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Seismic Inversion Based on Simulate Annealing Algorithm

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Seismic Inversion methods have been routinely used to estimate subsurface properties such that acoustic impedance, elastic impedance, density, ratio of P-wave and S-wave velocity using seismic and well log data together. These properties are very important to understand subsurface lithology and fluid contents. The aim of the present study is to perform seismic inversion using Simulate Annealing approach. Simulate Annealing is a global optimization algorithm used to find global optima of a nonlinear problem in the presence of large numbers of local optima. In the present study, pre-stack seismic inversion based on Simulate annealing is performed for Penobscot Field, Canada. The algorithm is performed in three steps; first, the algorithm is tested on synthetically generated data over 7 layer earth model. The inverted and expected results points out good performance of the algorithm with very high correlation value (0.99). Thereafter, in the second step, one composite trace is extracted from the seismic data and inversion is performed. After getting satisfactory results, in the third step, entire seismic section is inverted and verities of attribute cubes are estimated. The inverted results shows very high resolution images of the subsurface compared with the seismic section. The correlation is estimated to be 0.82 and RMS error is 0.354 m/s*g/cc. The impedance variation is estimated to be 4000-10000 m/s*g/cc of the region. The inverted section shows smooth variation of the attributes from top to bottom and hence concluded that the area does not have any major prospective zone. Thereafter, these attributes are transformed into the lame parameters which include lambda-rho and mu-rho parameters. These lame parameters are more sensitive towards fluids and rock properties. The analysis of these sections also confirms the non-availability of prospective zone. These analysis is performed for one inline and hence this can be not deny that the other part of the area have some other interpretation.

Keywords: Global optimization, Simulate annealing, Seismic inversion, Reservoir characterization