 continued from page 23

Integrated Seismic Texture Segmentation and SOM Cluster Analysis for Channel Delineation

Malleswar Yenugu

In recent years, 3D volumetric attributes have gained wide acceptance by seismic interpreters. The early introduction of the single-trace complex trace attribute was quickly followed by seismic sequence attribute mapping workflows. Three-dimensional geometric attributes such as coherence and curvature are also widely used. Most of these attributes correspond to very simple, easy-to-understand measures of a waveform or surface morphology. However, not all geologic features can be so easily quantified. For this reason, simple statistical measures of the seismic waveform such as rms amplitude and texture analysis techniques prove to be quite valuable in delineating more chaotic stratigraphy.

I coupled structure-oriented texture analysis based on the gray-level co-occurrence matrix with self-organizing maps (SOM) clustering technology and applied it to classify seismic textures. By this way, I expect that this workflow should be more sensitive to lateral changes, rather than vertical changes, in reflectivity. I applied the methodology to a 3D seismic survey acquired over Osage County, Oklahoma, USA. The results indicate that this method can be used to delineate meandering channels as well as to characterize chert reservoirs. ■

Seismic Wavelet Phase Estimate

Jiangbo Yu

In this study we develop a seismic wavelet phase estimation procedure using a histogram matching technique that recovers the wavelet phase information from seismic data with the help of well logs. This method is compared with kurtosis phase estimation and optimum Wiener filter wavelet estimation methods. Limitations and assumptions of these three methods are discussed.

Histogram matching is a type of seismic wavelet estimation which extracts phase information based on the statistical properties of seismic data. Compared with other wavelet estimation methods – kurtosis phase estimation and optimum Wiener filter wavelet estimation, matching histogram can do the phase estimation without a super-Gaussian distribution assumption for reflectivity amplitude and won't be affected by timing relationship between seismic data and reflectivity from well log. The phase rotation is performed on the seismic deconvolution output in order to minimize the difference between the histogram of the amplitude of the reflection series from well logs and that of the seismic deconvolution output in a L2 sense. The phase rotation which renders the minimum misfit is considered as the phase of the wavelet. By doing this, no assumption is needed for the amplitude distribution of reflectivity series; non-minimum-phase wavelet can be extracted from seismic data.

Both synthetic seismic traces and real seismic traces are tested using those three methods. Histogram matching method could give phase estimation with error less than 20 degree even given with small amount of data, Gaussian distributed reflectivity and inaccurate timing relationship between well logs and seismic data. ■