Fundamentals Of Seismic Wave Propagation

Authored by the internationally renowned José M. Carcione, Wave Fields in Real Media: Wave Propagation in Anisotropic, Anelastic, Porous and Electromagnetic Media examines the differences between an ideal and a real description of wave propagation, starting with the introduction of relevant stress-strain relations. The combination of this relation and the equations of momentum conservation lead to the equation of motion. The differential formulation is written in terms of memory variables, and Biot's theory is used to describe wave propagation in porous media. For each rheology, a plane-wave analysis is performed in order to understand the physics of wave propagation. This book contains a review of the main direct numerical methods for solving the equation of motion in the time and space domains. The emphasis is on geophysical applications for seismic exploration, but researchers in the fields of earthquake seismology, rock acoustics, and material science - including many branches of acoustics of fluids and solids - may also find this text useful. New to this edition: This new edition presents the fundamentals of wave propagation in Anisotropic, Anelastic, Porous Media while also incorporating the latest research from the past 7 years, including that of the author. The author presents all the equations and concepts necessary to understand the physics of wave propagation. These equations form the basis for modeling and inversion of seismic and electromagnetic data. Additionally, demonstrations are given, so the book can be used to teach post-graduate courses. Addition of new and revised content is approximately 30%. Examines the fundamentals of wave propagation in anisotropic, anelastic and porous media Presents all equations and concepts necessary to understand the physics of wave propagation, with examples Emphasizes geophysics, particularly, seismic exploration for hydrocarbon reservoirs, which is essential for exploration and production of oil

Presenting a comprehensive introduction to the propagation of high-frequency body-waves in elastodynamics, this volume develops the theory of seismic wave propagation in acoustic, elastic and anisotropic media to allow seismic waves to be modelled in complex, realistic three-dimensional Earth models. The book is a text for graduate courses in theoretical seismology, and a reference for all academic and industrial seismologists using numerical modelling methods. Exercises and suggestions for further reading are included in each chapter.

This volume features invited contributions from researchers whose work has recently been the focus of attention in journals and at conferences.

Fundamentals of Seismic Wave Propagation, published in 2004, presents a comprehensive introduction to the propagation of high-frequency body-waves in elastodynamics. The theory of seismic wave propagation in acoustic, elastic and anisotropic media is developed to allow seismic waves to be modelled in complex, realistic three-dimensional Earth models. This book provides a consistent and thorough development of modelling methods widely used in elastic wave propagation ranging from the whole Earth, through regional and crustal seismology, exploration seismics to borehole seismics, sonics and ultrasonics. Particular emphasis is placed on developing a consistent notation and approach throughout, which highlights similarities and allows more complicated methods and extensions to be developed without difficulty. This book is intended as a text for graduate courses in theoretical seismology, and as a reference for all academic and industrial seismologists using numerical modelling methods. Exercises and suggestions for further reading are included in each chapter.

In the last few decades, metamaterials have revolutionized the ways in which waves are controlled, and applied in physics and practical situations. The extraordinary properties of metamaterials, such as their locally resonant structure with deep subwavelength band gaps and their ranges of frequency where propagation is impossible, have opened the way to a host of applications that were previously unavailable. Acoustic metamaterials have been able to replace traditional treatments in several sectors, due to their better performance in targeted and tunable frequency ranges with strongly reduced dimensions. This is a training book composed of nine chapters written by experts in the field, giving a broad overview of acoustic metamaterials and their uses. The book is divided into three parts, covering the state-of-the-art, the fundamentals and the real-life applications of acoustic metamaterials.

This book treats various generalizations of the classical O'Doherty-Anstey formula in order to describe stratigraphic filtering effects. These are the effects that can be observed when elastic and electromagnetic waves propagate through multilayered structures. Our aim was to treat this topic in a comprehensive manner and present compact results in a didactically simple way, emphasizing the physics of the wave-propagation phenomena. We do not claim mathematical rigidity in all our derivations, however, we are pleased to have obtained quite simple descriptions of scattering, transmission and reflection of wavefields in acoustic, elastic, and poroelastic media which can be useful for various seismological and non-seismological applications.

This book provides an approachable and concise introduction to seismic theory, designed as a first course for undergraduate students. It clearly explains the fundamental concepts, emphasizing intuitive understanding over lengthy derivations. Incorporating over 30% new material, this second edition includes all the topics needed for a one-semester course in seismology. Additional material has been added throughout including numerical methods, 3-D ray tracing, earthquake location, attenuation, normal modes, and receiver functions. The chapter on earthquakes and source theory has been extensively revised and enlarged, and now includes details on non-double-couple sources, earthquake scaling, radiated energy, and finite slip inversions. Each chapter includes worked problems and detailed exercises that give students the opportunity to apply the techniques they have learned to compute results of interest and to illustrate the Earth's seismic properties. Computer subroutines and datasets for use in the exercises are available at www.cambridge.org/shearer.

3C seismic applications provide enhanced rock property characterization of the reservoir that can complement P-wave methods. Continued interest in converted P- to S-waves (PS-waves) and vertical seismic profiles (VSPs) has resulted in the steady development of advanced vector wavefield techniques. PS-wave images along with VSP data can be used to help P-wave interpretation of structure in gas obscured zones, of elastic and fluid properties for lithology discrimination from S-wave impedance and density inversion in unconventional reservoirs, and of fracture characterization and stress monitoring from S-wave birefringence (splitting) analysis. The book, which accompanies the 2016 SEG Distinguished Instructor Short Course, presents an overview of 3C seismic theory and practical application: from fundamentals of PS-waves and VSPs, through to acquisition and processing including interpretation techniques. The emphasis is on unique aspects of vector wavefields, anisotropy, and the important relationships that unify S-waves and P-waves. Various applications and case studies demonstrate image benefits from PS-waves, elastic properties and fluid discrimination from joint inversion of amplitude variations with offset/angle (AVO/A), and VSP methods for anisotropic velocity model building and improved reservoir imaging. The book will be of interest to geophysicists, geologists, and engineers, especially those involved with or considering the use of AVO/A inversion, fracture/stress characterization analyses, or interpretation in gas-obscured reservoirs.

This book presents state-of-the-art information on seismic ground response analysis, and is not only very valuable and useful for practitioners but also for researchers. The topics covered are related to the stages of analysis: 1. Input parameter selection, by reviewing the in-situ and laboratory tests used to determine dynamic soil properties as well as the methods to compile and model the dynamic soil properties from literature;2. Input ground motion; 3. Theoretical background on the equations of motion and methods for solving them; 4. The mechanism of damping and how this is modeled in the equations of motions; 5. Detailed analysis and discussion of results of selected case studies which provide valuable information on the problem of seismic ground response analysis from both a theoretical and practical point of view.

The second edition of Principles of Seismology has been extensively revised and updated to present a modern approach to observation seismology and the theory behind digital seismograms. It includes: a new chapter on Earthquakes, Earth's structure and dynamics; a considerably revised chapter on instrumentation, with new material on processing of modern digital seismograms and a list of website hosting data and seismological software; and 100 end-of-chapter problems. The fundamental physical concepts on which seismic theory is based are explained in full detail with step-by-step development of the mathematical derivations, demonstrating the relationship between motions recorded in digital seismograms and the mechanics of deformable bodies. With chapter introductions and summaries, numerous examples, newly drafted illustrations and new color figures, and an updated bibliography and reference list, this intermediate-level textbook is designed to help students develop the skills to tackle real research problems.

A graduate-level 2004 textbook introducing the theory of seismic wave propagation in acoustic, elastic and anisotropic media.

Intended as an introduction to the field, Modern Global Seismology is a complete, self-contained primer on seismology. It features extensive coverage of all related aspects, from observational data through prediction, emphasizing the fundamental theories and physics governing seismic waves--both natural and anthropogenic. Based on thoroughly class-tested material, the text provides a unique perspective on the earths large-scale internal structure and dynamic processes, particularly earthquake sources, and on the application of theory to the dynamic processes of the earths upper skin. Authored by two experts in the field of geophysics. this insightful text is designed for the first-year graduate course in seismology. Exploration seismologists will also find it an invaluable resource on topics such as elastic-wave propagation, seismicinstrumentation, and seismogram analysis useful in interpreting their high-resolution images of structure for oil and mineral resource exploration. More than 400 illustrations, many from recent research articles, help readers visualize mathematical relationships 49 Boxed Features explain advanced topics Provides readers with the most in-depth presentation of earthquake physics available Contains incisive treatments of seismic waves, waveform evaluation and modeling, and seismotectonics Provides quantitative treatment of earthquake source mechanics Contains numerous examples of modern broadband seismic recordings Fully covers current seismic instruments and networks Demonstrates modern waveform inversion methods Includes extensive references for further reading Modern Global Seismology, Second Edition, is a complete, self-contained primer on seismology, featuring extensive coverage of all related aspects—from observational data through prediction—and emphasizing the fundamental theories and physics governing seismic waves, both natural and anthropogenic. Based on thoroughly class-tested material, the text provides a unique perspective on Earth’s large-scale internal structure and dynamic processes, particularly earthquake sources, and the application of theory to the dynamic processes of the earth’s upper layer. This insightful new edition is designed for accessibility and comprehension for graduate students entering the field. Exploration seismologists will also find it an invaluable resource on topics such as elastic-wave propagation, seismic instrumentation, and seismogram analysis. Includes more than 400 illustrations, from both recent and traditional research articles, to help readers visualize mathematical relationships, as well as boxed features to explain advanced topics Offers incisive treatments of seismic waves, waveform evaluation and modeling, and seismotectonics, as well as quantitative treatments of earthquake source mechanics and numerous examples of modern broadband seismic recordings Covers current seismic instruments and networks and demonstrates modern waveform inversion methods Includes extensive, updated references for further reading new to this edition Features reorganized chapters split into two sections, beginning with introductory content such as tectonics and seismogram analysis, and moving on to more advanced topics, including seismic wave excitation and propagation, multivariable and vector calculus, and tensor approaches Completely updated references and figures to bring the text up to date Includes all-new sections on recent advancements and to enhance examples and understanding Split into shorter chapters to allow more flexibility for instructors and easier access for researchers, and includes exercises "Numerical simulation is an irreplaceable tool in earthquake ground motion research. Among all the numerical methods in seismology, the finite-difference (FD) technique is the most widely-used, providing the best balance of accuracy and computational efficiency. Now, for the first time, this book offers a comprehensive introduction to this method and its applications to earthquake motion"--

In this interdisciplinary book, leading experts in underwater acoustics, seismology, acoustic medical imaging and non-destructive testing present basic concepts as well as the recent advances in imaging. The different subjects tackled show significant similarities.

Acquisition and Processing of Marine Seismic Data demonstrates the main principles, required equipment, and suitable selection of parameters in 2D/3D marine seismic data acquisition, as well as theoretical principles of 2D marine seismic data processing and their practical implications. Featuring detailed datasets and examples, the book helps to relate theoretical background to real seismic data. This reference also contains important QC analysis methods and results both for data acquisition and marine seismic data processing. Acquisition and Processing of Marine Seismic Data is a valuable tool for researchers and students in geophysics, marine seismics, and seismic data, as well as for oil and gas exploration. Contains simple step-by-step diagrams of the methodology used in the processing of seismic data to demonstrate the theory behind the applications Combines theory and practice, including extensive noise, QC, and velocity analyses, as well as examples for beginners in the seismic operations market Includes simple illustrations to provide to the audience an easy understanding of the theoretical background Contains enhanced field data examples and applications

The seismic ray method plays an important role in seismology, seismic exploration, and in the interpretation of seismic measurements. Seismic Ray Theory presents the most comprehensive treatment of the method available. Many new concepts that extend the possibilities and increase the method's efficiency are included. The book has a tutorial character: derivations start with a relatively simple problem, in which the main ideas are easier to explain, and then advance to more complex problems. Most of the derived equations are expressed in algorithmic form and may be used directly for computer programming. This book will prove to be an invaluable advanced text and reference in all academic institutions in which seismology is taught or researched.

This second edition of Fundamentals of Geophysics has been completely revised and updated, and is the ideal geophysics textbook for undergraduate students of geoscience with an introductory level of knowledge in physics and mathematics. It gives a comprehensive treatment of the fundamental principles of each major branch of geophysics, and presents geophysics within the wider context of plate tectonics, geodynamics and planetary science. Basic principles are explained with the aid of numerous figures and step-by-step mathematical treatments, and important geophysical results are illustrated with examples from the scientific literature. Text-boxes are used for auxiliary explanations and to handle topics of interest for more advanced students. This new edition also includes review questions at the end of each chapter to help assess the reader's understanding of the topics covered and quantitative exercises for more thorough evaluation. Solutions to the exercises and electronic copies of the figures are available at www.cambridge.org/9780521859028.

This book introduces readers to the field of seismic data interpretation and evaluation, covering themes such as petroleum exploration and high resolution seismic data. It helps geoscientists and engineers who are practitioners in this area to both understand and to avoid the potential pitfalls of interpreting and evaluating such data, especially the over-reliance on sophisticated software packages and workstations alongside a lack of grasp on the elementary principles of geology and geophysics. Chapters elaborate on the necessary principles, from topics like seismic wave propagation and rock-fluid parameters to seismic modeling and inversions, explaining the need to understand geological implications. The difference between interpretation of data and its evaluation is highlighted and the author encourages imaginative, logical and practical application of knowledge. Readers will appreciate the exquisite illustrations included with the accessibly written text, which simplify the process of learning about interpretation of seismic data. This multidisciplinary, integrated and practical approach to data evaluation will prove to be a valuable tool for students and young professionals, especially those connected with oil companies.

Recent progress in numerical methods and computer science allows us today to simulate the propagation of seismic waves through realistically heterogeneous Earth models with unprecedented accuracy. Full waveform tomography is a tomographic technique that takes advantage of numerical solutions of the elastic wave equation. The accuracy of the numerical solutions and the exploitation of complete waveform information result in tomographic images that are both more realistic and better resolved. This book develops and describes state of the art methodologies covering all aspects of full waveform tomography including methods for the numerical solution of the elastic wave equation, the adjoint method, the design of objective functionals and optimisation schemes. It provides a variety of case studies on all scales from local to global based on a large number of examples involving real data. It is a comprehensive reference on full waveform tomography for advanced students, researchers and professionals.

One of the most methodical treatments of electromagnetic wave propagation, radiation, and scattering—including new applications and ideas Presented in two parts, this book takes an analytical approach on the subject and emphasizes new ideas and applications used today. Part one covers fundamentals of electromagnetic wave propagation, radiation, and scattering. It provides ample end-of-chapter problems and offers a 90-page solution manual to help readers check and comprehend their work. The second part of the book explores up-to-date applications of electromagnetic waves—including radiometry, geophysical remote sensing and imaging, and biomedical and signal processing applications. Written by a world renowned authority in the field of electromagnetic research, this new edition of Electromagnetic Wave Propagation, Radiation, and Scattering: From Fundamentals to Applications presents detailed applications with useful appendices, including mathematical formulas, Airy function, Abel's equation, Hilbert transform, and Riemann surfaces. The book also features newly revised material that focuses on the following topics: Statistical wave theories—which have been extensively applied to topics such as geophysical remote sensing, bio-electromagnetics, bio-optics, and bio-ultrasound imaging Integration of several distinct yet related disciplines, such as statistical wave theories, communications, signal processing, and time reversal imaging New phenomena of multiple scattering, such as coherent scattering and memory effects Multiphysics applications that combine theories for different physical phenomena, such as seismic coda waves, stochastic wave theory, heat diffusion, and temperature rise in biological and other media Metamaterials and solitons in optical fibers, nonlinear phenomena, and porous media Primarily a textbook for graduate courses in electrical engineering, Electromagnetic Wave Propagation, Radiation, and Scattering is also ideal for graduate students in bioengineering, geophysics, ocean engineering, and geophysical remote sensing. The book is also a useful reference for engineers and scientists working in fields such as geophysical remote sensing, bio–medical engineering in optics and ultrasound, and new materials and integration with signal processing.

An Introduction to Seismology, Earthquakes and Earth Structures is an introduction to seismology and its role in the earth sciences, and is written for advanced undergraduate and beginning graduate students. The fundamentals of seismic wave propagation are developed using a physical approach and then applied to show how refraction, reflection, and teleseismic techniques are used to study the structure and thus the composition and evolution of the earth. The book shows how seismic waves are used to study earthquakes and are integrated with other data to investigate the plate tectonic processes that cause earthquakes. Figures, examples, problems, and computer exercises teach students about seismology in a creative and intuitive manner. Necessary mathematical tools including vector and tensor analysis, matrix algebra, Fourier analysis, statistics of errors, signal processing, and data inversion are introduced with many relevant examples. The text also addresses the fundamentals of seismometry and applications of seismology to societal issues. Special attention is paid to help students visualize connections between different topics and view seismology as an integrated science. An Introduction to Seismology, Earthquakes, and Earth Structure gives an excellent overview for students of geophysics and tectonics, and provides a strong foundation for further studies in seismology.

Multidisciplinary examples throughout the text - catering to students in varied disciplines (geology, mineralogy, petrology, physics, etc.). Most up to date book on the market - includes recent seismic events such as the 1999 Earthquakes in Turkey, Greece, and Taiwan). Chapter outlines - each chapter begins with an outline and a list of learning objectives to help students focus and study.

Essential math review - an entire section reviews the essential math needed to understand seismology. This can be covered in class or left to students to review as needed. End of chapter problem sets - homework problems that cover the material presented in the chapter. Solutions to all odd numbered problem sets are listed in the back so that students can track their progress. Extensive References - classic references and more current references are listed at the end of each chapter. A set of instructor's resources containing downloadable versions of all the figures in the book, errata and answers to homework problems is available at: http://levee.wustl.edu/seismology/book/. Also available on this website are PowerPoint lecture slides corresponding to the first 5 chapters of the book.

Surface waves form the longest and strongest portion of a seismic record excited by explosions and shallow earthquakes. Traversing areas with diverse geologic structures, they 'absorb' information on the properties of these areas which is best retlected in dispersion, the dependence of velocity on frequency. The other prop erties of these waves - polarization, frequency content, attenuation, azimuthal variation of the amplitude and phase - arc also controlled by the medium between the source and the recording station; some of these are affected by the properties of the source itself and by the conditions around it. In recent years surface wave seismology has become an indispensable part of seismological practice. The maximum amplitude in the surface wave train of virtually every earthquake or major explosion is being measured and used by all national and international seismological surveys in the determination of the most important energy parameter of a seismic source, namely, the magnitude M,. The relationship between M, and the body wave magnitude fI1t, is routinely employed in identification of underground nuclear explosions. Surface waves of hundreds of earthquakes recorded every year are being analysed to estimate the seismic moment tensor of earthquake sources, to determine the periods of free oscillations of the Earth, to construct regional dispersion curves from which in turn the crustal and upper mantle structure in various areas is derived, and to evaluate the dissipative parameters of the mantle material.

This book presents theoretical fundamentals and applications of a new numerical model that has the ability to simulate wave propagation. Coverage examines linear waves in ideal fluids and elastic domains. In addition, the book includes a numerical simulation of wave propagation based on scalar and vector wave equations, as well as fluid-structure interaction and soil-structure interaction.

Concise textbook on seismic wave theory, with detailed derivations of formulas, clear explanations of topics, exercises, and selected answers.

The past few decades have witnessed the growth of the Earth Sciences in the pursuit of knowledge and understanding of the planet that we live on. This development addresses the challenging endeavor to enrich human lives with the bounties of Nature as well as to preserve the planet for the generations to come. Solid Earth Geophysics aspires to define and quantify the internal structure and processes of the Earth in terms of the principles of physics and forms the intrinsic framework, which other allied disciplines utilize for more specific investigations. The first edition of the Encyclopedia of Solid Earth Geophysics was published in 1989 by Van Nostrand Reinhold publishing company. More than two decades later, this new volume, edited by Prof. Harsh K. Gupta, represents a thoroughly revised and expanded reference work. It brings together more than 200 articles covering established and new concepts of Geophysics across the various sub-disciplines such as Gravity, Geodesy, Geomagnetism, Seismology, Seismics, Deep Earth Processes, Plate Tectonics, Thermal Domains, Computational Methods, etc. in a systematic and consistent format and standard. It is an authoritative and current reference source with extraordinary width of scope. It draws its unique strength from the expert contributions of editors and authors across the globe. It is designed to serve as a valuable and cherished source of information for current and future generations of professionals.

Elastic Waves in the Earth provides information on the relationship between seismology and geophysics and their general aspects. The book offers elastodynamic equations and derivative equations that can be used in the propagation of elastic waves. It also covers major topics in detail, such as the fundamentals of elastodynamics; the Lamb's problem, which includes the Cagniard-de Hoop theory; rays and modes in a radially inhomogeneous earth and in multilayered media, which includes the Thomson-Haskell theory; the elastic wave dissipation; the seismic source and noise; and the seismographs. The book consists of 33 chapters. The first 16 chapters include basic material related to the propagation of elastic waves. Topics covered by these chapters include scalars, vectors, and tensors in cartesian coordinates, stress and strain analysis, equations of elasticity and motion, plane waves, Rayleigh waves, plane-wave theory, and fluid-fluid and solid-solid interfaces. The second half of the book covers various ray and mode theories, elastic wave dissipation, and the observations and theories of seismic source and seismic noise. It concludes by discussing earthquake seismology and different seismographs, like the pendulum seismometer and the strain seismometer.

This book provides a guide to understanding of seismograms for graduate students, researchers, professionals in academia and the petroleum industry.

This volume contains an extensive presentation of the theory, phenomenology and interpretation of seismic waves produced by natural and artificial sources. Each theoretical topic discussed in the book is presented in a self-contained and mathematically rigorous form, yet without excessive demands on the reader's mathematical background. It is the only book to include such a complete presentation of the mathematical background and modern developments of the WKBJ theory of seismic waves, and detailed discussions of its wide ranging applications. The book will therefore be useful to postgraduate students and research workers specialising in seismic wave theory, theoretical seismology, electromagnetic wave theory and other fields of wave propagation theory.

Capitalizing on knowledge learned over decades and combining underlying theory with practical bases, this book presents a systematic analysis of the issues involved in high-resolution seismic exploration. Translated from the original Chinese edition published in 1993 by Petroleum Industry Press and now updated to reflect contemporary developments, the book is adept at clarifying the objectives and approaches toward better precision in seismic prospecting. It provides innovative views on fundamental concepts including: perspective resolution and perspective S/N; the empirical relationship between compressional velocity (Vp) and absorption coefficient (Q); constructing basin absorption models; understanding sand layer tracking; improving dynamic and static corrections of near-surface effects as well as deconvolution; achieving maximum effective bandwidth of seismic data; and regressive seismic impedance inversion. It is an excellent reference for those involved in seismic prospecting research, data processing, and geologic interpretation, and it is recommended for workers as well as professors and graduate students.

Technical guide to the theory and practice of seismic data processing with MATLAB algorithms for advanced students, researchers and professionals.

Extreme Environmental Events is an authoritative single source for understanding and applying the basic tenets of complexity and systems theory, as well as the tools and measures for analyzing complex systems, to the prediction, monitoring, and evaluation of major natural phenomena affecting life on earth. These phenomena are often highly destructive, and include earthquakes, tsunamis, volcanoes, climate change,, and weather. Early warning, damage, and the immediate response of human populations to these phenomena are also covered from the point of view of complexity and nonlinear systems. In 61 authoritative, state-of-the art articles, world experts in each field apply such tools and concepts as fractals, cellular automata, solitons game theory, network theory, and statistical physics to an understanding of these complex geophysical phenomena.

This book is an introductory text to a range of numerical methods used today to simulate time-dependent processes in Earth science, physics, engineering, and many other fields. The physical problem of elastic wave propagation in 1D serves as a model system with which the various numerical methods are introduced and compared. The theoretical background is presented with substantial graphical material supporting the concepts. The results can be reproduced with the supplementary electronic material provided as python codes embedded in Jupyter notebooks. The book starts with a primer on the physics of elastic wave propagation, and a chapter on the fundamentals of parallel programming, computational grids, mesh generation, and hardware models. The core of the book is the presentation of numerical solutions of the wave equation with six different methods: 1) the finite-difference method; 2) the pseudospectral method (Fourier and Chebyshev); 3) the linear finite-element method; 4) the spectral-element method; 5) the finite-volume method; and 6) the discontinuous Galerkin method. Each chapter contains comprehension questions, theoretical, and programming exercises. The book closes with a discussion of domains of application and criteria for the choice of a specific numerical method, and the presentation of current challenges. Readers are welcome to visit the author's website www.geophysik.lmu.de/Members/igel for more

information on his research, projects, publications, and other activities.
Seismic Wave Analysis for Near Surface Applications presents the foundational tools necessary to properly analyze surface waves acquired according to both active and passive techniques. Applications range from seismic hazard studies, geotechnical surveys and the exploration of extra-terrestrial bodies. Surface waves have become critical to near-surface geophysics both for geotechnical goals and seismic-hazard studies. Included in this book are the related theories, approaches and applications which the lead editor has assembled from a range of authored contributions carefully selected from the latest developments in research. A unique blend of theory and practice, the book’s concepts are based on exhaustive field research conducted over the past decade from the world’s leading seismologists and geophysicists. Edited by a geophysicist with nearly 20 years of experience in research, consulting, and geoscience software development. Nearly 100 figures, photographs, and examples aid in the understanding of fundamental concepts and techniques Presents the latest research in seismic wave characteristics and analysis, the fundamentals of signal processing, wave data acquisition and inversion, and the latest developments in horizontal-to-vertical spectral ratio (HVSR). Each chapter features a real-world case study—13 in all—to bring the book’s key principles to life.
This introduction to seismological theory and the principles of plate tectonics also develops a practical approach to the interpretation of seismograms for physicists and mathematicians as well as geologists.
Bridging the gap between introductory textbooks and advanced monographs, this book provides the necessary mathematical tools to tackle seismological problems and demonstrates how to apply them. Including student exercises, for which solutions are available on a dedicated website, it appeals to advanced undergraduate and graduate students. It is also a useful reference volume for researchers wishing to "brush up" on fundamentals before they study more advanced topics in seismology.
An informative look at the theory, computer implementation, and application of the scaled boundary finite element method This reliable resource, complete with MATLAB, is an easy-to-understand introduction to the fundamental principles of the scaled boundary finite element method. It establishes the theory of the scaled boundary finite element method systematically as a general numerical procedure, providing the reader with a sound knowledge to expand the applications of this method to a broader scope. The book also presents the applications of the scaled boundary finite element to illustrate its salient features and potentials. The Scaled Boundary Finite Element Method: Introduction to Theory and Implementation covers the static and dynamic stress analysis of solids in two and three dimensions. The relevant concepts, theory and modelling issues of the scaled boundary finite element method are discussed and the unique features of the method are highlighted. The applications in computational fracture mechanics are detailed with numerical examples. A unified mesh generation procedure based on quadtree/octree algorithm is described. It also presents examples of fully automatic stress analysis of geometric models in NURBS, STL and digital images. Written in lucid and easy to understand language by the co-inventor of the scaled boundary element method Provides MATLAB as an integral part of the book with the code cross-referenced in the text and the use of the code illustrated by examples Presents new developments in the scaled boundary finite element method with illustrative examples so that readers can appreciate the significant features and potentials of this novel method—especially in emerging technologies such as 3D printing, virtual reality, and digital image-based analysis The Scaled Boundary Finite Element Method: Introduction to Theory and Implementation is an ideal book for researchers, software developers, numerical analysts, and postgraduate students in many fields of engineering and science.