Wave scattering by many small particles and creating materials with desired refraction coefficients

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Abstract

Many-body wave scattering problems are solved asymptotically, as the characteristic size a of the particles tends to zero and the number of the particles tends to infinity. Acoustic and electromagnetic (EM) wave scattering by many small particles is studied. Quantum-mechanical scattering by many potentials with small non-intersecting supports is also discussed.

New homogenization technique is developed. No assumptions concerning periodicity of the particles' distribution, self-adjointness of the operators involved and discreteness of their spectra are made.

A recipe for creating materials with a desired refraction coefficient is given on the basis of this theory. The new material is created by embedding many small impedance particles into a given material.

As an example, creating material with negative refraction and materials with a desired wave-focusing properties is considered. For example, one can create a material which scatters plane wave mostly in a fixed given solid angle.

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