Computational Electromagnetics And Model Based Inversion A Modern Paradigm For Eddy Current Nondestructive Evaluation Scientific Computation

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Computational Geo-Electromagnetics Viacheslav V. Spichak 2020-02-01 Computational Geo-Electromagnetics: Methods, Models, and Forecasts, Volume Five in the Computational Geophysics series, is devoted to techniques for building of geoelectrical models from electromagnetic data, featuring Bayesian statistical analysis and neural network algorithms. These models are applied to studying the geoelectrical structure of famous volcanoes (i.e., Vesuvio, Kilauea, Elbrus, Komagatake, Hengill) and geothermal zones (i.e., Travale, Italy; Soultz-sous-Forets, Elsace). Methodological recommendations are given on electromagnetic sounding of faults as well as geothermal and hydrocarbon reservoirs. Techniques for forecasting of petrophysical properties from the electrical resistivity as proxy parameter are also considered. Computational Geo-Electromagnetics: Methods, Models, and Forecasts offers techniques and algorithms for building geoelectrical models under conditions of rare or irregularly distributed EM data and/or lack of prior geological and geophysical information. This volume also includes methodological guidelines on interpretation of electromagnetic sounding data depending on goals of the study. Finally, it details computational algorithms for using electrical resistivity for properties beyond boreholes. Provides algorithms for inversion of incomplete, rare or irregularly distributed EM data Features methodological issues of building geoelectrical models Offers techniques for retrieving petrophysical properties from EM sounding data and well logs

Nightside Electromagnetic Response of the Moon Gerald Schubert 1972 The electromagnetic response of the Moon to excitation by the time dependent fluctuations of the interplanetary magnetic field is given for the dark or antisolar hemisphere of the Moon.

Electromagnetic Nondestructive Evaluation H. G. Ramos 2017-06-02 Electromagnetic Nondestructive Evaluation (ENDE) provides an important method for assessing the condition of objects by observing the electromagnetic response to electric currents and/or magnetic fields introduced within them. Because it does not permanently alter the objects being tested, it is an invaluable tool for product evaluation, troubleshooting and research, and is employed in many fields from engineering and medicine to art.This volume presents

selected papers from the International Workshop on Electromagnetic Nondestructive Evaluation (ENDE2016), held in Lisbon, Portugal, in September 2016. This 21st edition of the workshop focused on the theoretical and application research into methods of electromagnetic non-destructive evaluation and, like previous editions, provided a forum for exchanging ideas and discussing recent developments. The book is divided into 6 sections which cover advanced ENDE sensors; material characterization; new developments; analytical and numerical modeling; inverse problems; signal processing; monitoring and diagnosis of mechanical structures; and innovative industrial applications of ENDE.Providing an overview of recent research and developments in the field, the book will be of interest to all those involved in ENDE research or applying it in their work.

Electromagnetic Nondestructive Evaluation (XII) Y.-K. Shin 2009-07-20 The 13th International Workshop on Electromagnetic Nondestructive Evaluation (ENDE) was held at the Seoul Education and Culture Center, Korea in June 2008. Electromagnetic Nondestructive Evaluation (XII) contains the proceedings of this workshop. 51 research papers present the latest research in topics ranging from ENDE in nuclear power plants, eddy current testing, modeling, material characterization, to inverse problem and imaging and the application of electromagnetic nondestructive techniques.

Statistical Inversion of Electromagnetic Logging Data Qiuyang Shen 2020-08-27 This book presents a comprehensive introduction to well logging and the inverse problem. It explores challenges such as conventional data processing methods ' inability to handle local minima issues, and presents the explanations in an easy-to-follow way. The book describes statistical data interpretation by introducing the fundamentals behind the approach, as well as a range of sampling methods. In each chapter, a specific method is comprehensively introduced, together with representative examples. The book begins with basic information on well logging and logging while drilling, as well as a definition of the inverse problem. It then moves on to discuss the fundamentals of statistical inverse methods, Bayesian inference, and a new sampling method that can be used to supplement it, the hybrid Monte Carlo method. The book then addresses a specific problem in the inversion of downhole logging data, and the interpretation of earth model complexity, before concluding with a meta-technique called the tempering method, which serves as a supplement to statistical sampling methods. Given its scope, the book offers a valuable reference guide for drilling engineers, well logging tool physicists, and geoscientists, as well as students in the areas of petroleum engineering and electrical engineering.

Nonlinear Electromagnetic Systems A. J. Moses 1996 The book covers classical and practical approaches to electromagnetic field solutions in magnetic devices. The following topics are addressed: Advanced computional techniques; Intelligent computer aided design; Magnetic materials; Inverse problems; Magnetic sensors and transducers; Performance and optimisation of devices; Applications to electronic systems; Modelling of non-linear systems and other related topics. This volume presents 200 of the best articles presented at the International Symposium on Non-Linear Electromagnetic Systems (ISEM in Cardiff, Wales). The previous ISEM papers were published in the successful volume Advanced Computational and Design Techniques in Applied Electromagnetic Systems (by Elsevier).Main chapters in this book are: Electromagnetic Devices: Non-linearities at contacts and interfaces in semiconductor structures by R.H. Williams as key-note. Optimisation, Inverse and Biological Studies: Power loss testing; intelligent computation of optimization of metal cutting; grid methods for CFD and CEM. Magnetic Materials: Materials for circuit semilator applications; rotational magnetostriction. Computational Techniques and Modelling: Electromagnetic device design; soft magnetic materials; engineering application of artificial intelligence. Sensors and Non-destructive Testing: Eddy current nondestructive evaluation; nonlinear magnetoresistance; micro magnetic sensor. Electronic and Electrical Applications: Non-linear transistor parameters; superconducting magnets.

Seismic Reservoir Modeling Dario Grana 2021-05-04 Seismic reservoir characterization aims to build

3-dimensional models of rock and fluid properties, including elastic and petrophysical variables, to describe and monitor the state of the subsurface for hydrocarbon exploration and production and for CO2 sequestration. Rock physics modeling and seismic wave propagation theory provide a set of physical equations to predict the seismic response of subsurface rocks based on their elastic and petrophysical properties. However, the rock and fluid properties are generally unknown and surface geophysical measurements are often the only available data to constrain reservoir models far away from well control. Therefore, reservoir properties are generally estimated from geophysical data as a solution of an inverse problem, by combining rock physics and seismic models with inverse theory and geostatistical methods, in the context of the geological modeling of the subsurface. A probabilistic approach to the inverse problem provides the probability distribution of rock and fluid properties given the measured geophysical data and allows quantifying the uncertainty of the predicted results. The reservoir characterization problem includes both discrete properties, such as facies or rock types, and continuous properties, such as porosity, mineral volumes, fluid saturations, seismic velocities and density. Seismic Reservoir Modeling: Theory, Examples and Algorithms presents the main concepts and methods of seismic reservoir characterization. The book presents an overview of rock physics models that link the petrophysical properties to the elastic properties in porous rocks and a review of the most common geostatistical methods to interpolate and simulate multiple realizations of subsurface properties conditioned on a limited number of direct and indirect measurements based on spatial correlation models. The core of the book focuses on Bayesian inverse methods for the prediction of elastic petrophysical properties from seismic data using analytical and numerical statistical methods. The authors present basic and advanced methodologies of the current state of the art in seismic reservoir characterization and illustrate them through expository examples as well as real data applications to hydrocarbon reservoirs and CO2 sequestration studies.

Eddy-Current Nondestructive Evaluation Nicola Bowler 2019-08-01 This book covers the topic of eddy current nondestructive evaluation, the most commonly practiced method of electromagnetic nondestructive evaluation (NDE). It emphasizes a clear presentation of the concepts, laws and relationships of electricity and magnetism upon which eddy current inspection methods are founded. The chapters include material on signals obtained using many common eddy current probe types in various testing environments. Introductory mathematical and physical concepts in electromagnetism are introduced in sufficient detail and summarized in the Appendices for easy reference. Worked examples and simple calculations that can be done by hand are distributed throughout the text. These and more complex end-of-chapter examples and assignments are designed to impart a working knowledge of the connection between electromagnetic theory and the practical measurements described. The book is intended to equip readers with sufficient knowledge to optimize routine eddy current NDE inspections, or design new ones. It is useful for graduate engineers and scientists seeking a deeper understanding of electromagnetic methods of NDE than can be found in a guide for practitioners.

Clutter Removal and Inversion of Eddy-Current Impedance Data (Postprint). 2006 A wide variety of problems in computational electromagnetics have been successfully solved using a volume-integral approach along with conjugate-gradient methods. The volume integral algorithm is particularly well suited to the notion of model-based inversion of eddy-current impedance data in the arena of quantitative nondestructive evaluation (NDE). The first step in preparing data for inversion is to remove 'clutter, ' which can originate in systematic measurement errors, or simply be a large background signal. In this paper we develop a systematic analytical technique to remove such clutter, which then allows the resulting impedance data to be fed into a nonlinear least-squares inversion algorithm, NLSE. The computational engine for the analysis is VIC-3D, a proprietary volume-integral code.

Electromagnetic Nondestructive Evaluation (VII) Gerd Dobmann 2006 "The aim of this selection of papers is to bring together researchers working very deep in the basics of electromagnetic NDT on one hand

and industrialist discussing their practical problems on the other hand. The papers cover topics as; Microwave applications and Material Characterization; General Eddy Current Inspection Tasks; Novel Techniques and Sensors; Magnetic Flux leakage Inspection; Steam Generator Eddy Current Inspection Tasks; and Material Characterization. Especially Novel Techniques and Sensors and Material Characterization are discussed on multiple papers. This publication gives a good overview of the many scientific problems in this area, but also explains the actual challenges for the scientific-technical community, like problems with in-line inspection of pipelines or the enhancing of the inspection performance in steam generator tubes inspection in the nuclear field. The material is important for scientists and engineers working in the field of electromagnetic non-destructive testing, in defect detection and sizing, as well as in material characterization."

Scientific Modeling and Simulations Sidney Yip 2010-04-07 Although computational modeling and simulation of material deformation was initiated with the study of structurally simple materials and inert environments, there is an increasing demand for predictive simulation of more realistic material structure and physical conditions. In particular, it is recognized that applied mechanical force can plausibly alter chemical reactions inside materials or at material interfaces, though the fundamental reasons for this chemomechanical coupling are studied in a material-speci c manner. Atomistic-level s- ulations can provide insight into the unit processes that facilitate kinetic reactions within complex materials, but the typical nanosecond timescales of such simulations are in contrast to the second-scale to hour-scale timescales of experimentally accessible or technologically relevant timescales. Further, in complex materials these key unit processes are “ rare events ” due to the high energy barriers associated with those processes. Examples of such rare events include unbinding between two proteins that tether biological cells to extracellular materials [1], unfolding of complex polymers, stiffness and bond breaking in amorphous glass bers and gels [2], and diffusive hops of point defects within crystalline alloys [3].

Joint Integration of Time-lapse Seismic, Electromagnetic and Production Data for Reservoir Monitoring and Management Jaehoon Lee 2015 Joint integration of time-lapse seismic, time-lapse electromagnetic, and production data can provide a powerful means of characterizing and monitoring reservoirs. Those data contain complementary information about the changes in the reservoir during operation, and, thus, their proper integration can lead to more reliable forecasts and optimal decisions in reservoir management. This dissertation focuses on developing workflows to jointly integrate time-lapse seismic, electromagnetic, and production data because this task is significantly time-consuming and very challenging. The first part of the thesis addresses a quick and efficient method, which can provide a tool for locating the changes in the reservoir and assessing the uncertainty associated with the estimation quantitatively. The developed workflow, termed statistical integration workflow, utilizes well logs to link reservoir properties with seismic and electromagnetic data by building the joint probability distribution. A new upscaling method from well logs to the scales of seismic and electromagnetic measurements is established using multiple-point geostatistical simulation. The statistical integration workflow is applied to facies classification and the detection of depleted regions. Stochastic optimization is also investigated in this dissertation. As the joint optimization of time-lapse seismic, electromagnetic, and production data requires a huge amount of computational time, we formulate a new algorithm, the probabilistic particle swarm optimization (Pro-PSO). This algorithm is designed to alleviate the time-consuming job by parallel computations of multiple candidate models and the improvement of models based on information sharing. More importantly, any probabilistic priors, such as geological information, can be incorporated into the algorithm. Applications are investigated for a synthetic example of seismic inversion and flow history matching of a Gaussian porosity field, parameterized by its spatial principal components. The result validates the effectiveness of Pro-PSO as compared with conventional PSO. Another version of Pro-PSO for discrete parameters, called Pro-DPSO, is also developed where particles (candidate models) move in the probability mass function space instead of the

parameter space. Then, Pro-DPSO is hybridized with a multiple-point geostatistical algorithm, the single normal equation algorithm (SNESIM) to preserve non-Gaussian geological features. This hybridized algorithm (Pro-DPSO-SNESIM) is evaluated on a synthetic example of seismic inversion and compared with a Markov chain Monte Carlo (MCMC) optimization method. The algorithms Pro-DPSO and Pro-DPSO-SNESIM provide not only optimized models but also optimized probability mass functions (pmf) of parameters. Therefore, it also presents the variations of realizations sampled from the optimized pmfs. Lastly, we introduce the specialization workflow of Pro-PSO algorithms for the joint integration of time-lapse seismic, time-lapse electromagnetic, and production data. In this workflow, the particles of Pro-PSO are divided into several groups, and each group is specialized in the evaluation of a particular type of data misfit. Dividing up the objective function components among different groups of particles allows the algorithm to take advantage of situations where different forward simulators for each type of data require very different computational times per iteration. The optimization is implemented by sharing multiple best models from each type of data misfit, not by sharing a single best model based on the sum (or other combinations) of all the misfits. The "divide-and-conquer" workflow is evaluated on two synthetic cases of joint integration showing that it is much more efficient than an equivalent conventional workflow minimizing an integrated objective function.

Computational Methods in Geophysical Electromagnetics Eldad Haber 2014-12-11 This monograph provides a framework for students and practitioners who are working on the solution of electromagnetic imaging in geophysics. Bridging the gap between theory and practical applied material (for example, inverse and forward problems), it provides a simple explanation of finite volume discretization, basic concepts in solving inverse problems through optimization, a summary of applied electromagnetics methods, and MATLAB??code for efficient computation.

Electromagnetic Nondestructive Evaluation XXII A. Tamburrino 2019-12-11 The use of electromagnetic nondestructive evaluation has grown significantly in recent years. This valuable technique enables the assessment of objects by observing the electromagnetic response to electric currents and/or magnetic fields introduced within them. This book presents the proceedings of the 23rd International Workshop on Electromagnetic Nondestructive Evaluation (ENDE2018), held in Detroit, Michigan, USA, from 9 - 13 September 2018. The workshop provides an international forum for the exchange of information on state-of-the-art technologies and development in electromagnetic nondestructive evaluation, and the 19 papers presented here cover topics including sensors; modeling; signal processing; inverse problems; materials state awareness and characterization; damage diagnosis and prognosis; biomedical applications; and innovative industrial applications of eNDE. Providing a comprehensive overview of current theoretical and applied research into electromagnetic nondestructive evaluation (eNDE) methods, the book will be of interest to all those whose work involves the non-destructive evaluation of objects, whatever their field.

Civil Engineering Applications of Ground Penetrating Radar Andrea Benedetto 2015-04-07 This book, based on Transport and Urban Development COST Action TU1208, presents the most advanced applications of ground penetrating radar (GPR) in a civil engineering context, with documentation of instrumentation, methods and results. It explains clearly how GPR can be employed for the surveying of critical transport infrastructure, such as roads, pavements, bridges and tunnels and for the sensing and mapping of underground utilities and voids. Detailed attention is also devoted to use of GPR in the inspection of geological structures and of construction materials and structures, including reinforced concrete, steel reinforcing bars and pre/post-tensioned stressing ducts. Advanced methods for solution of electromagnetic scattering problems and new data processing techniques are also presented. Readers will come to appreciate that GPR is a safe, advanced, non destructive and noninvasive imaging technique that can be effectively used for the inspection of composite structures and the performance of diagnostics relevant to the entire life cycle of civil engineering works.

Electromagnetic Non-Destructive Evaluation (XXIII) G.Y. Tian 2020-11-03 Electromagnetic Non-destructive Evaluation (ENDE) is an invaluable, non-invasive diagnostic tool for the inspection, testing, evaluation and characterization of materials and structures. It has now become indispensible in a number of diverse fields ranging from biomedics to many branches of industry and engineering. This book presents the proceedings of the 24th International Workshop on Electromagnetic Nondestructive Evaluation, held in Chengdu, China from 11 - 14 September 2019. The 38 peer-reviewed and extended contributions included here were selected from 45 original submissions, and are divided into 7 sections: eddy current testing and evaluation; advanced sensors; analytical and numerical modeling; material characterization; inverse problem and signal processing; artificial intelligence in ENDE; and industrial applications of ENDE. The papers cover recent studies concerning the progress and application of electromagnetic (EM) fields in the non-destructive examination of materials and structures, and topics covered include evaluations at a micro-structural level, such as correlating the magnetic properties of a material with its grain structure, and a macroscopic level, such as techniques and applications for EM NDT&E. Recent developments and emerging materials such as advanced EM sensors, multi-physics NDT&E, intelligent data management and maintaining the integrity of structures are also explored. The book provides a current overview of developments in ENDE, and will be of interest to all those working in the field.

1998 IEEE Antennas and Propagation International Symposium IEEE Antennas and Propagation Society. International Symposium 1998 The importance of cellular and portable communications systems is reflected in the many papers presented on compact antennas and their performance characteristics. The interest in direct satellite communications links at microwave and millimeter wavelengths with near-field effects of the user are presented. Indoor antennas for wireless computer, peripheral, and network interconnection are also described.

Electromagnetic Nondestructive Evaluation (XIII) Jeremy Knopp 2010

Microwave Imaging Methods and Applications Matteo Pastorino 2018-06-30 Microwave Imaging Methods and Applications provides practitioners and researchers with a complete overview of the latest and most important noninvasive and nondestructive techniques for inspecting structures and bodies by using microwaves. Placing emphasis on applications, the book considers many areas, from medical imaging and security··· to industrial engineering and subsurface prospection. For each application, readers are presented with the objectives of the inspection and related challenges. Moreover, this groundbreaking resource details computational methods that can be used to solve inverse problems related to specific applications. Including clear examples or the most significant practical results, this forward-looking reference focuses on systems that have been recently developed. Professionals gain the knowledge needed to compare imaging methods used in different applications and develop new uses of imaging apparatuses and systems.

Electromagnetic Non-Destructive Evaluation (XXI) D. Lesselier 2018-05-25 Electromagnetic Nondestructive Evaluation (ENDE) is a technique crucial to a great many engineering activities, as well as to environmental evaluation and protection issues. It is a discipline recognized for its theoretical insight, efficient models and simulations, robust data interpretation, and accurate instrumentation. This book presents contributions from the 22nd ENDE International Workshop, held in Saclay, France, in September 2017. It includes 1 of the 3 keynotes and 34 peer-reviewed and extended versions of the 47 oral contributions delivered during the workshop. Topics covered include static to THz electromagnetic; smart models and high-performance computations; advanced sensors; adaptive databases; model selection and the qualification of uncertainty; multi-sensor data fusion; the monitoring and diagnosis of mechanical structures; and innovative industrial applications. The book will be of interest to all those whose work involves the development or use of electromagnetic non-destructive evaluation.

Scattering, Two-Volume Set E. R. Pike 2001-10-09 Scattering is the collision of two objects that results in a change of trajectory and energy. For example, in particle physics, such as electrons, photons, or neutrons are

"scattered off" of a target specimen, resulting in a different energy and direction. In the field of electromagnetism, scattering is the random diffusion of electromagnetic radiation from air masses is an aid in the long-range sending of radio signals over geographic obstacles such as mountains. This type of scattering, applied to the field of acoustics, is the spreading of sound in many directions due to irregularities in the transmission medium. Volume I of Scattering will be devoted to basic theoretical ideas, approximation methods, numerical techniques and mathematical modeling. Volume II will be concerned with basic experimental techniques, technological practices, and comparisons with relevant theoretical work including seismology, medical applications, meteorological phenomena and astronomy. This reference will be used by researchers and graduate students in physics, applied physics, biophysics, chemical physics, medical physics, acoustics, geosciences, optics, mathematics, and engineering. This is the first encyclopedic-range work on the topic of scattering theory in quantum mechanics, elastodynamics, acoustics, and electromagnetics. It serves as a comprehensive interdisciplinary presentation of scattering and inverse scattering theory and applications in a wide range of scientific fields, with an emphasis, and details, up-to-date developments. Scattering also places an emphasis on the problems that are still in active current research. The first interdisciplinary reference source on scattering to gather all world expertise in this technique Covers the major aspects of scattering in a common language, helping to widening the knowledge of researchers across disciplines The list of editors, associate editors and contributors reads like an international Who's Who in the interdisciplinary field of scattering

Near-surface Geophysics Dwain K. Butler 2005

Introduction to Controlled-Source Electromagnetic Methods Anton Ziolkowski 2019-03-07 An introduction to the theory and practical application of CSEM methods to explore whether subsurface structures contain hydrocarbons.

Multifrequency Electromagnetic Data Interpretation for Subsurface Characterization Siddharth Misra 2021-07-13 Multifrequency Electromagnetic Data Interpretation for Subsurface Characterization focuses on the development and application of electromagnetic measurement methodologies and their interpretation techniques for subsurface characterization. The book guides readers on how to characterize and understand materials using electromagnetic measurements, including dielectric permittivity, resistivity and conductivity measurements. This reference will be useful for subsurface engineers, petrophysicists, subsurface data analysts, geophysicists, hydrogeologists, and geoscientists who want to know how to develop tools and techniques of electromagnetic measurements and interpretation for subsurface characterization. Includes case studies to add additional color to the presented content Provides codes for the mechanistic modeling of multi-frequency conductivity and relative permittivity of porous geomaterials Presents detailed descriptions of multifrequency electromagnetic data interpretation models and inversion algorithm

Electromagnetic Computation Methods for Lightning Surge Protection Studies Yoshihiro Baba 2016-02-02 Presents current research into electromagnetic computationtheories with particular emphasis on Finite-Difference Time-DomainMethod This book is the first to consolidate current research and toexamine the theories of electromagnetic computation methods inrelation to lightning surge protection. The authors introduceand compare existing electromagnetic computation methods such asthe method of moments (MOM), the partial element equivalent circuit(PEEC), the finite element method (FEM), the transmission-linemodeling (TLM) method, and the finite-difference time-domain (FDTD)method. The application of FDTD method to lightningprotection studies is a topic that has matured through manypractical applications in the past decade, and the authors explainthe derivation of Maxwell ’ s equations required by the FDTD,and modeling of various electrical components needed in computinglightning electromagnetic fields and surges with the FDTDmethod. The book describes the application of FDTDmethod to current and emerging problems of lightning surgeprotection of continuously more complex installations, particularlyin critical infrastructures of energy and information, such asoverhead power lines, air-insulated sub-stations,

wind turbinegenerator towers and telecommunication towers. Both authors are internationally recognized experts in the areaof lightning study and this is the first book to present currentresearch in lightning surge protection Examines in detail why lightning surges occur and what can bedone to protect against them Includes theories of electromagnetic computation methods andmany examples of their application Accompanied by a sample printed program based on thefinite-difference time-domain (FDTD) method written in C++program

Computational Electromagnetics and Model-Based Inversion Harold A Sabbagh 2013-06-22 This volume will define the direction of eddy-current technology in nondestructive evaluation (NDE) in the twenty-first century. It describes the natural marriage of the computer to eddy-current NDE, and its publication was encouraged by favorable responses from workers in the nuclear-power and aerospace industries. It will be used by advanced students and practitioners in the fields of computational electromagnetics, electromagnetic inverse-scattering theory, nondestructive evaluation, materials evaluation and biomedical imaging, among others, and will be based on our experience in applying the subject of computational electromagnetics to these areas, as manifested by our recent research and publications. Finally, it will be a reference to future monographs on advanced NDE that are being contemplated by our colleagues and others. Its importance lies in the fact that it will be the first book to show that advanced computational methods can be used to solve practical, but difficult, problems in eddy-current NDE. In fact, in many cases these methods are the only things available for solving the problems. The book will cover the topic of computational electromagnetics in eddy-current nondestructive evaluation (NDE) by emphasizing three distinct topics: (a) fundamental mathematical principles of volume-integral equations as a subset of computational electromagnetics, (b) mathematical algorithms applied to signal-processing and inverse scattering problems, and (c) applications of these two topics to problems in which real and model data are used. This will make the book more than an academic exercise; we expect it to be valuable to users of eddy-current NDE technology in industries as varied as nuclear power, aerospace, materials characterization and biomedical imaging. We know of no other book on the market that covers this material in the manner in which we will present it, nor are there any books, to our knowledge, that apply this material to actual test situations that are of importance to the industries cited. It will be the first book to actually define the modern technology of eddy-current NDE, by showing how mathematics and the computer will solve problems more effectively than current analog practice.

Tomography of the Earth ’ s Crust: From Geophysical Sounding to Real-Time Monitoring Michael Weber 2014-02-17 The research work on the topic of ‘ ‘ Tomography of the Earth ’ s Crust: From Geophysical Sounding to Real-Time Monitoring ’ ’ has focused on the development of cross-scale multiparameter methods and their technological application together with the development of innovative field techniques. Seismic wave field inversion theory, diffusion and potential methods were developed and optimized with respect to cost and benefit aspects. This volume summarizes the scientific results of nine interdisciplinary joint projects funded by the German Federal Ministry of Education and Research in the framework of the Research and Development Program GEOTECHNOLOGIEN. Highlights and innovations presented cover many length scales and involve targets ranging from applications in the laboratory, to ground water surveys of heterogeneous aquifer, geotechnical applications like tunnel excavation, coal mine and CO2 monitoring and the imaging and monitoring of tectonic and societally relevant objects as active faults and volcanoes. To study these objects, the authors use the full spectrum of geophysical methods (ultrasonics, seismic and seismology, electromagnetics, gravity, and airborne) in combination with new methods like seismic interferometry, diffuse wave field theory and full-wave-form inversion in 3D and partially also in 4D. Geophysical Sounding to Real-Time Monitoring ’ ’ has focused on the development of cross-scale multiparameter methods and their technological application together with the development of innovative field techniques. Seismic wave field inversion theory, diffusion and potential

methods were developed and optimized with respect to cost and benefit aspects. This volume summarizes the scientific results of nine interdisciplinary joint projects funded by the German Federal Ministry of Education and Research in the framework of the Research and Development Program GEOTECHNOLOGIEN. Highlights and innovations presented cover many length scales and involve targets ranging from applications in the laboratory, to ground water surveys of heterogeneous aquifer, geotechnical applications like tunnel excavation, coal mine and CO2 monitoring and the imaging and monitoring of tectonic and societally relevant objects as active faults and volcanoes. To study these objects, the authors use the full spectrum of geophysical methods (ultrasonics, seismic and seismology, electromagnetics, gravity, and airborne) in combination with new methods like seismic interferometry, diffuse wave field theory and full-wave-form inversion in 3D and partially also in 4D. 2 monitoring and the imaging and monitoring of tectonic and societally relevant objects as active faults and volcanoes. To study these objects, the authors use the full spectrum of geophysical methods (ultrasonics, seismic and seismology, electromagnetics, gravity, and airborne) in combination with new methods like seismic interferometry, diffuse wave field theory and full-wave-form inversion in 3D and partially also in 4D.

Computational Electromagnetics with MATLAB, Fourth Edition Matthew N.O. Sadiku 2018-07-20 This fourth edition of the text reflects the continuing increase in awareness and use of computational electromagnetics and incorporates advances and refinements made in recent years. Most notable among these are the improvements made to the standard algorithm for the finite-difference time-domain (FDTD) method and treatment of absorbing boundary conditions in FDTD, finite element, and transmission-line-matrix methods. It teaches the readers how to pose, numerically analyze, and solve EM problems, to give them the ability to expand their problem-solving skills using a variety of methods, and to prepare them for research in electromagnetism. Includes new homework problems in each chapter. Each chapter is updated with the current trends in CEM. Adds a new appendix on CEM codes, which covers commercial and free codes. Provides updated MATLAB code.

Computational Electromagnetics Raj Mittra 2013-08-20 Emerging Topics in Computational Electromagnetics in Computational Electromagnetics presents advances in Computational Electromagnetics. This book is designed to fill the existing gap in current CEM literature that only cover the conventional numerical techniques for solving traditional EM problems. The book examines new algorithms, and applications of these algorithms for solving problems of current interest that are not readily amenable to efficient treatment by using the existing techniques. The authors discuss solution techniques for problems arising in nanotechnology, bioEM, metamaterials, as well as multiscale problems. They present techniques that utilize recent advances in computer technology, such as parallel architectures, and the increasing need to solve large and complex problems in a time efficient manner by using highly scalable algorithms.

MATLAB-based Finite Element Programming in Electromagnetic Modeling Özlem Özgün 2018-09-03 This book is a self-contained, programming-oriented and learner-centered book on finite element method (FEM), with special emphasis given to developing MATLAB ® programs for numerical modeling of electromagnetic boundary value problems. It provides a deep understanding and intuition of FEM programming by means of step-by-step MATLAB ® programs with detailed descriptions, and eventually enabling the readers to modify, adapt and apply the provided programs and formulations to develop FEM codes for similar problems through various exercises. It starts with simple one-dimensional static and time-harmonic problems and extends the developed theory to more complex two- or three-dimensional problems. It supplies sufficient theoretical background on the topic, and it thoroughly covers all phases (pre-processing, main body and post-processing) in FEM. FEM formulations are obtained for boundary value problems governed by a partial differential equation that is expressed in terms of a generic unknown function, and then, these formulations are specialized to various electromagnetic applications together with a post-processing phase. Since the method is mostly described in a general context, readers from other

disciplines can also use this book and easily adapt the provided codes to their engineering problems. After forming a solid background on the fundamentals of FEM by means of canonical problems, readers are guided to more advanced applications of FEM in electromagnetics through a survey chapter at the end of the book. Offers a self-contained and easy-to-understand introduction to the theory and programming of finite element method. Covers various applications in the field of static and time-harmonic electromagnetics. Includes one-, two- and three-dimensional finite element codes in MATLAB ® . Enables readers to develop finite element programming skills through various MATLAB ® codes and exercises. Promotes self-directed learning skills and provides an effective instruction tool.

Computational Nondestructive Evaluation Handbook Sourav Banerjee 2020-06-01 Introducing computational wave propagation methods developed over 40 years of research, this comprehensive book offers a computational approach to NDE of isotropic, anisotropic, and functionally graded materials. It discusses recent methods to enable enhanced computational efficiency for anisotropic materials. It offers an overview of the need for and uses of NDE simulation. The content provides a basic understanding of ultrasonic wave propagation through continuum mechanics and detailed discussions on the mathematical techniques of six computational methods to simulate NDE experiments. In this book, the pros and cons of each individual method are discussed and guidelines for selecting specific simulation methods for specific NDE scenarios are offered. Covers ultrasonic CNDE fundamentals to provide understanding of NDE simulation methods Offers a catalog of effective CNDE methods to evaluate and compare Provides exercises on real-life NDE problems with mathematical steps Discusses CNDE for common material types, including isotropic, anisotropic, and functionally graded materials Presents readers with practical knowledge on ultrasonic CNDE methods This work is an invaluable resource for researchers, advanced students, and industry professionals across materials, mechanical, civil, and aerospace engineering, and anyone seeking to enhance their understanding of computational approaches for advanced material evaluation methods.

Remote Sensing of the Cryosphere M. Tedesco 2015-01-27 The cryosphere, that region of the world where water is temporarily or permanently frozen, plays a crucial role on our planet. Recent developments in remote sensing techniques, and the acquisition of new data sets, have resulted in significant advances in our understanding of all components of the cryosphere and its processes. This book, based on contributions from 40 leading experts, offers a comprehensive and authoritative overview of the methods, techniques and recent advances in applications of remote sensing of the cryosphere. Examples of the topics covered include: * snow extent, depth, grain-size and impurities * surface and subsurface melting * glaciers * accumulation over the Greenland and Antarctica ice sheets * ice thickness and velocities * gravimetric measurements from space * sea, lake and river ice * frozen ground and permafrost * fieldwork activities * recent and future cryosphere-oriented missions and experiments All figures are in color and provide an excellent visual accompaniment to the technical and scientific aspect of the book. Readership: Senior undergraduates, Masters and PhD Students, PostDocs and Researchers in cryosphere science and remote sensing. Remote Sensing of the Cryosphere is the significant first volume in the new Cryosphere Science Series. This new series comprises volumes that are at the cutting edge of new research, or provide focussed interdisciplinary reviews of key aspects of the science.

Geophysical Electromagnetic Theory and Methods Michael S. Zhdanov 2009-06-12 In this book the author presents the state-of-the-art electromagnetic (EM) theories and methods employed in EM geophysical exploration. The book brings together the fundamental theory of EM fields and the practical aspects of EM exploration for mineral and energy resources. This text is unique in its breadth and completeness in providing an overview of EM geophysical exploration technology. The book is divided into four parts covering the foundations of EM field theory and its applications, and emerging geophysical methods. Part I is an introduction to the field theory required for baseline understanding. Part II is an overview of all the basic elements of geophysical EM theory, from Maxwell's fundamental equations to

modern methods of modeling the EM field in complex 3-D geoelectrical formations. Part III deals with the regularized solution of ill-posed inverse electromagnetic problems, the multidimensional migration and imaging of electromagnetic data, and general interpretation techniques. Part IV describes major geophysical electromagnetic methods—direct current (DC), induced polarization (IP), magnetotelluric (MT), and controlled-source electromagnetic (CSEM) methods—and covers different applications of EM methods in exploration geophysics, including minerals and HC exploration, environmental study, and crustal study. * Presents theoretical and methodological findings, as well as examples of applications of recently developed algorithms and software in solving practical problems * Describes the practical importance of electromagnetic data through enabling discussions on a construction of a closed technological cycle, processing, analysis and three-dimensional interpretation * Updates current findings in the field, especially with MT, magnetovariational and seismo-electrical methods and the practice of 3D interpretations

Computational Geo-Electromagnetics Viacheslav V. Spichak 2020-02 Computational Geo-Electromagnetics: Methods, Models, and Forecasts, Volume Five in the Computational Geophysics series, is devoted to techniques for building of geoelectrical models from electromagnetic data, featuring Bayesian statistical analysis and neural network algorithms. These models are applied to studying the geoelectrical structure of famous volcanoes (i.e., Vesuvio, Kilauea, Elbrus, Komagatake, Hengill) and geothermal zones (i.e., Travale, Italy; Soultz-sous-Forets, Elsace). Methodological recommendations are given on electromagnetic sounding of faults as well as geothermal and hydrocarbon reservoirs. Techniques for forecasting of petrophysical properties from the electrical resistivity as proxy parameter are also considered. Computational Geo-Electromagnetics: Methods, Models, and Forecasts offers techniques and algorithms for building geoelectrical models under conditions of rare or irregularly distributed EM data and/or lack of prior geological and geophysical information. This volume also includes methodological guidelines on interpretation of electromagnetic sounding data depending on goals of the study. Finally, it details computational algorithms for using electrical resistivity for properties beyond boreholes. Provides algorithms for inversion of incomplete, rare or irregularly distributed EM data Features methodological issues of building geoelectrical models Offers techniques for retrieving petrophysical properties from EM sounding data and well logs

Advanced Electromagnetic Models for Materials Characterization and Nondestructive Evaluation Harold A Sabbagh 2021-04-20 This book expands on the subject matter of ’Computational Electromagnetics and Model-Based Inversion: A Modern Paradigm for Eddy-Current Nondestructive Evaluation.’ It includes (a) voxel-based inversion methods, which are generalizations of model-based algorithms; (b) a complete electromagnetic model of advanced composites (and other novel exotic materials), stressing the highly anisotropic nature of these materials, as well as giving a number of applications to nondestructive evaluation; and (c) an up-to-date discussion of stochastic integral equations and propagation-of-uncertainty models in nondestructive evaluation. As such, the book combines research started twenty-five years ago in advanced composites and voxel-based algorithms, but published in scattered journal articles, as well as recent research in stochastic integral equations. All of these areas are of considerable interest to the aerospace, nuclear power, civil infrastructure, materials characterization and biomedical industries. The book covers the topic of computational electromagnetics in eddy-current nondestructive evaluation (NDE) by emphasizing three distinct topics: (a) fundamental mathematical principles of volume-integral equations as a subset of computational electromagnetics, (b) mathematical algorithms applied to signal-processing and inverse scattering problems, and (c) applications of these two topics to problems in which real and model data are used. It is therefore more than an academic exercise and is valuable to users of eddy-current NDE technology in industries as varied as nuclear power, aerospace, materials characterization and biomedical imaging.

Newsletter 1995

Interdisciplinary Electromagnetic, Mechanic and Biomedical Problems E. Leiss 2007 The International

Symposium on Applied Electromagnetics and Mechanics (ISEM) is an interdisciplinary international forum. This title concerns 12th event and was organized by following three institutions: Vienna Magnetics Group, TU BioMed - Society for Biomedical Engineering, Bioelectricity & Magnetism Lab; and the Vienna University of Technology.

Microwave Imaging and Electromagnetic Inverse Scattering Problems Loreto Di Donato 2020-05-20 Microwave imaging techniques allow for the development of systems that are able to inspect, identify, and characterize in a noninvasive fashion under different scenarios, ranging from biomedical to subsurface diagnostics as well as from surveillance and security applications to nondestructive evaluation. Such great opportunities, though, are actually severely limited by difficulties arising from the solution of the underlying inverse scattering problem. As a result, ongoing research efforts in this area are devoted to developing inversion strategies and experimental apparatus so that they are as reliable and accurate as possible with respect to reconstruction capabilities and resolution performance, respectively. The intent of this Special Issue is to present the experiences of leading scientists in the electromagnetic inverse scattering community, as well as to serve as an assessment tool for people who are new to the area of microwave imaging and electromagnetic inverse scattering problems.

Computational Methods for Electromagnetic Inverse Scattering Xudong Chen 2018-07-18 A comprehensive and updated overview of the theory, algorithms and applications of for electromagnetic inverse scattering problems Offers the recent and most important advances in inverse scattering grounded in fundamental theory, algorithms and practical engineering applications Covers the latest, most relevant inverse scattering techniques like signal subspace methods, time reversal, linear sampling, qualitative methods, compressive sensing, and noniterative methods Emphasizes theory, mathematical derivation and physical insights of various inverse scattering problems Written by a leading expert in the field

Advances in Modeling and Interpretation in Near Surface Geophysics Arkoprovo Biswas 2020-01-01 This book deals primarily with the aspects of advances in near surface geophysical data modeling, different interpretation techniques, new ideas and an integrated study to delineate the subsurface structures. It also involves the practical application of different geophysical methods to delineate the subsurface structures associated with mineral, groundwater exploration, subsurface contamination, hot springs, coal fire etc. This book is specifically aimed with the state-of-art information regarding research advances and new developments in these areas of study, coupled to extensive modeling and field investigations obtained from around the world. It is extremely enlightening for the research workers, scientists, faculty members and students, in Applied Geophysics, Near Surface Geophysics, Potential Field, Electrical and Electromagnetic Methods, Mathematical Modeling Techniques in Earth Sciences, as well as Environmental Geophysics.