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«BASIC RESERVOIR SIMULATION: MODERN APPROACHES TO DESIGN, APPLICATION AND ASSESSMENT», 5 days

COURSE OBJECTIVE:

Development of professional competencies in basic technologies of geological-technical and reservoir modeling and models application, input data control and model adaptation procedure, geological targeting, model quality and validity assessment for more efficient technological solutions.

ACQUIRED ABILITIES:

- Analyze input data, and assess its conformation to reservoir engineering concept;
- Select geological model conversion parameters for rescaling;
- Use physically based approaches while model history matching;
- Build various geological-technical models, prepare and calculate prediction versions;
- Design wells location and predict engineering parameters;
- Assess the completeness of reserves selection, predict a deposit energy state;
- Perform integral control of model quality.

COURSE CONTENT:

Module Name	Content
Introduction	Reservoir (filtration) modeling, development history, problems and achievements, current state. Industrial rules and guidelines for permanent geological-technical modeling (PGTM).
Modeling fundamentals	Basic principles of modeling. Physical and mathematic models as a core of a field simulation. Main analytical solutions for petroleum sphere.
Elements of field development analysis for input data treatment while permanent geological-technical model engineering	Material balance for a model development. Analysis of decline and flooding curves. Well operation assessment based on analytical solutions for detection of formation parameters. Recognition of wells correlation (mainly injection-production). Anisotropy estimation. Detection and use of coning.
"Rescaling" – from geological to reservoir modeling	Grid dimensions for rescaling. Features of absolute and relative phase permeability rescaling. Quality control.
Physical properties setting – lab tests, geological features	Ways of reservoir fluid and rock physical-chemical properties data acquisition. Fundamentals of physical-chemical analysis, equation of state. Modeling of PVT-properties (Black Oil, EOS), and

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and field management results	adjustment. Features of filtration model PVT-properties setting. Feature of PVT properties setting for gas-condensate mixtures and oils in case of thermal exposure.
Setting and rescaling of relative permeability, residual saturation, capillar pressure, and its impact on field development features	Relative permeability, ways of acquisition and smoothing, correlation with capillar pressure. Types and features of relative permeability rescaling for two- and three-phase systems. Common mistakes in relative permeability approval. Practical application of relative permeability modification for a model adjustment.
Model initialization – setting of initial and boundary conditions, ensuring of initial state balance, connection of water formation	Features of equilibrium nd nonequilibrum initialization. Features of oil-water contact modeling. Boundary conditions and aquifer features. Estimation of simulator adjustment impact for counterbalancing.
Well simulation – features of geo-technical model and EOR technics setting, use of reservoir and well log studies	Theory of well setting, geo-technical model, and EOR in models. Restrictions associated with thermo-hydrodynamics equation discretization. Setting of easy operation (shutdown) mode for well or field, and accuracy estimation of vertical and horizontal wells setting. Imitation technics of geo-technical models and EOR. Reservoir connectivity multiplier setting for simulation in history and forecast.
Model history matching – stages, approaches, simulator features, mistakes	Main history matching principles. Patterns identification and consolidation while matching. Some matching technics with modification of absolute and relative permeability. Manual matching – case study. Typical matching mistakes. Filtration models quality control.
Prediction of development parameters. Planning of geo-technical models. Optimization	Identification of reservoir system performance features. A model-based estimation of reserves space distribution. Selection of candidate wells for geo-technical modeling, parameters optimization.
Some further modeling details	Fractured reservoir modeling features. Comparative analysis of reservoir modeling systems. Simulators testing, SPE and CDC tests.