Methodology to Characterized Reservoir Using Seismic Constraints for a Stochastic Reservoir Model and Flow Fluid Simulation

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Proper reservoir characterization is essential for optimum hydrocarbon recovery. Reservoir architecture and rock quality are usually based on well and seismic information. Well information from logs, cores, side-wall samples, and cuttings provide a good vertical characterization of the reservoir, whereas seismic information extends this knowledge in lateral dimension. Geostatistical tools provide the link between the well and seismic data.

The first approach is to perform a calibration between seismic and well stratigraphy. Attribute calculation is done for each horizon; geostatistical techniques are applied to build a quantitative relationship between rock quality and attributes. This relation is then incorporated into a Gaussian Stochastic Model in order to characterize the reservoir and a flow fluid simulation is performed.

To establish a quantitative relationship between seismic attributes and rock quality properties, a cross validation using Kriging with external drift was applied. Pseudo-petrophysical property maps are generated for unit resulting from the combination of attributes. Each unit is correlated with different attributes stemming from vertical and lateral rock quality variation.

These relations are introduced into a non-stationary stochastic model and an improvement in the definition and distribution of sand bodies is obtained comparing the models with and without seismic constraints. Based on cross validation techniques, at least 20% improvement can be obtained. Also a history match runs are performed and a more accurate history match is obtained using seismic. This methodology indicates that seismic constraints are essential to establish a stochastic reservoir model and the flow fluid simulation to decrease reservoir uncertainty.