

INVESTIGATIONS IN GEOPHYSICS NO. **19**

**ELEMENTS OF
3D SEISMOLOGY
THIRD EDITION**

CHRISTOPHER L. LINER



SOCIETY OF EXPLORATION GEOPHYSICISTS

Elements Of 3d Seismology

L Darling-Hammond



Elements Of 3d Seismology:

Elements of 3D Seismology Christopher L. Liner, 2005* Elements of 3D Seismology third edition is a thorough introduction to the acquisition processing and interpretation of 3D seismic data This third edition is a major update of the second edition Sections dealing with interpretation have been greatly revised in accordance with improved understanding and availability of data and software Practice exercises have been added as well as a 3D seismic survey predesign exercise Discussions include conceptual and historical foundations of modern reflection seismology an overview of seismic wave phenomena in acoustic elastic and porous media acquisition principles for land and marine seismic surveys methods used to create 2D and 3D seismic images from field data concepts of dip moveout prestack migration and depth migration concepts and limitations of 3D seismic interpretation for structure stratigraphy and rock property estimation and the interpretation role of attributes impedance estimation and AVO This book is intended as a general text on reflection seismology including wave propagation data acquisition processing and interpretation and will be of interest to entry level geophysicists experts in related fields geology petroleum engineering and experienced geophysicists in one subfield wishing to learn about another e g interpreters wanting to learn about seismic waves or data acquisition *Elements of 3D Seismology, third edition*

Christopher L. Liner, 2016-10-15 Elements of 3D Seismology third edition is a thorough introduction to the acquisition processing and interpretation of 3D seismic data This third edition is a major update of the second edition Sections dealing with interpretation have been greatly revised in accordance with improved understanding and availability of data and software Practice exercises have been added as well as a 3D seismic survey predesign exercise Discussions include conceptual and historical foundations of modern reflection seismology an overview of seismic wave phenomena in acoustic elastic and porous media acquisition principles for land and marine seismic surveys methods used to create 2D and 3D seismic images from field data concepts of dip moveout prestack migration and depth migration concepts and limitations of 3D seismic interpretation for structure stratigraphy and rock property estimation and the interpretation role of attributes impedance estimation and AVO This book is intended as a general text on reflection seismology including wave propagation data acquisition processing and interpretation and will be of interest to entry level geophysicists experts in related fields geology petroleum engineering and experienced geophysicists in one subfield wishing to learn about another e g interpreters wanting to learn about seismic waves or data acquisition *Elements of 3-D Seismology* Christopher L. Liner, 1999

Characterizing it as more eclectic than comprehensive more industrial than academic and more chatty than stuffy Liner geosciences U of Tulsa offers a textbook based on his course He introduces seismic concepts for one and two dimensions then discusses three dimensions from perspectives of hi The Art and Science of Seismic Interpretation Christopher L. Liner, T. A. (Mac) McGilvery, 2019-01-14 This book demystifies that art and science of seismic interpretation for those with and without formal geophysical training From geologists to managers and investors The Art and Science of Seismic

Interpretation is a guide to what seismic data is how it is interpreted and what it can deliver *Fundamentals of Geophysical Interpretation* Laurence R. Lines, Rachel Therese Newrick, 2004 Fundamentals of Geophysical Interpretation SEG Geophysical Monograph Series No 13 is 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 **Seismic Data Interpretation using Digital Image Processing** Abdullatif A. Al-Shuhail, Saleh A. Al-Dossary, Wail A. Mousa, 2017-06-05 Bridging the gap between modern image processing practices by the scientific community at large and the world of geology and reflection seismology This book covers the basics of seismic exploration with a focus on image processing techniques as applied to seismic data Discussions of theories concepts and algorithms are followed by synthetic and real data examples to provide the reader with a practical understanding of the image processing technique and to enable the reader to apply these techniques to seismic data The book will also help readers interested in devising new algorithms software and hardware for interpreting seismic data Key Features Provides an easy to understand overview of popular seismic processing and interpretation techniques from the point of view of a digital signal processor Presents image processing concepts that may be readily applied directly to seismic data Includes ready to run MATLAB algorithms for most of the techniques presented The book includes essential research and teaching material for digital signal and image processing individuals interested in learning seismic data interpretation from the point of view of digital signal processing It is an ideal resource for students professors and working professionals who are interested in learning about the application of digital signal processing theory and algorithms to seismic data **Atlas of Structural Geological Interpretation from Seismic Images** Achyuta Ayan Misra, Soumyajit Mukherjee, 2018-02-22 This comprehensive book deals primarily with reflection seismic data in the hydrocarbon industry It brings together seismic examples from North and South America Africa Europe Asia and Australia and features contributions from eleven international authors who are experts in their field It provides structural geological examples with full color illustrations and explanations so that students and industry professionals can get a better understanding of what they are being taught It also shows seismic images in black and white print and covers compression related structures Representing a compilation of examples for different types of geological structures Atlas of Structural Geological Interpretation from Seismic Images is a quick guide to finding analogous structures It provides extensive coverage of seismic expression of different geological structures faults folds mobile substrates shale and salt tectonic and regional structures and common pitfalls in interpretation The book also includes an uninterpreted seismic section for every interpreted section so that readers can feel free to draw their own conclusion as per their conceptualization Provides authoritative source of methodologies for seismic

interpretation Indicates sources of uncertainty and give alternative interpretations Directly benefits those working in petroleum industries Includes case studies from a variety of tectonic regimes Atlas of Structural Geological Interpretation from Seismic Images is primarily designed for graduate students in Earth Sciences researchers and new entrants in industry who are interested in seismic interpretation Principles of Petroleum Geoscience Ashok Vaidya,2025-02-20 Principles of Petroleum Geoscience offers a comprehensive exploration of essential concepts and methodologies in the field Authored by experts we bridge geology geophysics engineering and environmental science providing an interdisciplinary perspective Our topics span sedimentary basin analysis reservoir characterization seismic interpretation and well logging along with the latest advancements in research and technology We present real world examples and case studies to illustrate practical applications in petroleum exploration and production helping readers grasp complex ideas through practical insights With up to date content this resource is invaluable for students researchers and professionals in petroleum geoscience equipping them to meet modern challenges in hydrocarbon exploration and development **Tensor Computation for Seismic Data Processing** Feng Qian,Shengli Pan,Gulan Zhang,2025-04-26 This book aims to provide a comprehensive understanding of tensor computation and its applications in seismic data analysis exclusively catering to seasoned researchers graduate students and industrial engineers alike Tensor emerges as a natural representation of multi dimensional modern seismic data and tensor computation can help prevent possible harm to the multi dimensional geological structure of the subsurface that occurred in classical seismic data analysis It delivers a wealth of theoretical computational technical and experimental details presenting an engineer s perspective on tensor computation and an extensive investigation of tensor based seismic data analysis techniques Embark on a transformative exploration of seismic data processing unlock the potential of tensor computation and reshape your approach to high dimensional geological structures The discussion begins with foundational chapters providing a solid background in both seismic data processing and tensor computation The heart of the book lies in its seven chapters on tensor based seismic data analysis methods From structured low tubal rank tensor completion to cutting edge techniques like tensor deep learning and tensor convolutional neural networks each method is meticulously detailed The superiority of tensor based data analysis methods over traditional matrix based data analysis approaches is substantiated through synthetic and real field examples showcasing their prowess in handling high dimensional modern seismic data Notable chapters delve into seismic noise suppression seismic data interpolation and seismic data super resolution using advanced tensor models The final chapter provides a cohesive summary of the conclusion and future research directions ensuring readers facilitate a thorough understanding of tensor computation applications in seismic data processing The appendix includes a hatful of information on existing tensor computation software enhancing the book s practical utility Extraterrestrial Seismology Vincent C. H. Tong,Rafael A. García,2015-06-25 Seismology is a highly effective tool for investigating the internal structure of the Earth Similar techniques have also successfully been used to

study other planetary bodies planetary seismology the Sun helioseismology and other stars asteroseismology Despite obvious differences between stars and planetary bodies these disciplines share many similarities and together form a coherent field of scientific research This unique book takes a transdisciplinary approach to seismology and seismic imaging reviewing the most recent developments in these extraterrestrial contexts With contributions from leading scientists this timely volume systematically outlines the techniques used in observation data processing and modelling for asteroseismology helioseismology and planetary seismology drawing comparisons with seismic methods used in geophysics Important recent discoveries in each discipline are presented With an emphasis on transcending the traditional boundaries of astronomy solar planetary and Earth sciences this novel book is an invaluable resource and reference for undergraduates postgraduates and academics

Encyclopedia of Solid Earth Geophysics Harsh Gupta, 2011-06-29 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

Handbook of Poststack Seismic Attributes Arthur E. Barnes, 2016-10-15 The Handbook of Poststack Seismic Attributes is a general reference for poststack seismic attributes It discusses their theory meaning computation and application with the goal of improving understanding so that seismic attributes can be applied more effectively The chapters of the book build upon each other and progress from basic attributes to more involved methods The book introduces the ideas that underlie seismic attributes and reviews their history from their origins to current developments It examines attribute maps and interval statistics complex trace attributes 3D attributes that quantify aspects of geologic structure and stratigraphy primarily dip azimuth curvature reflection spacing and parallelism seismic discontinuity attributes derived through variances or differences spectral decomposition thin bed analysis and waveform classification the two poststack methods that purportedly record rock properties relative acoustic impedance through recursive inversion and Q estimation through spectral ratioing and multiattribute analysis through volume blending

cross plotting principal component analysis and unsupervised classification The book ends with an overview of how seismic attributes aid data interpretation and discusses bright spots frequency shadows faults channels diapirs and data reconnaissance A glossary provides definitions of seismic attributes and methods and appendices provide background mathematics The book is intended for reflection seismologists engaged in petroleum exploration including seismic data interpreters data processors researchers and students *Seismic Hydrocarbon Exploration* Hamid N. Alsadi, 2016-08-26

This book presents the essential principles and applications of seismic oil exploration techniques It concisely covers all stages in exploration activities data field acquisition data processing and interpretation supplementing the main text with a wealth of 350 illustrations and figures The book concentrates on the physics of the applied principles avoiding intricate mathematical treatment and lengthy theoretical reasoning A further prominent feature is the inclusion of a separate chapter on 3D surveying techniques and another equally important chapter on seismic digital signals and the aliasing problem which is presented in an accessible form The book is designed to meet the needs of both the academic and industrial worlds University students and employees of oil exploration companies alike will find the book to be a valuable resource **Digital Imaging and Deconvolution** Enders A. Robinson, Sven Treitel, 2008 Digital Imaging and Deconvolution The ABCs of Seismic Exploration and Processing SEG Geophysical References Series No 15 covers the basic ideas and methods used in seismic processing concentrating on the fundamentals of seismic imaging and deconvolution Most chapters are followed by problem sets Some exercises supplement textual material others are meant to stimulate classroom discussions Text and exercises deal mostly with simple examples that can be solved with nothing more than pencil and paper The book covers 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 provides a detailed mathematical overview Digital Imaging and Deconvolution nominated for the Association of Earth Science Editors award for best geoscience publication of 2008 2009 will interest professional geophysicists 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 The methods described are important in optical imaging video imaging medical and biological imaging acoustical analysis radar and sonar **A Primer on Machine Learning in Subsurface Geosciences** Shuvajit Bhattacharya, 2021-05-03 This book provides readers with a timely review and discussion of the success promise and perils of machine learning in geosciences It explores the fundamentals of data science and machine learning and how their advances have disrupted the traditional workflows used in the industry and academia including geology geophysics petrophysics geomechanics and geochemistry It then presents the real world applications and explains that while this disruption has affected the top level executives

geoscientists as well as field operators in the industry and academia machine learning will ultimately benefit these users The book is written by a practitioner of machine learning and statistics keeping geoscientists in mind It highlights the need to go beyond concepts covered in STAT 101 courses and embrace new computational tools to solve complex problems in geosciences It also offers practitioners researchers and academics insights into how to identify develop deploy and recommend fit for purpose machine learning models to solve real world problems in subsurface geosciences **Digital**

Terrain Analysis, Third Edition Igor Florinsky,2025-01-10 Digital Terrain Analysis Third Edition synthesizes knowledge on methods and applications of digital terrain analysis and geomorphometry in the context of multi scale problems in soil science geology and polar research Divided into four parts the book examines the main concepts principles and methods of digital terrain modeling methods for analysis modeling and mapping of spatial distribution of soil properties techniques for recognition analysis and interpretation of topographically manifested geological features and finally polar research This new release provides a theoretical and methodological basis for understanding and applying geographical modeling techniques Presents an integrated and unified view of digital terrain analysis in both soil science and geology Includes a rigorous description of the mathematical principles of digital terrain analysis Provides both a theoretical and methodological basis for understanding and applying geographical modeling Contain a new section on Digital Terrain Modeling in polar research as well as updated information methods and figures from previous editions **Seismic Wave Theory** Edward S.

Krebes,2019-03-28 Concise textbook on seismic wave theory with detailed derivations of formulas clear explanations of topics exercises and selected answers **Digital Terrain Analysis in Soil Science and Geology** Igor Florinsky,2016-07-11

Digital Terrain Analysis in Soil Science and Geology Second Edition synthesizes the knowledge on methods and applications of digital terrain analysis and geomorphometry in the context of multi scale problems in soil science and geology Divided into three parts the book first examines main concepts principles and methods of digital terrain modeling It then looks at methods for analysis modeling and mapping of spatial distribution of soil properties using digital terrain analysis before finally considering techniques for recognition analysis and interpretation of topographically manifested geological features Digital Terrain Analysis in Soil Science and Geology Second Edition is an updated and revised edition providing both a theoretical and methodological basis for understanding and applying geographical modeling techniques Presents an integrated and unified view of digital terrain analysis in both soil science and geology Features research on new advances in the field including DEM analytical approximation analytical calculation of local morphometric variables morphometric globes and two dimensional generalized spectral analytical methods Includes a rigorous description of the mathematical principles of digital terrain analysis Provides both a theoretical and methodological basis for understanding and applying geographical modeling

Ground-Penetrating Radar for Archaeology Lawrence B. Conyers,2023-09-05 Ground penetrating radar is a near surface geophysical technique that can provide three dimensional maps and other images of buried archaeological features and

associated stratigraphy in a precise way This revised edition by the expert in the field provides the basics of the physics chemistry geology and archaeology in a clear fashion unburdened by complex equations or theory Additions to the fourth edition include Updates to recent hardware and software advances in three dimensional antenna array systems and antenna offset technology Expanded data processing methods that explains how to get more from your raw data with examples to show why this is necessary and the results obtained Expanded examples from around the world and in various environmental settings that explains how non traditional data analysis steps can provide clarity to results in ways that are not usually done with traditional The reader will be able to understand how the latest equipment and software and the results of data collection and processing can be used effectively in a number of different settings Both potential pitfalls and successes and the reasons for them are discussed With over 100 images and important tables and graphs this book is a useful reference in the field and for data processing in GPR

Theoretical and Computational Seismology Jeroen Tromp, 2025-07-01 An authoritative self contained reference text on theoretical and computational seismology Over the past several decades computational advances have revolutionized seismology making it possible to simulate seismic wave propagation in complex Earth models and create detailed images of the planet s interior This cutting edge text introduces students and scholars to the fundamentals techniques and applications of this exciting field of research and discovery After establishing a strong foundation in continuum mechanics the book presents the fundamentals of theoretical seismology providing a basis for subsequent forward and inverse modeling grounded in numerical methods and then focuses on computational seismology investigating numerical solutions to seismic wave equations The adjoint state method is covered next along with applications of this technique to waveform inversions across scales after which the book concludes with a set of appendixes that provide a primer to differential geometry and tensor calculus which are used throughout the book to explain the fundamental concepts of deformation strain and stress from both Eulerian and Lagrangian perspectives Including over 150 student tested exercises the book is an essential resource for motivated students and scholars seeking to master the state of the art of theoretical and computational seismology Establishes a strong foundation through a geometric analysis of continuum mechanics Reveals how linearizing the resulting equations of motion enables the simulation of seismic wave propagation across nine decades of frequencies and wavelengths Demonstrates how to leverage the capabilities of simulations to create detailed tomographic images from the information embedded in seismographic recordings Covers diverse application areas including seismology helioseismology underwater acoustics medical imaging and nondestructive testing Features a wealth of exercises with online solutions Includes a comprehensive set of appendixes on differential geometry and tensor calculus An ideal textbook for graduate students studying theoretical seismology computational seismology or optimization and inverse problems An essential reference for researchers and scholars

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