

Application of Time-Frequency Transforms to Processing of Full Waveforms from Acoustic Logs

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Abstract

The paper deals with the application of time-frequency methods, Continuous Wavelet Transform (CWT) and Matching Pursuit algorithm (MP), to acoustic full waveform processing. The goal of the research is to present possible ways of application of these methods, particularly for the precise identification of selected acoustic waves, waveform decomposition into separate waves, and determination of zones of different elastic parameters in the geological profiles.

The simulations, developed methodology, and results of each method are discussed in detail. The Continuous Wavelet Transform is used to improve qualitative interpretation. Time-depth-frequency plots for a given frequency are constructed to distinguish the waves and identify gas-bearing zones. The Matching Pursuit has a better resolution in time-frequency space than CWT; thus, it is used to extract individual waves from the whole acoustic waveform, i.e., decompose the signal. For the extracted waves, the slowness is calculated. Results from MP methods are compared with their counterpart parameters obtained from the original waveforms. Additionally, time-frequency decompositions are used for the determination of the frequency content of each wave packet to get unique information about formation *in situ*.

Key words: acoustic full waveforms, time-frequency methods, Continuous Wavelet Transform, Matching Pursuit algorithm algorithm.