Mechanics Of Continua And Wave Dynamics Springer

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Mechanics Of Continua And Wave Dynamics Springer *2020-10-17*

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Waves and Rays in Elastic Continua Springer Science & Business Media
The present book — which is the third, significantly revised edition of the textbook originally published by Elsevier Science — emphasizes the interdependence of mathematical formulation and physical meaning in the description of seismic phenomena. Herein, we use aspects of continuum mechanics, wave theory and ray theory to explain phenomena resulting from the propagation of seismic waves. The book is divided into three main sections: Elastic Continua, Waves and Rays and Variational Formulation of Rays. There is also a fourth part, which consists of appendices. In Elastic Continua, we use continuum mechanics to describe the material through which seismic waves propagate, and to formulate a system of equations to study the behaviour of such a material. In Waves and Rays, we use these equations to identify the types of body waves propagating in elastic continua as well as to express their velocities and displacements in terms of the properties of these continua. To solve the equations of motion in anisotropic inhomogeneous continua, we invoke the concept of a ray. In Variational Formulation of Rays, we show that, in elastic continua, a ray is tantamount to a trajectory along which a seismic signal propagates in accordance with the variational principle of stationary traveltime. Consequently, many seismic problems in elastic continua can be conveniently formulated and solved using the calculus of variations. In the Appendices, we describe two mathematical concepts that are used in the book; namely, homogeneity of a function and Legendre's transformation. This section also contains a list of symbols. Request Inspection Copy
Wave Dynamics of Generalized Continua Springer Science & Business Media
A classic in the field, this book meets the demands of courses that establish groundwork in hydrodynamics, gas dynamics, plasticity and elasticity, and it provides typical continua problems for nonspecialists. The author addresses the major aspects of continuum studies: geometrical foundations, state of stress, instantaneous motion, fundamental laws, perfect fluids, viscous fluids, visco-plastic and perfectly plastic materials, hypoelastic materials, finite strain, and elastic and hyperelastic materials. The text’s broad converge and numerous applications include more than 160 problems and examples, and the only prerequisites are first- and second-year college calculus. 1961 ed.
The Wave Finite Element Method Elsevier
The book reviews recent research activities in applied mechanics and applied mathematics such as the fields of solid & fluid constitutive modeling for coupled fields, applications of geophysical & environmental context in judicious numerical-computational implementations. The book aims to merge foundation aspects of continuum mechanics with modern technological applications, notably on reviewing recent advances in the treated subjects in an attractive presentation accessible to a wide readership of engineering and applied sciences. Contents:Waves:Lamb Waves in Phononic Band Gap Structures (T T Wu)On Generalization of the Phase Relations in the Method of Reverberation-Ray Matrix (W Q Chen)Surface-Wave Nonlinearity Measured with Emat for Fatigued Steels (M Hirao)Acoustoelastic Lamb Waves and Implications for Structural Health Monitoring (J E Michaels)Source Synthesis for Inverse Problems in Wave Propagation (W W Symes)Numerical Mathematics/Time Series Analysis:An Introduction to an Adaptive Data Analysis Method (N E Huang)Computational Fluid Dynamics Based on the Unified Coordinates — A Brief Review (W H Hui)Towards Green's Function Retrieval from Imperfectly Partitioned Ambient Wave Fields: Travel Times, Attenuations, Specific Intensities, and Scattering (R L Weaver)Study on Two Scale Design Optimization for Structure and Material with Periodic Microstructure (G D Cheng)Continuum Mechanical Theories:A Continuum Formulation of Lava Flows — From Fluid Ejection to Solid Deposition (K Hutter)Rigorous Mechanics and Elegant Mathematics on the Formulation of Constitutive Laws for Complex Materials: An Example from Biomechanics (V Mow)Professor Pao's Influence on Research in Coupled Field Problems, Chirality and Acoustic and Electromagnetic Metamaterials and their Applications (V V Varadan)Transient Response of an Elastic Half Space by a Moving Concentrated Torque (C-S Yeh)Magnetic Force Model for Magnetizable Elastic Body in the Magnetic Field (Z J Zheng)Wind Energy:Principles of Nonlinear Vibro-Wind Energy Conversion (F Moon) Readership: Researchers, professionals, and graduate students in applied mechanics, and mathematics, energy studies, solid & fluid mechanics, and complex systems. Keywords:Meta & Nano Mechanics;Numerics (Fluids and Solids);Contact Mechanics;Coupled Fields;Elastic Waves;Lava Gravity FlowsKey Features:Covers waves and dynamics in complex continuous systems with applications to modern engineering and environmental-geophysical processesPresents the topics with fundamental understanding of the foundations of mathematics and physicsPushes the presented subjects into forms allowing immediate transposition that are relevant to engineering and applied sciences
Vibrations and Waves in Continuous Mechanical Systems Walter de Gruyter GmbH & Co KG
In their 1909 publication Théorie des corps déformables, Eugène and François Cosserat made a

historic contribution to materials science by establishing the fundamental principles of the mechanics of generalized continua. The chapters collected in this volume showcase the many areas of continuum mechanics that grew out of the foundational work of the Cosserat brothers. The included contributions provide a detailed survey of the most recent theoretical developments in the field of generalized continuum mechanics and can serve as a useful reference for graduate students and researchers in mechanical engineering, materials science, applied physics and applied mathematics.

Advances in Doublet Mechanics World Scientific Publishing Company

In the solid mechanical analysis contained herein, the governing and constitutive equations are derived and accompanied by proof that their solutions are unique. These sets of equations are plied to the case of a transversely isotropic, linear multiferroic under plane stress, the details and results of which are provided. From this analysis, an effective coupling factor is defined for determining the ability of a multiferroic material to convert energies.

Mechanics of Continua and Wave Dynamics Elsevier

This monograph is devoted to problems of propagation and stability of linear and nonlinear waves in continuous media with complex structure. It considers the different media, such as solid with cavities, preliminary deformed disperse medium, solid with porosity filled by the electrically conductive and non-conductive liquid, magnetoelastic, piezo-semiconductors, crystals with dislocations, composites with inclusions, an electrically conductive asymmetrical liquid, a mixture of gas with a drop liquid. The book also considers the propagation of a laser beam through a two-level medium. The presented results are based on methods of evolution and modulation equations that were developed by the authors. The book is intended for scientific and technical researchers, students and post-graduate students specializing in mechanics of continuous media, physical acoustics, and physics of the solid state.

Mechanics of Generalized Continua Springer

This book focuses on the mathematical potential and computational efficiency of the Boundary Element Method (BEM) for modeling seismic wave propagation in either continuous or discrete inhomogeneous elastic/viscoelastic, isotropic/anisotropic media containing multiple cavities, cracks, inclusions and surface topography. BEM models may take into account the entire seismic wave path from the seismic source through the geological deposits all the way up to the local site under consideration. The general presentation of the theoretical basis of elastodynamics for inhomogeneous and heterogeneous continua in the first part is followed by the analytical derivation of fundamental solutions and Green's functions for the governing field equations by the usage of Fourier and Radon transforms. The numerical implementation of the BEM is for antiplane in the second part as well as for plane strain boundary value problems in the third part. Verification studies and parametric analysis appear throughout the book, as do both recent references and seminal ones from the past. Since the background of the authors is in solid mechanics and mathematical physics, the presented BEM formulations are valid for many areas such as civil engineering, geophysics, material science and all others concerning elastic wave propagation through inhomogeneous and heterogeneous media. The material presented in this book is suitable for self-study. The book is written at a level suitable for advanced undergraduates or beginning graduate students in solid mechanics, computational mechanics and fracture mechanics.

The Influence of Effective and Magnetoelectric Coupling on the Elastic and Wave Mechanics of Linear Multiferroic Continua Elsevier

This book reviews the mathematical modeling and experimental study of systems involving two or more different length scales. The effects of phenomena occurring at the lower length scales on the behavior at higher scales are of intrinsic scientific interest, but can also be very effectively used to determine the behavior at higher length scales or at the macro-level. Efforts to exploit this micro- and macro-coupling are, naturally, being pursued with regard to every aspect of mechanical phenomena. This book focuses on the changes imposed on the dynamics, strength of materials and durability of mechanical systems by related multiscale phenomena. In particular, it addresses: 1: the impacts of effective dissipation due to kinetic energy trapped at lower scales 2: wave propagation in generalized continua 3: nonlinear phenomena in metamaterials 4: the formalization of more general models to describe the exotic behavior of meta-materials 5: the design and study of microstructures aimed at increasing the toughness and durability of novel materials

Wave Dynamics, Mechanics and Physics of Microstructured Metamaterials EOLSS Publications

Wave propagation is an important topic in engineering sciences, especially, in the field of solid mechanics. A description of wave propagation phenomena is given by Graff [98]: The effect of a sharply applied, localized disturbance in a medium soon transmits or 'spreads' to other parts of the medium. These effects are familiar to everyone, e.g., transmission of sound in air, the spreading of ripples on a pond of water, or the transmission of radio waves. From all wave types in nature, here, attention is focused only on waves in solids. Thus, solely mechanical disturbances in contrast to electro-magnetic or acoustic disturbances are considered. of waves - the compression wave similar to the In solids, there are two types pressure wave in fluids and, additionally, the shear wave. Due to continual reflec tions at boundaries and propagation of waves in bounded solids after some time a steady state is reached. Depending on the influence of the inertia terms, this state is governed by a static or dynamic equilibrium in frequency domain. However, if the rate of onset of the load is high compared to the time needed to reach this steady state, wave propagation phenomena have to be considered.

Modern Developments in the Mechanics of Continua John Wiley & Sons

This book marks the 60th birthday of Prof. Vladimir Erofeev – a well-known specialist in the field of wave processes in solids, fluids, and structures. Featuring a collection of papers related to Prof. Erofeev’s contributions in the field, it presents articles on the current problems concerning the theory of nonlinear wave processes in generalized continua and structures. It also discusses a number of applications as well as various discrete and continuous dynamic models of structures and media and problems of nonlinear acoustic diagnostics.

Acoustics World Scientific

Seismology, as a branch of mathematical physics, is an active subject of both research and development. Its reliance on computational and technological advances continuously motivates the developments of its underlying theory. The fourth edition of Waves and Rays in Elastic Continua responds to these needs.The book is both a research reference and a textbook. Its careful and explanatory style, which includes numerous exercises with detailed solutions, makes it an excellent

textbook for the senior undergraduate and graduate courses, as well as for an independent study. Used in its entirety, the book could serve as a sole textbook for a year-long course in quantitative seismology. Its parts, however, are designed to be used independently for shorter courses with different emphases. The book is not limited to quantitive seismology; it can serve as a textbook for courses in mathematical physics or applied mathematics.

Seismic Wave Propagation in Non-Homogeneous Elastic Media by Boundary Elements Springer

This book is an homage to the pioneering works of E. Aero and G. Maugin in the area of analytical description of generalized continua. It presents a collection of contributions on micropolar, micromorphic and strain gradient media, media with internal variables, metamaterials, beam lattices, liquid crystals, and others. The main focus is on wave propagation, stability problems, homogenization, and relations between discrete and continuous models.

Dynamics, Strength of Materials and Durability in Multiscale Mechanics World Scientific

This book provides a unified and systematic continuum approach for engineers and applied physicists working on the modelling of porous media. Self-contained, it sets out—from a macroscopic point of view—the main concepts and results of deformable porous media subject to the flow of one or several fluids. The theory presented includes developments in the areas of thermodynamics, poroelastoplasticity, poroviscoplasticity, wave propagation and surfaces of discontinuity, boundary value problems and numerical methods, as well as chemico-mechanical couplings. It can be used for numerous diversified applications in geophysics, civil engineering, biomechanics, material science, etc.

Selected Topics in Wave Propagation Elsevier

The book is devoted to the very basis of acoustics and vibro-acoustics. The physics of the phenomena, the analytical methods and the modern numerical techniques are presented in a concise form. Many examples illustrate the fundamental problems and predictions (analytic or numerical) and are often compared to experiments. Some emphasis is put on the mathematical tools required by rigorous theory and reliable prediction methods. A series of practical problems, which reflect the content of each chapter Reference to the major treatises and fundamental recent papers Current computing techniques, used in problem solving

Nonlinear Wave Dynamics of Materials and Structures Springer Nature

The main objective of continuum mechanics is to predict the response of a body that is under the action of external and/or internal influences, i.e. to capture and describe different mechanisms associated with the motion of a body that is under the action of loading. A body in continuum mechanics is considered to be matter continuously distributed in space. Hence, no attention is given to the microscopic (atomic) structure of real materials although non-classical generalized theories of continuum mechanics are able to deal with the mesoscopic structure of matter (i.e. defects, cracks, dispersive lengths, ...). Matter occupies space in time and the response of a body in continuum mechanics is restricted to the Newtonian space-time of classical mechanics in this volume. Einstein's theory of relativity is not considered. In the classical sense, loading is considered as any action that changes the motion of the body. This includes, for instance, a change in temperature or a force applied. By introducing the concept of configurational forces a load may also be considered as a force that drives a change in the material space, for example the opening of a crack. Continuum mechanics refers to field descriptions of phenomena that are usually modeled by partial differential equations and, from a mathematical point of view, require non-standard knowledge of non-simple technicalities. One purpose in this volume has been to present the different subjects in a self-contained way for a general audience. The organization of the volume is as follows. Mathematically, to predict the response of a body it is necessary to formulate boundary value problems governed by balance laws. The theme of the volume, that is an overview of the subject, has been written with this idea in mind for beginners in the topic. Chapter 1 is an introduction to continuum mechanics based on a one-dimensional framework in which, simultaneously, a more detailed organization of the chapters of this volume is given. A one-dimensional approach to continuum mechanics in some aspects maybe misleading since the analysis is oversimplified. Nevertheless, it allows us to introduce the subject through the early basic steps of the continuum analysis for a general audience. Chapters 3, 4 and 5 are devoted to the mathematical setting of continuum analysis: kinematics, balance laws and thermodynamics, respectively. Chapters 6 and 7 are devoted to constitutive equations. Chapters 8 and 9 deal with different issues in the context of linear elastostatics and linear elastodynamics and waves, respectively, for solids. Linear Elasticity is a classical and central theory of continuum mechanics. Chapter 10 deals with fluids while chapter 11 analyzes the coupled theory of thermoelasticity. Chapter 12 deals with nonlinear elasticity and its role in the continuum framework. Chapters 13 and 14 are dedicated to different applications of solid and fluid mechanics, respectively. The rest of the chapters involve some advanced topics. Chapter 15 is dedicated to turbulence, one of the main challenges in fluid mechanics. Chapter 16 deals with electro-magneto active materials (a coupled theory). Chapter 17 deals with specific ideas of soft matter and chapter 18 deals with configurational forces. In chapter 19, constitutive equations are introduced in a general (implicit) form. Well-posedness (existence, time of existence, uniqueness, continuity) of the equations of the mechanics of continua is an important topic which involves sophisticated mathematical machinery. Chapter 20 presents different analyses related to these topics. Continuum Mechanics is an interdisciplinary subject that attracts the attention of engineers, mathematicians, physicists, etc., working in many different disciplines from a purely scientific environment to industrial applications including biology, materials science, engineering, and many other subjects.

Wave Propagation in Viscoelastic and Poroelastic Continua Courier Corporation

This text is intended to provide a modern and integrated treatment of the foundations and applications of continuum mechanics. There is a significant increase in interest in continuum mechanics because of its relevance to microscale phenomena. In addition to being tailored for advanced undergraduate students and including numerous examples and exercises, this text also features a chapter on continuum thermodynamics, including entropy production in Newtonian viscous fluid flow and thermoelasticity. Computer solutions and examples are emphasized through the use of the symbolic mathematical computing program Mathematica®.

Electrodynamics of Continua I Springer

This book offers a novel but unified treatment of an established subject. Rather than describe the standard topics in fluid mechanics in traditional form, the book presents each topic as part of a wider class of problems so that a unity of concepts is emphasized over a unity of material.

Elements of Continuum Mechanics and Thermodynamics Elsevier Science
The Mechanics and Thermodynamics of Continua presents a unified treatment of continuum mechanics and thermodynamics that emphasises the universal status of the basic balances and the entropy imbalance. These laws are viewed as fundamental building blocks on which to frame theories of material behaviour. As a valuable reference source, this book presents a detailed and complete treatment of continuum mechanics and thermodynamics for graduates and advanced undergraduates in engineering, physics and mathematics. The chapters on plasticity discuss the standard isotropic theories and, in addition, crystal plasticity and gradient plasticity.
Waves And Rays In Elastic Continua (Fourth Edition) Cambridge University Press
Mechanics of Continua and Wave Dynamics is a textbook for a course on the mechanics of solids and fluids with the emphasis on wave theory. The material is presented with simplicity and clarity but also with mathematical rigor. Many wave phenomena, especially those of geophysical nature (different types of waves in the ocean, seismic waves in the earth crust, wave propagation in the atmosphere, etc.), are considered. Each subject is introduced with simple physical concepts using numerical examples and models. The treatment then goes into depth and complicated aspects are illustrated by appropriate generalizations. Numerous exercises with solutions will help students to comprehend and assimilate the ideas.
Topics in Fluid Mechanics Scientific e-Resources
The subject of vibrations is of fundamental importance in engineering and technology. Discrete modelling is sufficient to understand the dynamics of many vibrating systems; however a large number of vibration phenomena are far more easily understood when modelled as continuous systems. The theory of vibrations in continuous systems is crucial to the understanding of engineering problems in areas as diverse as automotive brakes, overhead transmission lines, liquid filled tanks, ultrasonic testing or room acoustics. Starting from an elementary level, Vibrations and Waves in Continuous Mechanical Systems helps develop a comprehensive understanding of the theory of these systems and the tools with which to analyse them, before progressing to more advanced topics. Presents dynamics and analysis techniques for a wide range of continuous systems including strings, bars, beams, membranes, plates, fluids and elastic bodies in one, two and three dimensions. Covers special topics such as the interaction of discrete and continuous systems, vibrations in translating media, and sound emission from vibrating surfaces, among others. Develops the reader’s understanding by progressing from very simple results to more complex analysis without skipping the key steps in the derivations. Offers a number of new topics and exercises that form essential steppingstones to the present level of research in the field. Includes exercises at the end of the chapters based on both the academic and practical experience of the authors. Vibrations and Waves in Continuous Mechanical Systems provides a first course on the vibrations of continuous systems that will be suitable for students of continuous system dynamics, at senior undergraduate and graduate levels, in mechanical, civil and aerospace engineering. It will also appeal to researchers developing theory and analysis within the field.