

Geophysical Exploration with Seismic Interferometry(3)-indoor model experiment

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In the Seismic Interferometry, the general relations between reflection and transmission response were derived by Claerbout(1968) about one-dimension, by Wapenaar(2003) about three-dimension. Using these relations, reflection seismic data can be reconstructed by cross-correlation of transmitted seismic data.

At present, reflection method is a common method for seismic subsurface imaging. In Seismic Interferometry, we use transmitted seismic data. We can image the subsurface structures by transmitted seismic data without controlled sources.

We have simulated acoustic wave by two-dimensional model, and confirmed that we can image subsurface structures with this technique under the acoustic wave propagation. This time, we applied this technique to the model experiment, in order to investigate the utility of this technique under the disturbance of S wave and surface wave.

The model size is 20cm in length, 20cm in width, and 15cm in height. The stratum boundary is two layer structure of a concave type. Gypsum is used in the upper layer and aluminum is used for the lower layer. We put 16 sources from 5cm to 25cm on the bottom of the model, observed with 31 receivers from 2.5cm to 27.5cm on the upper surface, and got transmitted seismic data

We took cross-correlation for the transmitted data, and got simulated shot gathers as many as receiver points. After that, we obtained subsurface imaging by the usual reflection method processing. As a result, the subsurface structure was confirmed in the migration section.

We applied Seismic Interferometry to the model experiment, and obtained the good subsurface image. We confirmed that this technique is useful in the existence of S wave, surface wave, and real data noise. We think that we can image the subsurface structures from real passive field data by Seismic Interferometry. This technique can be easily applied to other seismological events. In addition, such becomes easier as wide-ranging investigation, continuous monitoring lasting for a long term, investigation in city part, three-dimensional investigation, and so on. So the technique of Seismic Interferometry will become important in near future.