

Seismic interferometry for passive and controlled source data

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Seismic interferometry is the process of generating new seismic responses by cross-correlating seismic observations at different receiver locations. It has a wide range of applications for passive as well as for controlled source data.

One of the most intriguing aspects of passive seismic interferometry is the transformation of noise into signal. If one determines the cross-correlation of noise registrations of a diffuse wave field at two arbitrary points in space, one obtains the impulse response of the medium that would be measured if there were a source at one of the two points and a receiver at the other. It appears that this is true no matter how complex the medium is. This very simple principle has far-reaching consequences. To mention a few examples: in the field of ultrasonics, noise of thermal fluctuations in a specimen has been successfully turned into pulse-echo measurements of the specimen, in regional seismology recordings of ambient seismic noise have been used to reconstruct the crustal structure of southern California and in exploration seismology recordings of background noise in a desert area have been turned into seismic reflection measurements of the area. In the presentation I'll discuss the underlying principles in more detail and present various examples.

Controlled source interferometry has many promising applications in exploration. It has been pioneered by Schuster and Bakulin & Calvert. In the presentation I'll discuss its possibilities and limitations and indicate new directions, both for seismic and CSEM exploration.