**Course:** ADVANCED GEOSTATISTICS & SEISMIC RESERVOIR CHARACTERIZATION  
**Instructor:** Prof. Dr. Amilcar Soares – IST Lisboa / E-mail: asoares@ist.utl.pt  
**Location:** Porto Alegre, Brazil  
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### CATALOG DESCRIPTION

This course aims at providing the most recent and advanced methodologies of geostatistical modeling to characterize complex reservoirs: forward modeling of facies and petrophysical properties constrained to seismic information and seismic inversion methods to characterize the internal properties of reservoirs. Students will learn how to manage the seismic and well data in order to build high resolution numerical models of reservoirs and to assess the attached spatial uncertainty. The course incorporates examples of several real case studies and one synthetic case study for practical classes.

### PREREQUISITES

Graduate standing. Appropriated for Geologists, Geophysicists and Petroleum Engineers”.

### COURSE OBJECTIVES

After completing this course, students will be able to:

- Understand the main theoretical basis of different methodologies to constrain the facies and petrophysical modeling of a reservoir to seismic data.
- Identify and correctly use the main tools to integrate seismic information and well data for reservoir modeling.
- Construct a 3D high resolution model of reservoir properties by using well data and seismic information.
- Quantify the spatial uncertainty and risky areas attached to the petrophysical properties of the reservoir.

### TOPICS COVERED

**Day 1 and 2**

- The Role of Geostatistics in Reservoir Modeling and Uncertainty Assessment  
- Building High Resolution Models  
  - Geological Spatial Continuity. Variograms: Modelling Spatial Continuity Patterns.  
  - Spatial Inference: Kriging.  
  - Spatial Inference of Extreme Values: Indicator and MultiGaussian Formalisms.  
  - Accounting for Secondary Information: co-kriging.

**Day 3 to 5**

- Characterization of Petrophysical Properties and Spatial Uncertainty Assessment  
  - Facies and PetrophysicalModelling: Stochastic Simulations.  
  - Simulation of Categorical Variables  
  - Uncertainty assessment of geometry of lithofacies: Block indicator simulation.  
- Constrained Petrophysical Models to Seismic Data: Forward Modeling  
  - Simulation of petrophysical properties with local means  
  - Joint simulation  
  - Block direct co-simulation of petrophysical properties and seismic.
- Geostatistical Methods for Seismic Inversion
  Direct Sequential Simulation and Co-simulation
  Global Seismic Inversion and Elastic Inversion

- Uncertainty Assessment of Petrophysical Properties.
  Students will do a project with a provided data set, covering all the topics of the course. They practice with a freeware software: geoMS (GeostatisticalModelling Software of IST), SGeMS (Stanford GeostatisticalModelling Software) and GSI toolbox for the seismic inversion.

**TEXTBOOK(S) AND/OR OTHER REQUIRED MATERIAL**

- Oxford University Press.
  Handouts of the course.

**THE COURSE WILL BE GIVEN IN PORTUGUESE OR IN ENGLISH**