacities
- Choke performance modeling
- VLP curves sensitivity and production test matching
 - Matching production test data workflow
 - Sensitivity analysis

Integrated Production Modeling and Field Development Plans

- What is Field Development Planning?
- IPS as a tool to production forecast of field development plans
- Field development plan NPV and Risk calculation. Importance of evaluating multiple scenarios via IPS
- What Is Optimization Under Uncertainty? uncertainty definition, Uncertainties vs. Risk, uncertainty analysis, descriptive statistics, type of probability distributions
- Production optimization under uncertainty. Field development plan optimization exercises
- Case studies discussions

Integrated Production System and Optimization

- Integrated Production System (IPS)
 - Common constraints boundaries among reservoir, wells and facilities



- Simultaneous vs. coupled vs. integrated
- Commercial interface programs (e.g. Resolve, Nexus, Gap, etc.)
- Preparation of IPS components – wellbore model, reservoir model, surface network models, economic model
- Scenarios analysis with IPS
- Technical and economic evaluation of scenarios workflow
- Practical IPS fundamentals
- Integrated production optimization
- Overview of economic evaluation in oil and gas Projects
 - Overview of cash flow, net present value, internal rate of return, pay out time, and profitability index.
 - Cost modeling and economic KPI management (NPV, IRR, UTC, \$/bbl, \$/bpd)