

J.L. Davis

Wave Propagation in Solids and Fluids



Springer-Verlag

Wave Propagation In Solids And Fluids

Lee Davison



Wave Propagation In Solids And Fluids:

Wave Propagation in Solids and Fluids Julian L. Davis, 1988-09-12 The purpose of this volume is to present a clear and systematic account of the mathematical methods of wave phenomena in solids gases and water that will be readily accessible to physicists and engineers The emphasis is on developing the necessary mathematical techniques and on showing how these mathematical concepts can be effective in unifying the physics of wave propagation in a variety of physical settings sound and shock waves in gases water waves and stress waves in solids Nonlinear effects and asymptotic phenomena will be discussed Wave propagation in continuous media solid liquid or gas has as its foundation the three basic conservation laws of physics conservation of mass momentum and energy which will be described in various sections of the book in their proper physical setting These conservation laws are expressed either in the Lagrangian or the Eulerian representation depending on whether the boundaries are relatively fixed or moving In any case these laws of physics allow us to derive the field equations which are expressed as systems of partial differential equations For wave propagation phenomena these equations are said to be hyperbolic and in general nonlinear in the sense of being quasi linear We therefore attempt to determine the properties of a system of quasi linear hyperbolic partial differential equations which will allow us to calculate the displacement velocity fields etc

Stability and Wave Propagation in Fluids and Solids Giovanni P. Galdi, 2014-10-08 The content of the volume is constituted by four articles The first concerns the theory of propagation of plane waves in elastic media The second treats theoretically the linear weakly non linear and non linear stability of flows of a viscous incompressible fluid in a diverging channel The third lecture investigates the mathematical properties of the equations governing the motion of a viscous incompressible second grade fluid such as existence uniqueness of classical solutions and stability of steady state flows The last lecture provides some basic results on wave propagation in continuum models The objective of this book is to emphasize and to compare the various aspects of interest which include the necessary mathematical background constitutive theories for material of differential type polarized and shock waves and second sound in solids at low temperatures

Fundamentals of Shock Wave Propagation in Solids Lee Davison, 2008-04-24 My intent in writing this book is to present an introduction to the thermo mechanical theory required to conduct research and pursue applications of shock physics in solid materials Emphasis is on the range of moderate compression that can be produced by high velocity impact or detonation of chemical explosives and in which elastoplastic responses are observed and simple equations of state are applicable In the interest of simplicity the presentation is restricted to plane waves producing uniaxial deformation Although applications often involve complex multidimensional deformation fields it is necessary to begin with the simpler case This is also the most important case because it is the usual setting of experimental research The presentation is also restricted to theories of material response that are simple enough to permit illustrative problems to be solved with minimal recourse to numerical analysis The discussions are set in the context of established continuum mechanical principles I have endeavored to define the quantities

encountered with some care and to provide equations in several convenient forms and in a way that lends itself to easy reference Thermodynamic analysis plays an important role in continuum mechanics and I have included a presentation of aspects of this subject that are particularly relevant to shock physics The notation adopted is that conventional in expositions of modern continuum mechanics insofar as possible and variables are explained as they are encountered Those experienced in shock physics may find some of the notation unconventional

Wave Propagation in Electromagnetic Media Julian L. Davis, 2012-12-06 This is the second work of a set of two volumes on the phenomena of wave propagation in nonreacting and reacting media The first entitled *Wave Propagation in Solids and Fluids* published by Springer Verlag in 1988 deals with wave phenomena in nonreacting media solids and fluids This book is concerned with wave propagation in reacting media specifically in electro magnetic materials Since these volumes were designed to be relatively self contained we have taken the liberty of adapting some of the pertinent material especially in the theory of hyperbolic partial differential equations concerned with electromagnetic wave propagation variational methods and Hamilton Jacobi theory to the phenomena of electromagnetic waves The purpose of this volume is similar to that of the first except that here we are dealing with electromagnetic waves We attempt to present a clear and systematic account of the mathematical methods of wave phenomena in electromagnetic materials that will be readily accessible to physicists and engineers The emphasis is on developing the necessary mathematical techniques and on showing how these methods of mathematical physics can be effective in unifying the physics of wave propagation in electromagnetic media Chapter 1 presents the theory of time varying electromagnetic fields which involves a discussion of Faraday s laws Maxwell s equations and their applications to electromagnetic wave propagation under a variety of conditions

Introduction to Wave Propagation in Nonlinear Fluids and Solids Douglas S. Drumheller, 1998-02-13 Waves occur widely in nature and have innumerable commercial uses Waves are responsible for the sound of speech meteors igniting the atmosphere radio and television broadcasting medical diagnosis using ultrasound This book provides a thorough modern introduction to the study of linear and nonlinear waves Beginning with fundamental concepts of motion the book goes on to discuss linear and nonlinear mechanical waves thermodynamics and constitutive models for a variety of gases liquids and solids Among the important areas of research and application are impact analysis shock wave research explosive detonation nonlinear acoustics and hypersonic aerodynamics Students at an advanced undergraduate graduate level will find this text a clear and comprehensive introduction to the study of nonlinear wave phenomena and it will also be valuable as a professional reference in engineering and applied physics

Inhomogeneous Waves In Solids And Fluids Giacomo Caviglia, Angelo Morro, 1992-10-09 The book may be viewed as an introduction to time harmonic waves in dissipative bodies notably viscoelastic solids and fluids The inhomogeneity of the waves which is due to the fact that planes of constant phase are not parallel to planes of constant amplitude is shown to be strictly related to the dissipativity of the medium A preliminary analysis is performed on the propagation of inhomogeneous

waves in unbounded media and of reflection and refraction at plane interfaces Then emphasis is given to those features that are of significance for applications In essence they regard surface waves scattering by curved obstacles wave propagation in layered heterogeneous media and ray methods The pertinent mathematical techniques are discussed so as to make the book reasonably self contained

Mathematics of Wave Propagation Julian L. Davis, 2000-05-07 Earthquakes a plucked string ocean waves crashing on the beach the sound waves that allow us to recognize known voices Waves are everywhere and the propagation and classical properties of these apparently disparate phenomena can be described by the same mathematical methods variational calculus characteristics theory and caustics Taking a medium by medium approach Julian Davis explains the mathematics needed to understand wave propagation in inviscid and viscous fluids elastic solids viscoelastic solids and thermoelastic media including hyperbolic partial differential equations and characteristics theory which makes possible geometric solutions to nonlinear wave problems The result is a clear and unified treatment of wave propagation that makes a diverse body of mathematics accessible to engineers physicists and applied mathematicians engaged in research on elasticity aerodynamics and fluid mechanics This book will particularly appeal to those working across specializations and those who seek the truly interdisciplinary understanding necessary to fully grasp waves and their behavior By proceeding from concrete phenomena e g the Doppler effect the motion of sinusoidal waves energy dissipation in viscous fluids thermal stress rather than abstract mathematical principles Davis also creates a one stop reference that will be prized by students of continuum mechanics and by mathematicians needing information on the physics of waves

Waves in Fluids and Solids Ruben Picó Vila, 2011-09-22 Acoustics is an discipline that deals with many types of fields wave phenomena Originally the field of Acoustics was consecrated to the sound that is the study of small pressure waves in air detected by the human ear The scope of this field of physics has been extended to higher and lower frequencies and to higher intensity levels Moreover structural vibrations are also included in acoustics as a wave phenomena produced by elastic waves This book is focused on acoustic waves in fluid media and elastic perturbations in heterogeneous media Many different systems are analyzed in this book like layered media solitons piezoelectric substrates crystalline systems granular materials interface waves phononic crystals acoustic levitation and soft media Numerical methods are also presented as a fourth order Runge Kutta method and an inverse scattering method

Wave Propagation in Elastic Solids Hugh Joseph McBride, Clyde Scandrett, Van Emden Henson, 1992

Wave Propagation in Elastic Solids Jan Achenbach, 2012-12-02 The propagation of mechanical disturbances in solids is of interest in many branches of the physical sciences and engineering This book aims to present an account of the theory of wave propagation in elastic solids The material is arranged to present an exposition of the basic concepts of mechanical wave propagation within a one dimensional setting and a discussion of formal aspects of elastodynamic theory in three dimensions followed by chapters expounding on typical wave propagation phenomena such as radiation reflection refraction propagation in waveguides and diffraction The treatment necessarily involves considerable mathematical analysis

The pertinent mathematical techniques are however discussed at some length

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