Imaging in random media and kinetic models

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Abstract

Consider the imaging of inclusions buried in heterogeneous media (modeled as random media) from wave field measurements. For strongly disordered random media, classical imaging techniques based on the back-propagation of coherent wave fields are bound to fail when the random media are not known explicitly. Our only hope then rests on our finding a macroscopic model for the random clutter.

I will argue that kinetic equations offer the simplest models to quantify available observables of wave propagation in such random media, namely, wave energy densities and field-field correlations. Moreover, these observables are asymptotically statistically stable quantities, i.e. do not depend on the realization of the random medium. Buried inclusions then become constitutive parameters in the kinetic equations and their imaging becomes a deterministic inverse transport problem.

I will consider several kinetic-based imaging scenarios depending on available measurements (wave energy measurements or field-field correlation measurements). Their theoretical imaging capabilities will be compared for small-volume inclusions. I will present some reconstructions based on numerical simulations as well as on experimental measurements.