1. Record Nr. UNINA9910453391503321

Autore	Ramm A. G (Alexander G.)
Titolo	Scattering of acoustic and electromagnetic waves by small impedance bodies of arbitrary shapes : applications to creating new engineered materials / / Alexander G. Ramm
Pubbl/distr/stampa	New York, New York : , : Momentum Press, , [2013] ©2013
ISBN	1-60650-622-6
Descrizione fisica	1 online resource (262 p.)
Disciplina	531.1133
Soggetti	Wave-motion, Theory of Electronic books.
Lingua di pubblicazione	Inglese
Formato	Materiale a stampa
Livello bibliografico	Monografia
Note generali	Bibliographic Level Mode of Issuance: Monograph
Nota di bibliografia	Includes bibliographical references and index.
Nota di contenuto	Contents -- Preface -- Introduction -- 1. Scalar wave scattering by one small body of an arbitrary shape -- 1.1 Impedance bodies -- 1.2 Acoustically soft bodies (the Dirichlet boundary condition) -- 1.3 Acoustically hard bodies (the Neumann boundary condition) -- 1.4 The interface (transmission) boundary condition -- 1.5 Summary of the results -- 2. Scalar wave scattering by many small bodies of an arbitrary shape -- 2.1 Impedance bodies -- 2.2 The Dirichlet boundary condition -- 2.3 The Neumann boundary condition -- 2.4 The transmission boundary condition -- 2.5 Wave scattering in an inhomogeneous medium -- 2.6 Summary of the results -- 3. Creating materials with a desired refraction coefficient -- 3.1 Scalar wave scattering. Formula for the refraction coefficient -- 3.2 A recipe for creating materials with a desired refraction coefficient -- 3.3 A discussion of the practical implementation of the recipe -- 3.4 Summary of the results -- 4. Wave-focusing materials -- 4.1 What is a wave-focusing material? -- 4.2 Creating wave-focusing materials -- 4.3 Computational aspects of the problem -- 4.4 Open problems -- 4.5 Summary of the results -- 5. Electromagnetic wave scattering by a single small body of an arbitrary shape -- 5.1 The impedance boundary condition -- 5.2

Perfectly conducting bodies -- 5.3 Formulas for the scattered field in the case of EM wave scattering by one impedance small body of an arbitrary shape -- 5.4 Summary of the results --
6. Many-body scattering problem in the case of small scatterers -- 6.1 Reduction of the problem to linear algebraic system -- 6.2 Derivation of the integral equation for the effective field -- 6.3 Summary of the results --
7. Creating materials with a desired refraction coefficient -- 7.1 A formula for the refraction coefficient -- 7.2 Formula for the magnetic permeability -- 7.3 Summary of the results --
8. Electromagnetic wave scattering by many nanowires -- 8.1 Statement of the problem -- 8.2 Asymptotic solution of the problem -- 8.3 Many-body scattering problem equation for the effective field -- 8.4 Physical properties of the limiting medium -- 8.5 Summary of the results --
9. Heat transfer in a medium in which many small bodies are embedded -- 9.1 Introduction -- 9.2 Derivation of the equation for the limiting temperature -- 9.3 Various results -- 9.4 Summary of the results --
10. Quantum-mechanical wave scattering by many potentials with small support -- 10.1 Problem formulation -- 10.2 Proofs -- 10.3 Summary of the results --
11. Some results from the potential theory -- 11.1 Potentials of the simple and double layers -- 11.2 Replacement of the surface potentials -- 11.3 Asymptotic behavior of the solution to the Helmholtz equation under the impedance boundary condition -- 11.4 Some properties of the electrical capacitance -- 11.5 Summary of the results --
12. Collocation method -- 12.1 Convergence of the collocation method -- 12.2 Collocation method and homogenization -- 12.3 Summary of the results --
13. Some inverse problems related to small scatterers -- 13.1 Finding the position and size of a small body from the scattering data -- 13.2 Finding small subsurface inhomogeneities -- 13.3 Inverse radio measurements problem -- 13.4 Summary of the results --
Appendix -- A1. Banach and Hilbert spaces -- A2. A result from perturbation theory -- A3. The Fredholm alternative -- Bibliographical notes -- Bibliography -- Index.

Sommario/riassunto

In this book, mathematicians, engineers, physicists, and materials scientists will learn how to create material with a desired refraction coefficient. For example, how to create material with negative refraction or with desired wave-focusing properties. The methods for creating these materials are based on the many-body wave scattering theory developed by the author. The book offers new analytical formulas that allow one to calculate acoustic and electromagnetic waves, scattered by one and many small impedance bodies of an arbitrary shape under various boundary conditions. Equations for the effective (self-consistent) field in media consisting of many small impedance particles are derived. Numerical methods for solving many-body wave scattering problems are developed for small impedance scatterers.