TU Delft

DARSim
Delft Advanced Reservoir Simulation

Title: “Practical aspects of reservoir simulation” by Dr. Denis Voskov (D.V.Voskov@tudelft.nl)

Dates: second part of May

Entrance requirements: BSc level of science or technology

Course format: Two sessions per day: 8:45 - 12:30 (lecture) and 13:45 - 17:30 (computer exercise). For exercise session each student should use PC with installed E100 and E300 simulators (GeoQuest-Schlumberger) and MS Excel.

GS credits: 2

Scope: During that course students will learn the basics and different numerical aspects of reservoir simulation. A lecture material covers basic mechanisms of multiphase flow in porous media, derivation of governing equations, basic numerical methods required for discretization of governing equations, different types of time approximation and the major physical models. Each student will construct a set of models for simulation of simplified reservoirs. Various aspects of reservoir engineering and simulation will be studied based on these models.

Day 1: 1D simple two-phase model

8:45 – 10:30	Darcy equation and single-phase flow in porous media; basics of numerical methods
10:45 – 12:30	1D discretization of single- and two-phase equations
13:45 – 15:30	Introduction to Eclipse; construction of simple 2-phase problem; sensitivity to property variation;
15:45 – 17:45	IMPES time step restriction; numerical error control; grid variation sensitivity; convergence control (*)

Day 2: 3D black-oil model

8:45 – 10:30	3D discretization; IMPES vs. Fully Implicit methods; time truncation error
10:45 – 12:30	Black-oil properties and equations; discretization of black-oil equations
13:45 – 15:30	Comparison IMPES vs. Fully Implicit; FIM time step restriction; numerical error control; construction of the SPE1;
15:45 – 17:45	PVT properties and relative permeabilities; sensitivity to property and grid variations; non-linear and linear convergence (*)

Day 3: Thermal-compositional model

8:45 – 10:30	Introduction to compositional simulation, derivations of governing equations and flash, two-phase for binary and ternary systems;
10:45 – 12:30	Solution of compositional problem; nonlinear formulation and unknowns; general multiphase equilibrium, flash calculation;
13:45 – 15:30	Construction of simple compositional model; wet gas, retrograde gas and volatile oil simulation; sensitivity to the number of components
15:45 – 17:45	Sensitivity to the number of components; thermal extension (hot water injection); development of miscibility (*)

(*) – advanced task