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ANALYSIS OF AMBIENT VIBRATIONS USING A MAXIMUM LIKELIHOOD METHOD

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The analysis of ambient vibrations represents a valuable tool in seismic microzonation, engineering seismology, and other fields. An extensively used approach for the study of ambient vibrations is the use of array processing techniques.

In the last years, we have developed a technique for the analysis of the seismic wavefield overcoming certain limitations of existing array processing methods (Maranò et al., 2012).

- We developed an implementation of a Maximum Likelihood (ML) estimator for the analysis of Love and Rayleigh waves.
- In the proposed technique all the measurements are considered in the same framework, that is, the three translational components are processed jointly. In addition, measurements from rotational sensors may also be included, as shown in Maranò & Fäh (2014).
- The technique allows to model the simultaneous presence of multiple waves, both Love and Rayleigh. This enables us to separate the contribution of Love and Rayleigh waves as well as fundamental and higher modes.
- Notably, the method allows the retrieval of Rayleigh wave ellipticity including the retrograde vs. prograde behavior of the particle motion. One benefit of such information is an accurate detection of the singularities of the ellipticity curve, which is related to peaks and zeros of the H/V ratio. This additional information also helps to identify the mode number constraining the inversion.
- In the ML estimation framework we also explained the occurrence of estimation errors and develop a criterion for array design (Maranò et al., 2014)

We assess the performance of our method on SESAME synthetic models (Bard et al. 2008) and on data from real array measurements. We show result of the retrieval of Rayleigh and Love wave dispersion curves. We also show examples of the retrieval of Rayleigh wave ellipticity and compare with H/V spectral ratios.

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