



# AR2Tech

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## SHORT COURSE:

# Reservoir simulation for geomodeler

**Instructor:** Dr. Herve Gross, AR2Tech

**Date:** TBD

**Host:** Mining Engineering Department ([www.demin.ufrgs.br/lpm](http://www.demin.ufrgs.br/lpm))  
Federal University of Rio Grande do Sul Porto Alegre, Brasil

**Cost:** TBD

### **Abstract:**

This 4-day course covers fundamentals of reservoir simulation as a practical tool for reservoir performance forecasting and optimization. The goal of the class is to give geomodelers a clear understanding for how geological reservoir models are exploited with a simulator. The class will be hands-on, and theory will be kept to the essential (no prerequisites needed). Guided exercises with a simulator will be used to demonstrate concepts. The connection between geomodeling and simulation will be facilitated by the AR2GEMS platform using appropriate plug-ins.

# Class outline

## 1. Reservoir simulation overview

- a. What is reservoir simulation?
  - i. Before reservoir simulation (decline curve, mass balance simulators, numerical/empirical simulators)
  - ii. History of simulation and progress in the most detailed 3D forecasting methods,
  - iii. Different flavors of simulation (black-oil, compositional, streamlines) and simulators (Eclipse, VIP, CMG GEM, Intersect...).
- b. Why do we use simulators?
  - i. Green field forecasting (new field development),
  - ii. Brown field development (history-matching),
  - iii. Field Development Plan Optimization
- c. How does a simulator work?
  - i. Energy and mass balance principles
  - ii. Rock models, fluid models, rock-fluid interaction models.
  - iii. Sources and sinks: boundaries, wells, faults, thief zones
  - iv. Constraints, and operational limit
- d. Limitations of reservoir simulation
  - i. Modeling heterogeneities and the question of scale,
  - ii. Fluid flow assumptions and thermodynamic basics,
  - iii. Predictive power, trends and pinpoint information : manage expectations

## 2. Relationship between reservoir models and reservoir simulators

- a. Integration of static data:
  - i. The big question: what are the volumes in place? The quest for STOOIP.
  - ii. “Real” data: well logs, cores, seismic
  - iii. “Interpreted” data: porosity, permeability, saturations, relative permeability
- b. Integration of dynamic data:

- i. Well tests, production-logging, pressure decline: early production data sets
  - ii. Flow rates, tracer tests, geochemical fingerprinting: more mature production
  - iii. Well productivity index, well flow constraints, well models.
- c. Turning a geomodel into a simulation model:
  - i. Upscaling,
  - ii. Sectoring,
  - iii. Non-neighbor connections (faults, pinchouts)

### **3. Geomodeling with a purpose: a geomodelers' guide to working with simulation engineers**

- a. Meaningful geomodeling assumptions
  - i. Understand how the simulator sees the field,
  - ii. Realize that heterogeneities may be lost in scale changes,
  - iii. Offer various interpretations, not realizations.
- b. When assumptions do not suffice: how to keep geological uncertainty in the loop
  - i. Uncertainties require workflows: automate your field creation
  - ii. Think in terms of extremes: how low can it go, how high?
  - iii. Geological Scenario: create a portfolio of models, decimate with new data
- c. Big-loops and closed-loops: geological complexity and decision-making
  - i. Big loops: aiming for geological consistency
  - ii. Closed-loops: an optimization technique with control and calibration cycles
  - iii. Decision-making under uncertainty: project specific modeling

## Biography

Dr. Herve Gross is a reservoir engineer with experience in field development optimization, uncertainty quantification, and decision-making under uncertainty. He graduated from the Department of Petroleum Engineering (now Energy resources Engineering) at Stanford University (MS'03, PhD'06). He worked for Chevron (2006-2013) at the corporate headquarters where he offered consulting services to multiple business units, different types of field development projects, interfaced with research scientists, and contributed to several technical and economic studies. Dr. Herve Gross joined AR2Tech in 2013 to further expand the company's range of services and products. AR2Tech's goal is to offer a specific suite of

geomodeling services and solutions for field optimization, and to provide decision-makers with a complete and accurate picture of their resources development opportunities.