



EC001: Geostatistics for Reservoir Modelling

Format and Duration

Self-Paced - 6 Hours

Summary

This course will introduce the practical principles and workflows that are needed to prepare for building subsurface models of petroleum reservoirs. Gathering, cleaning and analysing the data to be used alongside managing missing data and how to deal with sparse data situations will be discussed. The learner will be introduced to the variogram and be instructed on creation of both the horizontal and vertical variogram for use in geostatistical modelling. Kriging and conditional simulation are the interpolation and stochastic modelling and simulation methods used in geostatistics to estimate and predict values at unsampled locations. They are techniques that produce maps along lines, areas and volumes with a high degree of statistical rigour that emphasises the assessment of uncertainty. Both methods will be discussed in detail with reference to the variogram. Finally, the learner will gain an appreciation of how to summarise a geostatistical model and prepare for a dynamic simulation.

Learning Outcomes

Participants will learn to:

1. Develop an understanding of regionalised variables and the difference between classic statistics and Geostatistics.
2. Understand how to manage missing and sparse data when building inputs for a geostatistical model.
3. Learn about the definition, function and construction of a variogram and how these are used in geostatistics.
4. Learn about kriging and conditional simulation and appreciate how the variogram applies to these techniques.
5. Understand how to summarise geostatistical models and prepare a model for dynamic simulation.

Training Method

This is a self-paced e-learning course. Learning materials are structured into short sections, each including interactive text and image content, animations, video, and audio. An end of course quiz is scored to provide the learner with their learning progress. Approximately 6 hours learning time

Who Should Attend

This course is designed for geoscientists, petrophysicists and engineers involved in the development of reservoir models.

Course Content

Exploratory Data Analytics

This module will introduce basic statistics and the terminology used when statistically analysing data. The module will also describe how to apply univariate, bivariate, and multivariate statistics to clean data and

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discover data relationships. Finally, the learner will develop an understanding of how to identify and manage missing and sparse data when preparing datasets for geostatistical modelling.

Spatial Analysis Principles

This module will build an appreciation of the differences between classic statistics and geostatistics and discuss the theory and logic behind variograms. Variograms are the principal input into geostatistical interpolation and simulation and the key metric that distinguishes kriging and conditional simulation from other methods.

Spatial Modelling

This module will focus on constructing variograms for kriging and conditional simulation. The learner will develop an understanding of how to properly parametrise and how to avoid inducing a false 'nugget effect' as well as how to integrate horizontal, vertical, and nested variograms. Finally, common model types and practices used in the energy industry will be discussed.

Geostatistical Estimation Methods

This module will outline how kriging works, how it is different from other interpolation methods and why it is referred to as B.L.U.E (Best Linear Unbiased Estimate). The effect of the variogram and how to apply the variogram to kriging will be explored. Finally, the learner will develop knowledge and understanding of multivariate kriging, examples of how it could be used and how to apply the methodology when constructing Earth models.

Conditional Simulation Principles

This module will outline how simulation works in the context of several simulation methods, including Monte Carlo simulation and both conditional and unconditional simulation. The learner will gain an appreciation of how to prepare a model for dynamic simulation and how to process the results of a model with multiple realisations. Finally, the Earth modelling workflow for unconventional reservoirs will be explored.

Common Simulation Methods

This module will explore some common simulation methods, the difference between pixel- and object-based methods and the uses of both. The workflow behind collocated co-simulation to integrate multiple variables will also be discussed.