Interferometric reconstruction of plate waves from cross correlation of a diffuse field on a thin aluminum plate

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This study contributes to evaluating the robustness and accuracy of Green's function (GF) reconstruction by cross-correlation of noise, disentangling the respective roles of ballistic and reverberated ("coda") signals. We conduct a suite of experiments on a highly reverberating thin aluminum plate, where we generate an approximately diffuse flexural wave field. We validate ambient-noise theory by comparing cross correlation to the directly measured Green's function. We develop analytically a theoretical model, predicting the dependence of the symmetry of the cross correlations on the number of sources and signal-to-noise ratio. We validate this model against experimental results. We next study the effects of cross-correlating our data over time windows of variable length, possibly very short, and taken at different points in the coda of recordings. We find that, even so, a relatively dense/uniform source distribution could result in a good estimate of the GF; we demonstrate that this window does not have to include the direct-arrival signal for the estimated GF to be a good approximation of the exact one. Afterwards, we explicitly study the role of non-deterministic noise on cross correlations and establish a model which confirms that the relative effect of noise is stronger when the late coda is cross-correlated.