
Seismic Data Processing Theory And Practice

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The Seismic Signal and Its Meaning
Fundamentals of Geophysical Data Processing
Digital Imaging and Deconvolution
Practical Seismic Data Analysis
Digital Processing of Geophysical Data
With Applications to Petroleum Prospecting

ERICK MATHEWS

Mathematics for Seismic Data Processing and Interpretation SEG Books

Seismic imaging methods are currently used to produce images of the Earth's subsurface properties at diverse length scales, from high-resolution, near-surface environmental studies for oil and gas exploration to long-period images of the entire planet. This book presents the physical and mathematical basis of imaging algorithms in the context of controlled-source reflection seismology. The approach taken is motivated by physical optics and theoretical seismology. The theory is constantly put into practice via a graded sequence of computer exercises using the widely available SU (Seismic Unix) software package.

3-D Seismic Interpretation Springer

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.

Advanced Digital Signal Processing of Seismic Data John Wiley & Sons

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.

Practical Seismic Interpretation Springer Science & Business Media

This book was primarily written for an audience that has heard about neural networks or has had some experience with the algorithms, but would like to gain a deeper understanding of the fundamental material. For those that already have a solid grasp of how to create a neural network application, this work can provide a wide range of examples of nuances in network design, data set design, testing strategy, and error analysis. Computational, rather than artificial, modifiers are used for neural networks in this book to make a distinction between networks that are implemented in hardware and those that are implemented in software. The term artificial neural network covers any implementation that is inorganic and is the most general term. Computational neural networks are only implemented in software but represent the vast majority of applications. While this book cannot provide a blue print for every conceivable geophysics application, it does outline a basic approach that has been used successfully.

Understanding Amplitudes SEG Books

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

researchers and professionals.

Illustrated Seismic Processing, Volume 2: Preimaging SEG Books

With the growth of modern computing power it has become possible to apply far more mathematics to real problems. This has led to the difficulty that many people who have been working in various jobs suddenly find themselves not understanding the modern processing which is being applied to their own professional field. It also means that the people presently being trained in these subjects need to understand a much wider range of mathematics than in the past. It is to both of these groups that this book is addressed. The major objective is to present the reader with the basic mathematical understanding to follow the new developments in their own field. The mathematics in this book is based on the need to understand signal processing. The modern work in this area is mathematically very sophisticated and our purpose is not to train professional mathematicians but to make far more of the literature accessible. Since this book is based on courses devised for Rascal Geophysics there is clearly going to be a bias towards the applications in that area, as the title implies. It is also true that the bibliography has been chosen in order to aid the reader in that field by pointing them in the direction of recent applications in geophysics.

High-resolution Seismic Exploration Cambridge University Press

Following the breakthrough in the last decade in identifying the key parameters for time and depth imaging in anisotropic media and developing practical methodologies for estimating them from seismic data, this title primarily focuses on the far reaching exploration benefits of anisotropic processing. This volume provides the first comprehensive description of reflection seismic signatures and processing methods in anisotropic media. It identifies the key parameters for time and depth imaging in transversely isotropic media and describes practical methodologies for estimating them from seismic data. Also, it contains a thorough discussion of the important issues of uniqueness and stability of seismic velocity analysis in the presence of anisotropy. The book contains a complete description of anisotropic imaging methods, from the theoretical background

to algorithms to implementation issues. Numerous applications to synthetic and field data illustrate the improvements achieved by the anisotropic processing and the possibility of using the estimated anisotropic parameters in lithology discrimination. *Two-dimensional Transforms* Morgan & Claypool Publishers

Many text books have been written on the subject "Exploration Geophysics". The majority of these texts focus on the theory and the mathematical treatment of the subject matter but lack treatment of practical aspects of geophysical exploration. This text is written in simple English to explain the physical meaning of jargon, or terms used in the industry. It describes how seismic data is acquired in 2-D and 3-D, how they are processed to convert the raw data to seismic vertical and horizontal cross sections, that are geologically meaningful, and how these and other data are interpreted to delineate a prospect. Workshops are included after each chapter and are designed to reinforce learning of the concepts presented. Key Features: Written in simple easy to understand language Heavily illustrated to aid in understanding the text End of chapter "Key words and workshop" The text includes several appendices and answers for the selected workshop problems

Information-Based Inversion and Processing with Applications Cambridge University Press

3-D seismic data have become the key tool used in the petroleum industry to understand the subsurface. In addition to providing excellent structural images, the dense sampling of a 3-D survey makes it possible to map reservoir quality and the distribution of oil and gas. Topics covered in this book include basic structural interpretation and map-making; the use of 3-D visualisation methods; interpretation of seismic amplitudes, including their relation to rock and fluid properties; and the generation and use of AVO and acoustic impedance datasets. This new paperback edition includes an extra appendix presenting new material on novel acquisition design, pore pressure prediction from seismic velocity, elastic impedance inversion, and time lapse seismic. Written by professional geophysicists with many years' experience in the oil industry, the book is indispensable for geoscientists using 3-D seismic data, including graduate students and new entrants into the petroleum industry.

John Wiley & Sons

Acquisition and Processing of Marine Seismic Data Elsevier

Exploration Seismology Cambridge University Press

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.

The Concept of Multishooting Elsevier

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 Processing, Inversion, and Interpretation of Seismic Data Springer Science & Business Media

This short book is for students, professors and professionals interested in signal processing of seismic data using MATLAB . The step-by-step demo of the full reflection seismic data processing workflow using a complete real seismic data set places itself as a very useful feature of the book. This is especially true when students are performing their projects, and when professors and researchers are testing their new developed algorithms in MATLAB for processing seismic data. The book provides the basic seismic and signal processing theory required for each chapter and shows how to process the data from raw field records to a final image of the subsurface all using MATLAB . Table of

Contents: Seismic Data Processing: A Quick Overview / Examination of A Real Seismic Data Set / Quality Control of Real Seismic Data / Seismic Noise Attenuation / Seismic Deconvolution / Carrying the Processing Forward / Static Corrections / Seismic Migration / Concluding Remarks" *Exploration Geophysics* Elsevier

Information-Based Inversion and Processing with Applications examines different classical and modern aspects of geophysical data processing and inversion with emphasis on the processing of seismic records in applied seismology. Chapter 1 introduces basic concepts including: probability theory (expectation operator and ensemble statistics), elementary principles of parameter estimation, Fourier and z-transform essentials, and issues of orthogonality. In Chapter 2, the linear treatment of time series is provided. Particular attention is paid to Wold decomposition theorem and time series models (AR, MA, and ARMA) and their connection to seismic data analysis problems. Chapter 3 introduces concepts of Information theory and contains a synopsis of those topics that are used throughout the book. Examples are entropy, conditional entropy, Burg's maximum entropy spectral estimator, and mutual information. Chapter 4 provides a description of inverse problems first from a deterministic point of view, then from a probabilistic one. Chapter 5 deals with methods to improve the signal-to-noise ratio of seismic records. Concepts from previous chapters are put in practice for designing prediction error filters for noise attenuation and high-resolution Radon operators. Chapter 6 deals with the topic of deconvolution and the inversion of acoustic impedance. The first part discusses band-limited extrapolation assuming a known wavelet and considers the issue of wavelet estimation. The second part deals with sparse deconvolution using various 'entropy' type norms. Finally, Chapter 7 introduces recent topics of interest to the authors. The emphasis of this book is on applied seismology but researchers in the area of global seismology, and geophysical signal processing and inversion will find material that is relevant to the ubiquitous problem of estimating complex models from a limited number of noisy observations. Non-conventional approaches to data processing and inversion are presented Important problems in the area of seismic resolution enhancement are discussed Contains research material that could inspire graduate students and their supervisors to undertake new research directions in applied

seismology and geophysical signal processing
Seismic Data Interpretation using Digital Image Processing
 Elsevier

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.

Processing of Seismic Reflection Data Using MATLAB

Acquisition and Processing of Marine Seismic Data

The purpose of this book is to get a practical understanding of the most common processing techniques in earthquake seismology. The book deals with manual methods and computer assisted methods. Each topic will be introduced with the basic theory followed by practical examples and exercises. There are manual exercises entirely based on the printed material of the book, as well as computer exercises based on public domain software. Most exercises are computer based. The software used, as well as all test data are available from <http://extras.springer.com>. This book is intended for everyone processing earthquake data, both in the observatory routine and in connection with research. Using the exercises, the book can also be used as a basis for university courses in earthquake processing. Since the main emphasis is on processing, the theory will only be dealt with to the extent needed to understand the processing steps, however references will be given to where more extensive explanations can be found.

Includes: • Exercises • Test data • Public domain software (SEISAN) available from <http://extras.springer.com>

Coding and Decoding: Seismic Data SEG Books

This modern introduction to seismic data processing in both exploration and global geophysics demonstrates practical applications through real data and tutorial examples. The underlying physics and mathematics of the various seismic analysis methods are presented, giving students an appreciation of their limitations and potential for creating models of the subsurface. Designed for a one-semester course, this textbook discusses key techniques within the context of the world's ever increasing need for petroleum and mineral resources - equipping upper undergraduate and graduate students with the tools they need for a career in industry. Examples presented throughout the text allow students to compare different methods and can be demonstrated using the instructor's software of choice. Exercises at the end of sections enable students to check their understanding and put the theory into practice and are complemented by solutions for instructors and additional case study examples online to complete the learning package.

Applications of Velocity-stack Methods to Seismic Data Processing
 International Red Cross

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.

Essentials of Geophysical Data Processing Elsevier

This publication originated in 1967 as a few notes to accompany a basic seminar for the Canadian SEG and expanded in 1968 into an SEG Continuing Education course. Old and new information about geophysical data processing is consolidated in this edition. How to choose processes and parameters for any given field data is shown.

Seismic Signatures and Analysis of Reflection Data in Anisotropic Media Springer Science & Business Media

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

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