Wave scattering by many small particles, creating materials with a desired refraction coefficient and other applications

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Abstract

The theory of wave scattering by many small impedance particles of arbitrary shapes is developed. The basic assumptions are: $a \ll d \ll \lambda$, where a is the characteristic size of particles, d is the smallest distance between the neighboring particles, λ is the wavelength.

This theory allows one to give *a recipe for creating materials with a desired refraction coefficient.*

One can create material with negative refraction: the group velocity in this material is directed opposite to the phase velocity.

One can create a material with a desired *wave focusing property.*

Quantum-mechanical scattering by many potentials with small supports is considered.

Equation is derived for the EM field in the medium in which many small impedance particles are embedded.

Similar results are obtained in [6] for heat transfer in the media in which many small particles are distributed.

The theory presented in this talk is developed in the author's monographs [1], [7], [9], [12] and in papers [2]–[6], [8], [10], [11].

Practical realizations of this theory are discussed in [9].

In [9] the problem of creating material with a desired refraction coefficient is discussed in the case when the material is located inside a bounded closed connected surface on which the Dirichlet boundary condition is imposed.

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