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Direct Hydrocarbon Indication Using Instantaneous Spectral Analysis

Instantaneous spectral analysis (ISA) is a continuous time-frequency analysis technique that provides a frequency spectrum for each time sample of a seismic trace. ISA achieves both excellent time and frequency localization utilizing wavelet transforms to avoid windowing problems that complicate conventional Fourier analysis. Applications of the method include enhanced resolution, improved visualization of stratigraphic features, thickness estimation for thin beds, noise suppression, improved spectral balancing and direct hydrocarbon indication. We have seen four distinct ways in which ISA can help in the detection of hydrocarbons: (1) anomalously high attenuation in thick or very unconsolidated gas reservoirs, (2) low frequency shadows in reservoirs where the thickness is not sufficient to result in significant attenuation, (3) preferential illumination at the tuning frequency which can be different for gas or brine-saturated rocks, and (4) frequency-dependent amplitude-variation-with offset (AVO).