

Acoustic and electromagnetic wave scattering by many small particles and creating materials with desired properties

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Abstract

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Many-body scattering problem is solved asymptotically when the size of the particles tends to zero and the number of the particles tends to infinity.

A method is given for calculation of the number of small particles and their boundary impedances such that embedding of these particles in a bounded domain, filled with known material, results in creating a new material with a desired refraction coefficient.

The new material may be created so that it has negative refraction, that is, the group velocity in this material is directed opposite to the phase velocity.

Another possible application consists of creating the new material with some desired wave-focusing properties. For example, one can create a new material which scatters plane wave mostly in a fixed given solid angle. In this application it is assumed that the incident plane wave has a fixed frequency and a fixed incident direction.

An inverse scattering problem with scattering data given at a fixed wave number and at a fixed incident direction is formulated and solved.

Many-body scattering problem is considered for electromagnetic (EM) wave scattering under various assumptions concerning small scatterers.

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²key words: wave scattering by small particles; wave-focusing; negative refraction; many-body scattering.

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