

Risk Reduction in Estimation of Petrophysical Properties from Seismic Data through Well Log Modeling, Seismic Modeling and Rock Properties Estimation

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Abstract

A methodology to reduce risk, when using seismic data, to estimate petrophysical properties associated to reservoir performance is presented. The methodology includes: well log reconstruction, seismic modeling and rock properties estimation from seismic data.

Well log modeling involves the reconstruction of P- and S- wave velocity and density logs through the use of porosity (f), shale volume (V_{sh}) and water saturations (S_w). After a satisfactory reconstruction, the petrophysical properties (f , V_{sh} and S_w) can be modified and P- and S-wave velocity and density pseudo-logs generated to emulate those that would have been recorded if the modified petrophysical property had occurred in the logged formations. These logs are used to compute rock properties related to incompressibility (Λ^*Rho) and rigidity (μ^*Rho), which can also be computed from seismic data.

Sensitivity and ambiguity analyses, at seismic resolution, of different reservoir conditions are done using the reconstructed P- and S-wave and density logs to compute pre-stack synthetic seismic data from which Λ^*Rho and μ^*Rho are estimated through AVO analysis and post-stack inversion.

Since elastic properties are obtained from both well log and seismic data, it is possible to quality control Λ^*Rho and μ^*Rho results at well locations with hard (log) data. The process provides seismic attributes related to petrophysical properties and an understanding of the limitations, sensitivity and ambiguities when using the technique to reduce risk in the determination of petrophysical properties from.

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