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Nota di contenuto

Part I Wave propagation in periodic and structured media -- Periodic structures and the plane wave expansion method -- Introduction to multiple scattering theory for scalar waves -- Sound wave propagation in sonic crystals -- The transfer matrix method to model one-dimensional phononic crystals and metamaterials -- Part II Wave propagation in absorbing metamaterials and porous media -- Acoustic metamaterial absorbers -- Acoustic wave propagation in viscothermal fluids -- Nonlocal dynamic homogenization of uid-saturated metamaterials -- Numerical methods for modelling and simulation porous materials -- Part III Industrial applications of porous media and acoustic metamaterials -- Industrial applications I: A general Perspective -- Industrial Applications II: Building industry -- Industrial Applications III: Automotive industry -- Industrial Applications IV: Aeronautics industry.

Sommario/riassunto

This book delivers a comprehensive and up-to-date treatment of practical applications of metamaterials, structured media, and conventional porous materials. With increasing levels of urbanization, a growing demand for motorized transport, and inefficient urban planning, environmental noise exposure is rapidly becoming a pressing societal and health concern. Phononic and sonic crystals, acoustic metamaterials, and metasurfaces can revolutionize noise and vibration control and, in many cases, replace traditional porous materials for these applications. In this collection of contributed chapters, a group of international researchers reviews the essentials of acoustic wave propagation in metamaterials and porous absorbers with viscothermal losses, as well as the most recent advances in the design of acoustic metamaterial absorbers. The book features a detailed theoretical introduction describing commonly used modelling techniques such as plane wave expansion, multiple scattering theory, and the transfer matrix method. The following chapters give a detailed consideration of acoustic wave propagation in viscothermal fluids and porous media, and the extension of this theory to non-local models for fluid saturated metamaterials, along with a description of the relevant numerical methods. Finally, the book reviews a range of practical industrial applications, making it especially attractive as a white book targeted at the building, automotive, and aeronautic industries.