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EM wave scattering by one and many small impedance particles of arbitrary shape and applications

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Many-body electromagnetic (EM) wave scattering problems are solved asymptotically, as the size of particles tends to zero and the number of these particles tends to infinity. Electromagnetic wave scattering by many small impedance particles of an arbitrary shape is studied. This theory allows one to give a recipe for creating materials with a desired refraction coefficient. One can create material with negative refraction, that is, the group velocity in this material is directed opposite to the phase velocity. One can create a material with a desired permeability. The theory presented in this talk is developed in the monograph. Numerical results are available in the papers. Papers deal with wave scattering by many small particles. Monograph deals with inverse problems. In particular, the problem of finding the location of small subsurface inhomogeneities from the scattering data measured on the surface is studied. In monograph analytical formulas for the polarization tensor for bodies of arbitrary shapes are derived.

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Nanophotonics of optical fibres

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Nanoscale effects in photonic structures fabricated from pure optical fibres are reviewed. In contrast to those in plasmonics, these structures do not contain metal particles, wires, or films with nanoscale dimensions. Nevertheless, a nanoscale perturbation of the fibre radius can significantly alter their performance. I consider slow propagation of whispering gallery modes along the fibre surface. The axial propagation of these modes is so slow that they can be governed by extremely small nanoscale changes of the optical fibre radius. The described phenomenon is exploited in SNAP (Surface Nanoscale Axial Photonics), a new platform for fabrication of miniature super-low-loss photonic integrated circuits with unprecedented sub-angstrom precision. The SNAP theory and applications are reviewed.

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