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Comparisons between multiple scattering methods and time-domain numerical simulations for elastic waves

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Propagation of elastic waves in heterogeneous medium composed of scatterers embedded in a homogeneous matrix is considered. Both matrix and scatterers are isotropic elastic media. The multiple scattering regime is assumed, and the focus is put on the coherent field obtained by averaging several equivalent realizations of disorder. Classical methods, such as Independent Scattering Approximation, Foldy or Waterman-Truell's model, provide expressions of the complex effective wavenumber of the coherent field, leading to an effective phase velocity and effective damping factor. Two-dimensional time-domain numerical simulations are performed for studying the validity of these analytical or semi-analytical methods. To reduce spurious effects, such as numerical diffraction, to a negligible level, a high-order numerical scheme and an immersed interface method are used together. Comparisons between theoretical and numerical values of the effective phase velocity and damping factor are proposed and analyzed in terms of the frequency, the scatterer density, and the propagation length.