Bandlimited Design and Stacking of P-P and P-S Surveys

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ABSTRACT
It is common practice in seismic survey design to take fold as the number of traces with midpoints within each CDP bin. This corresponds to the way in which the fold of a stacked trace is normally computed in processing. Unfortunately, this method does not take into account any midpoint scatter within each bin. If we calculate the fold using a method that honours midpoint scatter, we obtain a more realistic display of reflector illumination. The different methods usually give similar results for P-P data, but vastly different results for P-S data. It is important to be aware of this difference when planning P-S survey geometry since it can avoid unnecessary expense or unneeded complexities in the survey design.

When we choose the bin size for a survey, we are actually making an assumption about the highest wavenumber that we believe could be present in the data, and preserved in processing. The bin width is the assumed spatial Nyquist sample interval. A sinc-function interpolator is designed to preserve all wavenumbers up to the assumed Nyquist. We use sinc-function spatial interpolators that are based on that assumption in wave equation processes such as DMO and migration, and we can also use the same assumption in a simple process like stack. Once we do so, midpoint scatter within each bin is properly taken into account during stack and fold calculations. Other interpolators like linear or Gaussian can give similar results at low wavenumbers, but can attenuate high wavenumbers.