A stochastic approach of Residual Move Out Analysis in seismic data processing

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Abstract

Analysis of the subsurface geology relies on the interpretation of seismic images. To obtain the seismic images in depth domain, an imaging tool called depth migration is used to convert wave field recorded in time domain to depth domain. Depth migration requests knowledge of an accurate velocity model. For each depth point different images can be computed for each source -receiver offset. For a correct velocity model the depth of a particular reflector point should be the same for all common offset images. Consequently, events presented on the depth versus offset panels should be flat. The non flatness (curvature) of events (residual move out) on these panels is due to the ratio between migration and medium velocity. These panels serve as a tool to verify the correctness and update the velocity model. Nowadays, this ratio is estimated by deterministic method for velocity model analysis and updating. But the noise presented in seismic data and the approximation of the physics are sources of uncertainty. The quantifying of this uncertainty, not currently considered, is a major issue that could help in the decisions that will have social and commercial implications. To address this requirement, we propose to exploit the redundancy (typical of seismic data) in the surface offset domain with a Bayesian approach to estimate the PDF of the residual move out parameter to asses corresponding uncertainty.

Keywords: Common-Image-Gathers, Velocity model, Residual Move Out, Markov Chain Monte Carlo, Uncertainty, Gaussian Process, Smoothing

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