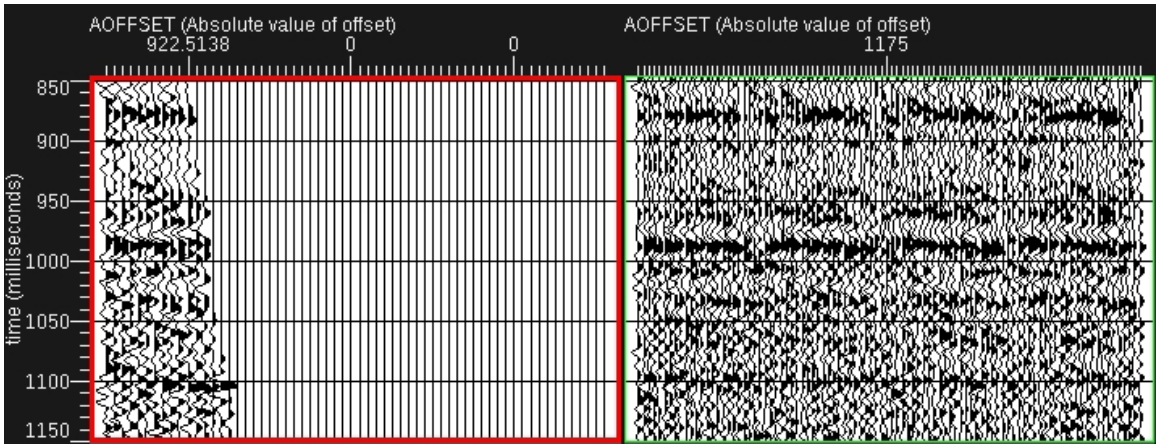
Arbitrarily sampled Fourier transform (ASFT) for 5D interpolation

John Guo, Ye Zheng, and Wenyuan Liao

ABSTRACT

Seismic trace interpolation, which spatially transforms irregularly sampled acquired data to regularly sampled data or to any desired grid in general, is an important step in seismic data processing. A class of algorithms, such as Minimum Weighted Norm Interpolation (MWNI), Anti-Leakage Fourier Transform (ALFT), and Matching Pursuit (MP), are based on the Fourier theory in the f-k domain by computing the estimated spatial frequency content of irregularly sampled data. However, a key limitation of current algorithms is that the spatial frequency content is always restricted to a regularized grid in the f-k domain, therefore, they cannot achieve the optimal sparsity in the f-k domain, and consequently this may reduce interpolation accuracy.

We present the Arbitrarily Sampled Fourier Transform (ASFT) method for 5D interpolation, which incorporates several enhancements. First, true positions of the input data are used for computation; second, the spatial frequency content is allowed to be at an arbitrary point in the f-k domain. As a result, ASFT is able to obtain better sparsity in the f-k domain. ASFT was tested on Western Canadian Sedimentary Basin data and produced excellent interpolation results.



Comparison of gather data before (left) and after 4-azimuth ASFT interpolation (right).