

Fundamentals Of Seismic Exploration For Hydrocarbon

Covers the basic ideas and methods used in seismic processing, concentrating on the fundamentals of seismic imaging and deconvolution. Many of the seismic methods in popular use today go back to the work of some of the great scientists of past centuries. The ideas are developed from the ground up. Most chapters in the book are followed by problem sets. Some exercises are designed to supplement the material presented in the text; others are meant to stimulate classroom discussions. There are few industrial-grade illustrations. Instead, both the text and the exercises deal mostly with simple examples that often can be solved with nothing more than a pencil and paper. Each chapter is as self-contained as possible to make it easier for a reader to concentrate on topics of particular interest. The book covers such basic topics as wave motion; digital imaging; digital filtering; various visualization aspects of the seismic reflection method; sampling theory; the frequency spectrum; synthetic seismograms; wavelets and wavelet processing; deconvolution; the need for continuing interaction between the seismic interpreter and the computer; seismic attributes; phase rotation; and seismic attenuation. The last of the 15 chapters gives a detailed mathematical overview. Digital Imaging and Deconvolution, nominated for the Association of Earth Science Editors award for the best geoscience publication of 2008-2009, will be of interest to professional geophysicists as well as graduate students and upper-level undergraduates in geophysics. The book also will be helpful to scientists and engineers in other disciplines who use digital signal processing to analyze and image wave-motion data in remote-detection applications. In particular, the methods described in this book are important in optical imaging, video imaging, medical and biological imaging, acoustical analysis, radar, and sonar.

All rock masses are seismically anisotropic, but we generally ignore this in our seismic acquisition, processing, and interpretation. The anisotropy nonetheless does affect our data, in ways that limit the effectiveness with which we can use it, as long as we ignore it. This book, produced for use with the fifth SEG/EAGE Distinguished Instructor Short Course, helps us understand why this inconsistency between reality and practice has been so successful in the past and why it will be less successful in the future as we acquire better seismic data (especially including vector seismic data) and correspondingly higher expectations of it. This book helps us understand how we can modify our practice to more fully realize the potential inherent in our data through algorithms which recognize the fact of seismic anisotropy.

This book is written for advanced earth science students, geologists, petroleum engineers and others who want to get quickly 'up to speed' on the interpretation of reflection seismic data. It is a development of material given to students on the MSc course in Petroleum Geology at Aberdeen University and takes the form of a course manual rather than a systematic textbook. It can be used as a self-contained course for individual study, or as the basis for a class programme. The book clarifies those aspects of the subject that students tend to find difficult, and provides insights through practical tutorials which aim to reinforce and deepen understanding of key topics and provide the reader with a measure of feedback on progress. Some tutorials may only involve drawing simple diagrams, but many are computer-aided (PC based) with graphics output to give insight into key steps in seismic data processing or into the seismic response of some common geological scenarios. Part I of the book covers basic ideas and it ends with two tutorials in 2-D structural interpretation. Part II concentrates on the current seismic reflection contribution to reservoir studies, based on 3-D data.

The purpose of this book is to give a theoretical and practical introduction to seismic-while-drilling by using the drill-bit noise. This recent technology offers important products for geophysical control of drilling. It involves aspects typical of borehole seismics and of the drilling control surveying, hitherto the sole domain of mudlogging. For aspects related to the drill-bit source performance and borehole acoustics, the book attempts to provide a connection between experts working in geophysics and in drilling. There are different ways of thinking related to basic knowledge, operational procedures and precision in the observation of the physical quantities. The goal of the book is to help "build a bridge" between geophysicists involved in seismic while drilling - who may need to familiarize themselves with methods and procedures of drilling and drilling-rock mechanics - and drillers involved in geosteering and drilling of "smart wells" - who may have to familiarize themselves with seismic signals, wave resolution and radiation. For instance, an argument of common interest for drilling and seismic while drilling studies is the monitoring of the drill-string and bit vibrations. This volume contains a large number of real examples of SWD data analysis and applications.

Elementary, conceptual, and easy to read, this book describes the methods and techniques used to estimate rock properties from seismic data, based on a sound understanding of the elastic properties of materials and rocks and how the amplitudes of seismic reflections change with those properties. By examining the recorded seismic amplitudes in some detail, we can deduce properties beyond the basic geological structure of the subsurface. We can, using AVO and other amplitude techniques, characterize rocks and the reservoirs inside them with some degree of qualitative, and even quantitative, detail. Mathematics is not ignored, but is kept to a minimum. Intended for geophysicists, seismic acquisition specialists, processors, and interpreters, even those with little previous exposure to 'quantitative interpretation', 'interpretive processing' or 'advanced seismic analysis', this book also would be appropriate for geologists, engineers, and technicians who are familiar with the concepts but need a methodical review as well as managers and businesspeople who would like to obtain an understanding of these concepts.

The interpretation of geophysical data in exploration geophysics, well logging, engineering, mining and environmental geophysics requires knowledge of the physical properties of rocks and their correlations. Physical properties are a "key" for combined interpretation techniques. The study of rock physics provides an interdisciplinary treatment of physical properties, whether related to geophysical, geotechnical, hydrological or geological methodology. Physical Properties of Rocks, 2nd Edition, describes the physical fundamentals of rock properties, based on typical experimental results and relevant theories and models. It provides readers with all relevant rock properties and their interrelationships in one concise volume. Furthermore, it guides the reader through experimental and theoretical knowledge in order to handle models and theories in practice. Throughout the book the author focuses on the problems of applied geophysics with respect to exploration and the expanding field of applications in engineering and mining geophysics, geotechnics, hydrology and environmental problems, and the properties under the conditions of the upper Earth crust. Physical Properties of Rocks, Second Edition, guides readers through a systematic presentation of all relevant physical properties and their interrelationships in parallel with experimental and theoretical basic knowledge and a guide for handling core models and theories

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 (V_p) 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.

The material in this volume provides the basic theory necessary to understand the principles behind imaging the subsurface of the Earth using reflection and refraction seismology. For reflection seismology, the end product is a "record section" from a collection of "wiggly traces" that are recorded in the field from which information about the properties of subsurface structure and rock can be derived. For the most part, the principles of imaging are the same regardless of the depth to the target; the same mathematical background is necessary for targeting a shallow water table as for investigating the base of the earth's continental "crust" at a depth of 30-50 km.

This book focuses on using seismic techniques to find oil in specific situations. It looks at variables such as exploration attitude, being competitive, and being affected by deadlines among others.

Presents an advanced overview of Digital Signal Processing and its applications to exploration seismology, for electrical engineers, geophysicists and petroleum professionals.

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.

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

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

This illustration-rich paperback book explains a broad spectrum of seismic data acquisition operations from a fundamental and practical standpoint, ranging from land to marine 2D methods to 3D seismic methods. The book explains why we use the seismic method in exploration and is written in a manner palatable to geologists, field crews, exploration managers, petroleum engineers, and geophysicists. The book is written by a senior lecturer at a university and is ideal for use as a text in education settings. It opens with a brief history of the origins of the seismic method. It explains how to understand what we see on shot records. It examines the problem of noise and how to improve seismic signals using geophone and hydrophone arrays. Other discussions cover land and marine receiver equipment, available energy sources, fundamental stacking methods as an approach to understanding operations of seismic instrumentation, basic geodetic systems, and the use of GPS systems. Each chapter concludes with exercises designed to emphasize problems of recording field data, including setting up survey parameters.

Seismic Exploration Fundamentals Seismic Techniques for Finding Oil Pennwell Corporation High-resolution Seismic Exploration SEG Books

Geophysical techniques apply the principles of physics for study of physical responses of rocks under passive or active perturbation. Geophysical data acquisition, processing and interpretation are driven by established scientific principles. Data from geophysical tools provide coverage with spatially continuous high density measurements. Well data like cores and well logs provide vertically high resolution measurements at the well location, however, the distribution of wells is sparse and discontinuous. The detailed spatial coverage from geophysical data are calibrated with analysis of well logs, pressure tests, cores, geologic depositional knowledge and other information from appraisal wells. The methods use high precision sensors that measure the properties on the earth's surface, in oceans, in wells and from the air, also from satellites. They measure changes of physical properties and calibrate the measured geophysical attributes with rock properties. The data play important role in developing a gross reservoir model. The reservoir architecture or structure and the reservoir rock and fluid properties are derived from the analysis and data integration. Other reservoir properties that can affect geophysical measurements are density, oil viscosity, stresses, and fractures. The interpretation has inherent ambiguity or multiple interpretations. Geophysics contributes to reservoir characterization, reservoir monitoring and its management by adding maximum value in improving production plan and by minimizing risk e.g., risk of dry hole, risk of blow out, risk of in-efficient recovery process, among others. Multiple geologic parameters are assessed with the same geophysical data.

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.

The first edition of this book was a slightly modified version of my dissertation (defended in February 2001). This second edition has been extended considerably. Many technological developments of the past 10 years have been included. Feedback from students attending my course on 3D survey design has helped clarify various not-so-clear discussions in the book. Another major difference is the inclusion of many new figures copied from the literature. Most of the existing figures have been redrawn to comply with the high standards used for figures in Geophysics, and all references are now compiled in a single list. Although the main text for this edition was ready by the end of 2010, some developments in the field of seismic data acquisition that occurred in 2011 and 2012 have still been included. The ideas and results discussed in this book should help one to achieve a better understanding of the structure of 3D acquisition geometries. With this understanding, geophysical requirements can be satisfied with an optimal choice of acquisition geometry and its parameters. Processing techniques can be adapted to honor and exploit the specific requirements of each geometry, especially orthogonal and areal geometries, leading to a more interpretable end product.

This volume presents an overview of the results of a European Union integrated program in which approximately two hundred earth scientists participated, drawn from all fields related to exploration. Two classes of modeling were addressed - geological modeling - the relationship between the conditions of sedimentation and the resulting reservoir conditions; and wave-propagation modeling - the investigation of wave-propagation through media of various degrees of complexity. Wave-propagation modeling was carried out either mathematically or physically with the most modern tools. An important aspect of the project was the inversion of seismic data, that is the determination of the parameters of the medium from observations. This problem is closely related to modeling since it is based on the inversion of the mathematical steps and often uses modeling for verification and updating. The geological data presents novel concepts with a coverage that is both broad in area and in discipline. The geophysical investigations are at the leading edge of current research. Although detailed results have been published separately by investigators, this volume is the only source of reference which summarises the results; but incorporating sufficient detail to enable the reader to follow the scientific reasoning.

This tutorial or practical guide on seismic tomography is aimed at an audience familiar with basic seismology concepts and calculus. The intent is to provide the reader with a fundamental understanding of both seismic ray tomography and seismic diffraction tomography. Case studies illustrate processing methodology, basic interpretation technique, and pitfalls. After reading through this presentation, one will have a greater understanding of and appreciation for seismic tomography articles found in the literature.

A practical handbook for the petroleum geophysicist. Fundamental concepts are explained using heuristic descriptions of seismic modeling, deconvolution, depth migration, and tomography. Pitfalls in processing and contouring are described briefly. Applications include petroleum exploration of carbonate reefs, salt intrusions, and overthrust faults. The book includes past, present, and possible future developments in time-lapse seismology, borehole geophysics, multicomponent seismology, and integrated reservoir characterization.

An essential ingredient for successful 3D seismic survey design is a basic understanding of the spatial properties of the seismic wavefield. These properties were described for 2D seismic data in Seismic Wavefield Sampling by the same author. This book extends the description into the much more complex field of 3D seismic data. A chapter on guidelines for survey design translates theory into practice. Some case histories illustrate the concepts. Noise suppression, resolution, and imaging are discussed in detail. Converted-wave survey design is covered in a separate chapter. This book provides essential knowledge for any acquisition or processing geophysicist and is recommended to everyone dealing with 3D seismic data. An included CD-ROM also contains an Acquisition Design Wizard and survey optimization software.

This combination of textbook and reference manual provides a comprehensive account of gravity and magnetic methods for exploring the subsurface using surface, marine, airborne and satellite measurements. It describes key current topics and techniques, physical properties of rocks and other earth materials, and digital data analysis methods used to process and interpret anomalies for subsurface information. Each chapter starts with an overview and concludes by listing key concepts to consolidate new learning. An accompanying website presents problem sets and interactive computer-based exercises, providing hands-on experience of processing, modeling and interpreting data. A comprehensive online suite of full-color case histories illustrates the practical utility of modern gravity and magnetic surveys. This is an ideal text for advanced undergraduate and graduate courses and reference text for research academics and professional geophysicists. It is a valuable resource for all those interested in petroleum, engineering, mineral, environmental, geological and archeological exploration of the lithosphere.

Öz Yilmaz has expanded his original volume on processing to include inversion and interpretation of seismic data. In addition to the developments in all aspects of conventional processing, this two-volume set represents a comprehensive and complete coverage of the modern trends in the seismic industry-from time to depth, from 3-D to 4-D, from 4-D to 4-C, and from isotropy to anisotropy.

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