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# Validity of radiative transfer approximations in bounded random media

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## Abstract

This presentation focuses on the propagation of waves in a randomly-fluctuating heterogeneous medium. In general, the solution of such an equation in a given position displays two phases: (i) a coherent wave, somewhat similar to a wave propagating in a homogeneous medium, and (ii) an incoherent wave, seemingly more random. In some very heterogeneous media, like concrete, granular media or the Earth, that second phase of the solution is the most prominent, and the coherent wave almost vanishes. The amplitude of the solution can then be represented by a radiative transfer equation, obtained through an asymptotic expansion assuming random fluctuations of the properties in the appropriate regime. The RTE only models the amplitude of the solution, not its phase, but has the advantage of homogenizing all the rapid fluctuations of the properties and solution. It is similar in that respect with diffusion models, that are more widely used in the wave physics literature, but has the enormous advantage of being capable of modeling both the coherent and incoherent waves, while diffusion models can only account for the coda. This presentation reports a series of numerical experiments comparing solutions of the 3D acoustic wave equation in a heterogeneous medium and of the radiative transfer equations. Parameters of the two equations are chosen such that the radiative transfer solution is expected to provide an accurate approximation of the energy of the wave in the weak scattering regime. The comparisons indicate that the radiative transfer provides accurate approximations even quite far from that regime. A particular attention is devoted to analyzing the results close to boundaries, where the accuracy of the radiative transfer equation has not been evaluated before.

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