

## Seismic interferometry and beyond

Kees Wapenaar

The past decade has seen the conception and development of the field of seismic interferometry, which enables the creation of virtual seismic sources at positions where there are only receivers. Methodologies have been developed for controlled-source data as well as for passive measurements, such as ambient noise. Of course no new information is generated by seismic interferometry, but information hidden in noise or in a complex scattering coda, is reorganized into easy interpretable responses that can be further processed by standard tomographic inversion or reflection imaging methodologies. The main strength is that this “information unraveling” neither requires knowledge of the subsurface medium parameters nor of the positions or timing of the actual sources. Moreover, the processing consists of simple crosscorrelations and is almost entirely data-driven. In the first part of the presentation I will review Green’s function representations as a basis for the theory of seismic interferometry

In all interferometric applications studied thus far, receivers are needed at the positions where virtual sources are created. Recently, we have shown that it is possible to create the response to a virtual source inside the Earth, without needing a receiver at the position of the virtual source. This new methodology, which can be called “beyond seismic interferometry”, requires the reflection response at the surface and an estimate of the direct arrivals between the virtual source and the acquisition surface. A novel iterative scheme retrieves the full response to this virtual source (the Green’s function), which consists of the direct wave and all multiple reflections. In the second part of the presentation I will discuss new Green’s function representations, underlying this methodology, and indicate the exciting applications in seismic imaging and monitoring.

### References

Wapenaar, K., and Fokkema, J., 2006, Green's function representations for seismic interferometry: *Geophysics*, Vol. 71, SI33-SI46.

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