Study of Wide Angle Reflection Using Least Squares Methods

Lisapaly, Leonard, author

Abstrak

As mentioned before in the submitted proposal, the aim of this investigation is to study the wide angle reflection characteristic which has both advantage and disadvantage. The advantage we could obtain from such reflection angle is the stronger reflections (i.e S/N ratio) compared to the narrower angle reflections. This strong reflection makes the horizon identification becomes easier and its amplitudes might be used to study the rock properties using inversion technique. Its disadvantage comes from the fact that wide angle reflection involves what co-called chase distortion that affects the travel-time picking and also the amplitude measurement.

Some workers have studied the phase distortion effect and proposed some methods to overcome the problem. Choy and Richards [2] who studied seismograms produced by a caustic region found the similarities between event in the original seismograms and the Hilbert transformed seismograms. They observed that, for example, an sS-wave is a Hilbert transform pair of an SS-wave, which suggested a 90° phase distortion. To tackle the problem of obscure travel-time, they applied the matched filter to the distorted signal after Hilbert transforming the reference signal. This method, however, is limited to 913° phase distortion only.

The matched filter is a simple and straightforward method to estimate the amplitude ratio and differential travel-time of two different signals. However, it works well only when both signals have similar waveforms. When the phase distortion occurs, i.e. the original waveform is distorted, the matched filter fails to obtain an optimum amplitude and travel-time estimations. Pointer and Neuberg [8] introduced an iterative matched filter for analysing the effect of a phase distortion. First, the reference signal is phase distorted and used to find the amplitude ratio and travel-time by matched filter. The procedure is repeated ti changing the phase with a particular increment until they obtain the best cross-correlation value automatically revealing the amplitude ratio, the differential travel-time, and the phase distortion. However, the method is sensitive to the choice of the phase increment and in some cases it.