



Estimation of bias in conventional petrophysical inversion

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The aim of well log inversion is the estimation of rock parameters (composition, structural parameters etc.) The conventional inversion is based on maximum likelihood principle and the measurement noise is assumed to be additive centered Gaussian noise. For the derivation of statistical characteristics of estimated parameters (covariance matrix) the petrophysical equations are linearized.

The linearization may lead to biased parameter estimation. The bias depends on the higher derivatives of petrophysical forward equations that is on the local curvature of the multidimensional surface of possible solutions in the measurement space.

This study aims to examine the dependence of the bias values on the petrophysical models (water saturation models for shaly sand and tight gas reservoirs), parameters and noise level, using synthetic and real well logging data. In the simulations second order approximation is applied. As a result we defined the parameter range where the bias value is significant and therefore bias correction is necessary.