AUTOMATIC STRETCH-FREE ZERO-OFFSET SEISMIC STACKED SECTION

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ABSTRACT

Velocity-independent seismic data processing requires information about the local slope in the data. From estimates of local time and space derivatives of the data, a total least squares algorithm gives an estimate of the local slope at each data point. Total least squares minimizes the orthogonal distance from the data points (the local time and space derivatives) to the fitted straight line defining the local slope. This gives a more consistent estimate of local slope than standard least squares, since it takes into account uncertainty in both the temporal and spatial derivatives.

The new slope estimation algorithm is applied to stacking along local slope. Starting at the largest offset, the estimated signal is accumulated until the smallest offset without using velocity information. Extrapolation to zero offset is done using a hyperbolic traveltime function where slope information replaces the knowledge of the NMO velocity. The new data processing method requires no velocity analysis or mute and there is no stretch effect. All major reflections and diffractions which are present at zero offset will be reproduced in the output zero-offset section. It therefore requires previous multiple removal if multiple reflections are undesired in the output.

In the case that the NMO velocities for the primary reflections are known, this can be used to produce a map of local slope. Stacking along these slopes produces a better estimate of the zero-offset primary reflections, again without stretch effect.

Synthetic and field seismic data examples demonstrate the effectiveness of the method. Comparison with standard seismic data processing, velocity analysis, mute, NMO correction and stack, shows that the new method is superior in complex data sets.