Beyond Conventional Seismic Resolution: Spectral Decomposition Methodology and Workflow, Case Histories from Oman and Arthit Projects.

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ABSTRACT

Spectral decomposition refers to any method that produces a continuous time-frequency analysis of a seismic trace yielding frequency and phase spectrum for each time sample. The technology provides an additional tool to the seismic interpreter and has been used for mapping temporal thickness, stratigraphic variation, and geologic discontinuities in three-dimensional seismic survey data.

Conventional seismic data are the Earth's response to a wavelet of a specific dominant frequency and best highlight beds at the corresponding tuning thickness. Spectral decomposition decomposes a seismic signal into its component frequencies and can, therefore, be used to better highlight beds of other thickness with different tuning frequencies. Amplitude spectrum variation is used to show thickness variations, whereas phase spectrum variations can identify reservoir discontinuities. Importantly, spectral decomposition can often resolve smaller features beyond the limits of resolution of conventional time domain seismic data.

The different spectral decomposition workflow of tuning cube and reconnaissance cube are discussed with examples from the Arthit and Oman projects. A color blending technique was used to combine the results of three separate component frequency attributes.