

2019 COURSES

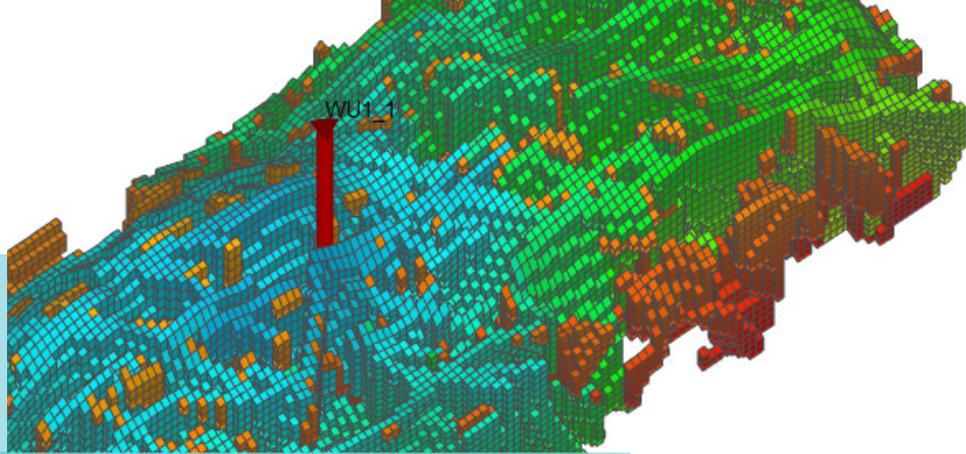
Istanbul 8 – 12 APR

Mexico City 20 – 24 MAY

Kuala Lumpur 17 – 21 JUN

London 23 – 27 SEP

Perth 18 – 22 NOV



Reservoir Simulation – FUNDAMENTALS

5 Day Course

Course Overview

Subject to participant requirements

The course begins with discussion of the fundamentals of reservoir simulation. Why and how and under what conditions reservoir simulation is necessary over, for instance, a simple material balance. The course refreshes the student in the basics of the diffusivity equation, beginning with single phase, 1-D coordinate systems. Analytical solutions to the diffusivity equation are discussed and assumptions are presented that allow the use of finite differences to be utilized to create a system of algebraic equations that can be solved by iterative procedures. We then discuss the solution methods, implicit, explicit and IMPES methods.

We discuss the conditions for stability and convergence and the applicability of each of these methods. We review briefly matrix solvers and establish the fundamental engine in all finite difference simulators.

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Oil and gas training specialists

After this we utilise the simulation software for a series of practical applications. We begin with a simple 1-D, single phase application for simple short term well tests. We then move on to more sophisticated problems such as the design of a hydraulic fracture, design and simulation of horizontal wells, and eventually multi-well simulation of pattern water injection models that require understanding the basics of two phase flow, gridding a pattern area, optimizing specific patterns based on reservoir properties and analysis of saturation fronts as water injection proceeds. These hands-on exercises are prefaced with the basics of multiphase flow in porous media by reviewing relative permeability, initialisation with drainage capillary pressure and variation of rock properties as expressed with the Leverett J-Function. We conclude with the concepts of history matching with field case histories and demonstration of full field modelling.

During the course we have modules that allow participants to perform practical simulation using RFD's tNavigator.

tNavigator@rfdyn.com

tNavigator®

Learning objectives

Learn or refresh the basic mathematics behind numerical simulation

Discuss the practical use of reservoir simulation

Learn the numerical methods to convert partial differential equations into simulation equations using finite differences

Learn to simulate simple single well models, with practical modules and hands on use of software, like:

- well tests
- hydraulic fracturing
- horizontal wells

Discuss the concepts of a successful history match in preparation for forecasting:

- infill wells
- water injection projects
- gas injection EOR

Fortify learning with case history studies of simulation projects

Demonstrate large projects with multi-million cell models and the current state of the art in speed efficiency for tNavigator

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RFD

Rock Flow Dynamics
 Integrated static and dynamic modeling from reservoir to surface

The course is designed for

Engineers with a good grasp of fundamental reservoir engineering principles. This could be a fresh graduate with limited exposure to simulation principles and applications or more experienced engineers that have had limited exposure to numerical simulation and would like to learn or refresh their knowledge base. Also for attendees with little or no experience in reservoir simulation to pick up the principles and run a modern reservoir simulator for very simple to more complex small models (i.e. single well to multi-well pattern models).

DAY 1	DAY 2	DAY 3	DAY 4	DAY 5
<p>Morning</p> <ul style="list-style-type: none"> Introduction to reservoir simulation Diffusivity equation and partial differential equations Analytical and numerical solutions to diffusivity equation Application of finite differences for system of algebraic equations Simulation of single well pressure transient test (1-D) <p>Afternoon</p> <ul style="list-style-type: none"> Pressure transient analysis Description of damage, geometric and mechanical skin Determination of reservoir permeability Discussion of boundary conditions Discussion of cylindrical and Cartesian coordinate systems *Simulation of single well pressure transient test (1-D) 	<p>Morning</p> <ul style="list-style-type: none"> Numerical solutions to 1-D diffusivity equation Implicit, explicit and IMPES solutions to diffusivity equation Flow chart for solution of implicit method Use of matrix solvers for solution of iterative equations Extension of 1-D simulation models to 2-D and 3-D Relative permeability, capillary pressure for oil-water and gas-oil systems <p>Afternoon</p> <ul style="list-style-type: none"> Principles of hydraulic fracturing Determination of fracture conductivity Use of fine grid blocks to simulate hydraulic fracture Fracture permeability and half-length *Simulation of hydraulic fracture in vertical well (2-D) 	<p>Morning</p> <ul style="list-style-type: none"> Horizontal well simulation Peaceman's equation and productivity index Inflow performance and calculation of well index Vertical permeability and determination net pay thickness Review of open-hole logging for determination of porosity and net pay <p>Afternoon</p> <ul style="list-style-type: none"> Horizontal wells and sensitivity of EUR to lateral length Gridding fundamentals for horizontal wells Principles of symmetry *Simulation of horizontal well in Cartesian coordinates 	<p>Morning</p> <ul style="list-style-type: none"> Multi-well principles in reservoir simulation Waterflood principles Pressure maintenance and secondary to primary ratio Patterns for water injection (5-spot, 9-spot...etc) <p>Afternoon</p> <ul style="list-style-type: none"> Gridding principles for injection wells Rate and pressure constraints for production and injection wells Optimization of patterns for maximum reserves *Simulation of water injection in patterns 	<p>Morning</p> <ul style="list-style-type: none"> Aquifers and water drive (peripheral and bottom water drive) Simulation of aquifers Initialization of aquifer models with capillary pressure History matching principles History matching average reservoir pressure and flowing BHP History matching GOR, WOR field-wide and for individual wells <p>Afternoon</p> <ul style="list-style-type: none"> Complex large-scale models Demonstration of field-wide models RFD's demo of speed of tNavigator

* Practical Reservoir Simulation exercises

Course schedule:- subject to modification to suit participant requirements

Course instructor: Professor Andrew Wadsley

Dr Andrew Wadsley has more than forty-two years' experience in the petroleum industry—starting as a wellsite petroleum engineer with Shell International in 1975—and has been a consultant petroleum engineer for thirty years. Dr Wadsley is a founder and engineering guru with EPGuru.com; he was Chief Technology Officer and founder of Stochastic Simulation Limited; Director and Principal of his own company, Exploration and Production Consultants (Australia) Pty Ltd which he founded in 1988;

adjunct Professor in Petroleum Engineering at the Curtin University of Technology; Chief Scientist for Paradigm Geophysical from 1999 to 2005; and Reservoir Engineering Expert on the Gorgon CO2 Sequestration Review Committee for Department of Industry and Resources, Western Australia. Dr Wadsley has been Umpire for resolution of a Gas Reserves Dispute, and has been called as an expert witness in cases ranging from reservoir engineering, the mercury content of natural gas, to gas production

operations. He is a member of the Society of Petroleum Engineers (SPE), the European Association of Geoscientists and Engineers (EAGE), and the Society for Industrial and Applied Mathematics (SIAM). He received a Bsc (Hons), University Medal in Mathematics from the Australian National University in 1970, an MSc from the University of Warwick (UK) in 1972, and a PhD from the University of Warwick (UK) in 1974.