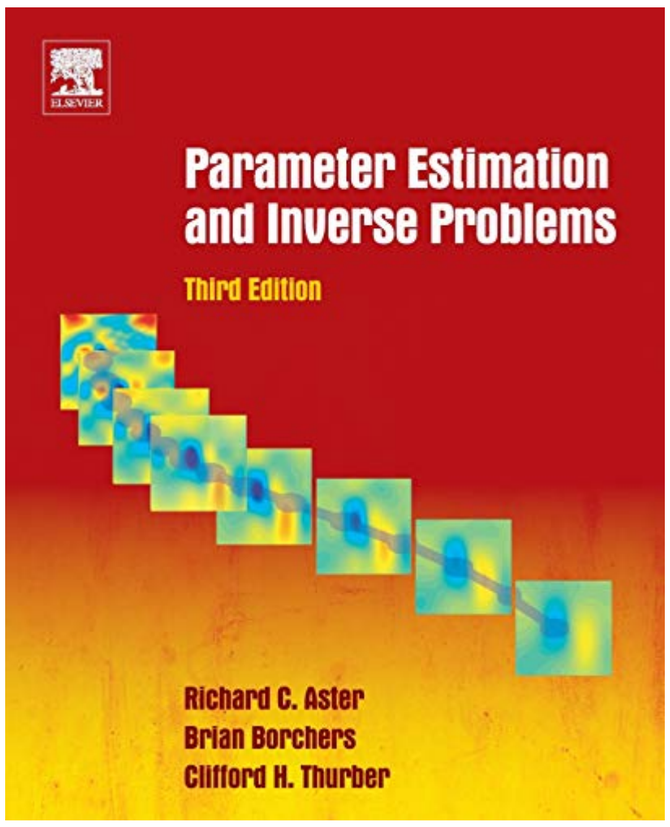

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Parameter Estimation and Inverse Problems-Richard C. Aster 2013 Parameter Estimation and Inverse Problems, Second Edition provides geoscience students and professionals with answers to common questions like how one can derive a physical model from a finite set of observations containing errors, and how one may determine the quality of such a model. This book takes on these fundamental and challenging problems, introducing students and professionals to the broad range of approaches that lie in the realm of inverse theory. The authors present both the underlying theory and practical algorithms for solving inverse problems. The authors' treatment is appropriate for geoscience graduate students and advanced undergraduates with a basic working knowledge of calculus, linear algebra, and statistics. Parameter Estimation and Inverse Problems, Second Edition introduces readers to both Classical and Bayesian approaches to linear and nonlinear problems with particular attention paid to computational, mathematical, and statistical issues related to their application to geophysical problems. The textbook includes Appendices covering essential linear algebra, statistics, and notation in the context of the subject. Includes appendices for review of needed concepts in linear, statistics, and vector calculus. Accessible to students and professionals without a highly specialized mathematical background.

Inverse Problem Theory and Methods for Model Parameter Estimation-Albert Tarantola 2005-01-01 This book proposes a general approach to the basic difficulties appearing in the resolution of inverse problems.

Parameter Estimation and Inverse Problems-Richard C. Aster 2018-10-16 Parameter Estimation and Inverse Problems, Third Edition, is structured around a course at New Mexico Tech and is designed to be accessible to typical graduate students in the physical sciences who do not have an extensive mathematical background. The book is complemented by a companion website that includes MATLAB codes that correspond to examples that are illustrated with simple, easy to follow problems that illuminate the details of particular numerical methods. Updates to the new edition include more discussions of Laplacian smoothing, an expansion of basis function exercises, the addition of stochastic descent, an improved presentation of Fourier methods and exercises, and more. Features examples that are illustrated with simple, easy to follow problems that illuminate the details of a particular numerical method Includes an online instructor’s guide that helps professors teach and customize exercises and select homework problems Covers updated information on adjoint methods that are presented in an accessible manner

Inverse Problem Theory-A. Tarantola 2013-10-14 Inverse Problem Theory is written for physicists, geophysicists and all scientists facing the problem of quantitative interpretation of experimental data. Although it contains a lot of mathematics, it is not intended as a mathematical book, but rather tries to explain how a method of acquisition of information can be applied to the actual world. The book provides a comprehensive, up-to-date description of the methods to be used for fitting experimental data, or to estimate model parameters, and to unify these methods into the Inverse Problem Theory. The first part of the book deals with discrete problems and describes Maximum likelihood, Monte Carlo, Least squares, and Least absolute values methods. The second part deals with inverse problems involving functions. The book is almost completely self-contained, with all important concepts carefully introduced. Although theoretical concepts are strongly emphasized, the author has ensured that all the useful formulas are listed, with many special cases included. The book will thus serve equally well as a reference manual for researchers needing to refresh their memories on a given algorithm, or as a textbook in a course for undergraduate or graduate students.

Parameter Identification and Inverse Problems in Hydrology, Geology and Ecology-Johannes Gottlieb 2012-12-06 The Workshop on Parameter Identification and Inverse Problems in Hydrology, Geology and Ecology, Karlsruhe, April 10-12, 1995, was organized to bring to gether an interdisciplinary group drawn from the areas of science, engineering and mathematics for the following purposes: - to promote, encourage and influence more understanding and cooperation in the community of parameter identifiers from various disciplines, - to forge unity in diversity by bringing together a variety of disciplines that attempt to understand the reconstruction of inner model parameters, un known nonlinear constitutive relations, heterogeneous structures inside of geological objects, sources or sinks from observational data, - to discuss modern regularization tools for handling improperly posed pro blems and strategies of incorporating a priori knowledge from the applied problem into the model and its treatment. These proceedings contain some of the results of the workshop, representing a bal anced selection of contributions from the various groups of participants. The reviewed invited and contributed articles are grouped according to the broad headings of hydrology, non-linear diffusion and soil physics, geophysical methods, mathematical analysis of inverse and ill-posed problems and parallel algorithms for inverse problems. Some of the issues adressed by the articles in these proceedings include the rela tion between least squares and direct formulations of inverse problems for partial differential equations, nonlinear regularization, identification of nonlinear consti tutive relations, fast parallel algorithms for large scale inverse problems, reduction of model structures, geostatistical inversion techniques.

Computational Methods for Inverse Problems-Curtis R. Vogel 2002-01-01 Provides a basic understanding of both the underlying mathematics and the computational methods used to solve inverse problems.

Numerical Methods for Inverse Problems-Michel Kern 2016-06-07 This book studies methods to concretely address inverse problems. An inverse problem arises when the causes that produced a given effect must be determined or when one seeks to indirectly estimate the parameters of a physical system. The author uses practical examples to illustrate inverse problems in physical sciences. He presents the techniques and specific methods chosen to solve inverse problems in a general domain of application, choosing to focus on a small number of methods that can be used in most applications. This book is aimed at readers with a mathematical and scientific computing background. Despite this, it is a book with a practical perspective. The methods described are applicable, have been applied, and are often illustrated by numerical examples.

Discrete Inverse and State Estimation Problems-Carl Wunsch 2006-06-29 The problems of making inferences about the natural world from noisy observations and imperfect theories occur in almost all scientific disciplines. This 2006 book addresses these problems using examples taken from geophysical fluid dynamics. It focuses on discrete formulations, both static and time-varying, known variously as inverse, state estimation or data assimilation problems. Starting with fundamental algebraic and statistical ideas, the book guides the reader through a range of inference tools including the singular value decomposition, Gauss-Markov and minimum variance estimates, Kalman filters and related smoothers, and adjoint (Lagrange multiplier) methods. The final chapters discuss a variety of practical applications to geophysical flow problems. Discrete Inverse and State Estimation Problems is an ideal introduction to the topic for graduate students and researchers in oceanography, meteorology, climate dynamics, and geophysical fluid dynamics. It is also accessible to a wider scientific audience; the only prerequisite is an understanding of linear algebra.

Discrete Inverse Problems-Per Christian Hansen 2010 This book gives an introduction to the practical treatment of inverse problems by means of numerical methods, with a focus on basic mathematical and computational aspects. To solve inverse problems, we demonstrate that insight about them goes hand in hand with algorithms.

Geophysical Inverse Theory-Robert L. Parker 2019-12-31 In many physical sciences, the most natural description of a system is with a function of position or time. In principle, infinitely many numbers are needed to specify that function, but in practice only finitely many measurements can be made. Inverse theory concerns the mathematical techniques that enable researchers to use the available information to build a model of the unknown system or to determine its essential properties. In Geophysical Inverse Theory, Robert Parker provides a systematic development of inverse theory at the graduate and professional level that emphasizes a rigorous yet practical solution of inverse problems, with examples from experimental observations in geomagnetism, seismology, gravity, electromagnetic sounding, and interpolation. Although illustrated with examples from geophysics, this book has broad implications for researchers in applied disciplines from materials science and engineering to astrophysics, oceanography, and meteorology. Parker's approach is to avoid artificial statistical constructs and to emphasize instead the reasonable assumptions researchers must make to reduce the ambiguity that inevitably arises in complex problems. The structure of the book follows a natural division in the subject into linear theory, in which the measured quantities are linear functionals of the unknown models, and nonlinear theory, which covers all other systems but is not nearly so well understood. The book covers model selection as well as techniques for drawing firm conclusions about the earth independent of any particular model.

Inverse Problems-Alexander G. Ramm 2006-01-20 Inverse Problems is a monograph which contains a self-contained presentation of the theory of several major inverse problems and the closely related results from the theory of ill-posed problems. The book is aimed at a large audience which include graduate students and researchers in mathematical, physical, and engineering sciences and in the area of numerical analysis.

Model Calibration and Parameter Estimation-Ne-Zheng Sun 2015-07-01 This three-part book provides a comprehensive and systematic introduction to these challenging topics such as model calibration, parameter estimation, reliability assessment, and data collection design. Part 1 covers the classical inverse problem for parameter estimation in both deterministic and statistical frameworks, Part 2 is dedicated to system identification, hyperparameter estimation, and model dimension reduction, and Part 3 considers how to collect data and construct reliable models for prediction and decision-making. For the first time, topics such as multiscale inversion, stochastic field parameterization, level set method, machine learning, global sensitivity analysis, data assimilation, model uncertainty quantification, robust design, and goal-oriented modeling, are systematically described and summarized in a single book from the perspective of model inversion, and elucidated with numerical examples from environmental and water resources modeling. Readers of this book will not only learn basic concepts and methods for simple parameter estimation, but also get familiar with advanced methods for modeling complex systems. Algorithms for mathematical tools used in this book, such as numerical optimization, automatic differentiation, adaptive parameterization, hierarchical Bayesian, metamodeling, Markov chain Monte Carlo, are covered in details. This book can be used as a reference for graduate and upper level undergraduate students majoring in environmental engineering, hydrology, and geosciences. It also serves as an essential reference book for professionals such as petroleum engineers, mining engineers, chemists, mechanical engineers, biologists, biology and medical engineering, applied mathematicians, and others who perform mathematical modeling.

Linear and Nonlinear Inverse Problems with Practical Applications-Jennifer L. Mueller 2012-11-30 Inverse problems arise in practical applications whenever there is a need to interpret indirect measurements. This book explains how to identify ill-posed inverse problems arising in practice and gives a hands-on guide to designing computational solution methods for them, with related codes on an accompanying website. The guiding linear inversion examples are the problem of image deblurring, x-ray tomography, and backward parabolic problems, including heat transfer. A thorough treatment of electrical impedance tomography is used as the guiding nonlinear inversion example which combines the analytic-geometric research tradition and the regularization-based school of thought in a fruitful manner. This book is complete with exercises and project topics, making it ideal as a classroom textbook or self-study guide for graduate and advanced undergraduate students in mathematics, engineering or physics who wish to learn about computational inversion. It also acts as a useful guide for researchers who develop inversion techniques in high-tech industry.

Introduction to Inverse Problems in Imaging-M. Bertero 2020-08-30 This is a graduate textbook on the principles of linear inverse problems, methods of their approximate solution, and practical application in imaging. The level of mathematical treatment is kept as low as possible to make the book suitable for a wide range of readers from different backgrounds in science and engineering. Mathematical prerequisites are first courses in analysis, geometry, linear algebra, probability theory, and Fourier analysis. The authors concentrate on presenting easily implementable and fast solution algorithms. With examples and exercises throughout, the book will provide the reader with the appropriate background for a clear understanding of the essence of inverse problems (ill-posedness and its cure) and, consequently, for an intelligent assessment of the rapidly growing literature on these problems.

Inverse Heat Transfer-M.Necat Ozisik 2018-05-02 This book introduces the fundamental concepts of inverse heat transfer problems. It presents in detail the basic steps of four techniques of inverse heat transfer protocol, as a parameter estimation approach and as a function estimation approach. These techniques are then applied to the solution of the problems of practical engineering interest involving conduction, convection, and radiation. The text also introduces a formulation based on generalized coordinates for the solution of inverse heat conduction problems in two-dimensional regions.

Geophysical Data Analysis: Understanding Inverse Problem Theory and Practice-Max A. Meju 1994 This publication is designed to provide a practical understanding of methods of parameter estimation and uncertainty analysis. The practical problems covered range from simple processing of time- and space-series data to inversion of potential field, seismic, electrical, and electromagnetic data. The various formulations are reconciled with field data in the numerous examples provided in the book; well-documented computer programmes are also given to show how easy it is to implement inversion algorithms.

Inverse Problems in Groundwater Modeling-Ne-Zheng Sun 2013-04-17 ... A diskette with the updated programme of Appendix C and examples is available through the author at a small fee. email: nezheng@ucla.edu fax: 1--310--825--5435 ... This book systematically discusses basic concepts, theory, solution methods and applications of inverse problems in groundwater modeling. It is the first book devoted to this subject. The inverse problem is defined and solved in both deterministic and statistic frameworks. Various direct and indirect methods are discussed and compared. As a useful tool, the adjoint state method and its applications are given in detail. For a stochastic field, the maximum likelihood estimation and co-kriging techniques are used to estimate unknown parameters. The ill-posed problem of inverse solution is highlighted through the whole book. The importance of data collection strategy is specially emphasized. Besides the classical design criteria, the relationships between decision making, prediction, parameter identification and experimental design are considered from the point of view of extended identifiabilities. The problem of model structure identification is also considered. This book can be used as a textbook for graduate students majoring in hydrogeology or related subjects. It is also a reference book for hydrogeologists, petroleum engineers, environmental engineers, mining engineers and applied mathematicians.

Estimation Techniques for Distributed Parameter Systems-H.T. Banks 2012-12-06 The research detailed in this monograph was originally motivated by our interest in control problems involving partial and delay differential equations. Our attempts to apply control theory techniques to such prob lems in several areas of science convinced us that in the need for better and more detailed models of distributed/ continuum processes in biology and mechanics lay a rich, interesting, and challenging class of fundamen tal questions. These questions, which involve science and mathematics, are typical of those arising in inverse or parameter estimation problems. Our efforts on inverse problems for distributed parameter systems, which are infinite dimensional in the most common realizations, began about seven years ago at a time when rapid advances in computing capabilities and availability held promise for significant progress in the development of a practically useful as well as theoretically sound methodology for such problems. Much of the research reported in our presentation was not begun when we outlined the plans for this monograph some years ago. By publishing this monograph now, when only a part of the originally intended topics are covered (see Chapter VII in this respect), we hope to stimulate the research and interest of others in an area of scientific en deavor which has exceeded even our optimistic expectations with respect to excitement, opportunity, and stimulation. The computer revolution alluded to above and the development of new codes allow one to solve rather routinely certain estimation problems that would have been

out of the question ten years ago.

Nonlinear Least Squares for Inverse Problems-Guy Chavent 2010-03-14 The domain of inverse problems has experienced a rapid expansion, driven by the increase in computing power and the progress in numerical modeling. When I started working on this domain years ago, I became somehow fr- tratedtoseethatmyfriendsworkingonmodelingwhereproducingexistence, uniqueness, and stability results for the solution of their equations, but that I was most of the time limited, because of the nonlinearity of the problem, to provethatmyleastsquaresobjectivefunctionwasdi?erentiable....Butwith my experience growing, I became convinced that, after the inverse problem has been properly trimmed, the ?nal least squares problem, the one solved on the computer, should be Quadratically (Q)-wellposed,thatis,both we- posed and optimizable: optimizability ensures that a global minimizer of the least squares function can actually be found using e?cient local optimization algorithms, and wellposedness that this minimizer is stable with respect to perturbation of the data. But the vast majority of inverse problems are nonlinear, and the clas- cal mathematical tools available for their analysis fail to bring answers to these crucial questions: for example, compactness will ensure existence, but provides no uniqueness results, and brings no information on the presence or absenceofparasiticlocalminimaorstationarypoints....

Inverse Engineering Handbook-Keith A. Woodbury 2002-09-25 Inverse problems have been the focus of a growing number of research efforts over the last 40 years-and rightly so. The ability to determine a "cause" from an observed "effect" is a powerful one. Researchers now have at their disposal a variety of techniques for solving inverse problems, techniques that go well beyond those useful for relatively simple parameter estimation problems. The question is, where can one find a single, comprehensive resource that details these methods? The answer is the Inverse Engineering Handbook. Leading experts in inverse problems have joined forces to produce the definitive reference that allows readers to understand, implement, and benefit from a variety of problem-solving techniques. Each chapter details a method developed or refined by its contributor, who provides clear explanations, examples, and in many cases, software algorithms. The presentation begins with methods for parameter estimation, which build a bridge to boundary function estimation problems. The techniques addressed include sequential function estimation, mollification, space marching techniques, and adjoint, Monte Carlo, and gradient-based methods. Discussions also cover important experimental aspects, including experiment design and the effects of uncertain parameters. While many of the examples presented focus on heat transfer, the techniques discussed are applicable to a wide range of inverse problems. Anyone interested in inverse problems, regardless of their specialty, will find the Inverse Engineering Handbook to be a unique and invaluable compendium of up-to-date techniques.

Modeling and Inverse Problems in the Presence of Uncertainty-H. T. Banks 2014-04-01 Modeling and Inverse Problems in the Presence of Uncertainty collects recent research—including the authors' own substantial projects—on uncertainty propagation and quantification. It covers two sources of uncertainty: where uncertainty is present primarily due to measurement errors and where uncertainty is present due to the modeling formulation itself. After a useful review of relevant probability and statistical concepts, the book summarizes mathematical and statistical aspects of inverse problem methodology, including ordinary, weighted, and generalized least-squares formulations. It then discusses asymptotic theories, bootstrapping, and issues related to the evaluation of correctness of assumed form of statistical models. The authors go on to present methods for evaluating and comparing the validity of appropriateness of a collection of models for describing a given data set, including statistically based model selection and comparison techniques. They also explore recent results on the estimation of probability distributions when they are embedded in complex mathematical models and only aggregate (not individual) data are available. In addition, they briefly discuss the optimal design of experiments in support of inverse problems for given models. The book concludes with a focus on uncertainty in model formulation itself, covering the general relationship of differential equations driven by white noise and the ones driven by colored noise in terms of their resulting probability density functions. It also deals with questions related to the appropriateness of discrete versus continuum models in transitions from small to large numbers of individuals. With many examples throughout addressing problems in physics, biology, and other areas, this book is intended for applied mathematicians interested in deterministic and/or stochastic models and their interactions. It is also suitable for scientists in biology, medicine, engineering, and physics working on basic modeling and inverse problems, uncertainty in modeling, propagation of uncertainty, and statistical modeling.

Inverse Problems and Related Topics-Gen Nakamura 2019-04-15 Inverse problems arise in many disciplines and hold great importance to practical applications. However, sound new methods are needed to solve these problems. Over the past few years, Japanese and Korean mathematicians have obtained a number of very interesting and unique results in inverse problems. Inverse Problems and Related Topics compi

Numerical Methods for Solving Inverse Problems of Mathematical Physics-A. A. Samarskii 2007-01-01 The main classes of inverse problems for equations of mathematical physics and their numerical solution methods are considered in this book which is intended for graduate students and experts in applied mathematics, computational mathematics, and mathematical modelling.

Inverse Problems in Engineering Mechanics III-G.S. Dulikravich 2001-11-20 Inverse Problems are found in many areas of engineering mechanics and there are many successful applications e.g. in non-destructive testing and characterization of material properties by ultrasonic or X-ray techniques, thermography, etc. Generally speaking, inverse problems are concerned with the determination of the input and the characteristics of a system, given certain aspects of its output. Mathematically, such problems are ill-posed and have to be overcome through development of new computational schemes, regularization techniques, objective functionals, and experimental procedures. This volume contains a selection of peer-reviewed papers presented at the International Symposium on Inverse Problems in Engineering Mechanics (ISIP2001), held in February of 2001 in Nagano, Japan, where recent development in inverse problems in engineering mechanics and related topics were discussed. The following general areas in inverse problems in engineering mechanics were the subjects of the ISIP2001: mathematical and computational aspects of inverse problems, parameter or system identification, shape determination, sensitivity analysis, optimization, material property characterization, ultrasonic non-destructive testing, elastodynamic inverse problems, thermal inverse problems, and other engineering applications. These papers can provide a state-of-the-art review of the research on inverse problems in engineering mechanics.

Numerical Treatment of Inverse Problems in Differential and Integral Equations-Deuflhard 2012-12-06 In many scientific or engineering applications, where ordinary differen tial equation (OOE),partial differential equation (POE), or integral equation (IE) models are involved, numerical simulation is in common use for prediction, monitoring, or control purposes. In many cases, however, successful simulation of a process must be preceded by the solution of the so-called inverse problem, which is usually more complex: given meas ured data and an associated theoretical model, determine unknown para meters in that model (or unknown functions to be parametrized) in such a way that some measure of the "discrepancy" between data and model is minimal. The present volume deals with the numerical treatment of such inverse probelms in fields of application like chemistry (Chap. 2,3,4, 7,9), molecular biology (Chap. 22), physics (Chap. 8,11,20), geophysics (Chap. 10,19), astronomy (Chap. 5), reservoir simulation (Chap. 15,16), elctrocardiology (Chap. 14), computer tomography (Chap. 21), and control system design (Chap. 12,13). In the actual computational solution of inverse problems in these fields, the following typical difficulties arise: (1) The evaluation of the sen sitivity coefficients for the model. may be rather time and storage con suming. Nevertheless these coefficients are needed (a) to ensure (local) uniqueness of the solution, (b) to estimate the accuracy of the obtained approximation of the solution, (c) to speed up the iterative solution of nonlinear problems. (2) Often the inverse problems are ill-posed. To cope with this fact in the presence of noisy or incomplete data or inev itable discretization errors, regularization techniques are necessary.

Iterative Optimization in Inverse Problems-Charles L. Byrne 2014-02-12 Iterative Optimization in Inverse Problems brings together a number of important iterative algorithms for medical imaging, optimization, and statistical estimation. It incorporates recent work that has not appeared in other books and draws on the author's considerable research in the field, including his recently developed class of SUMMA algorithms. Related to sequential unconstrained minimization methods, the SUMMA class includes a wide range of iterative algorithms well known to researchers in various areas, such as statistics and image processing. Organizing the topics from general to more specific, the book first gives an overview of sequential optimization, the subclasses of auxiliary-function methods, and the SUMMA algorithms. The next three chapters present particular examples in more detail, including barrier- and penalty-function methods, proximal minimization, and forward-backward splitting. The author also focuses on fixed-point algorithms for operators on Euclidean space and then extends the discussion to include distance measures other than the usual Euclidean distance. In the final chapters, specific problems illustrate the use of iterative methods previously discussed. Most chapters contain exercises that introduce new ideas and make the book suitable for self-study. Unifying a variety of seemingly disparate algorithms, the book shows how to derive new properties of algorithms by comparing known properties of other algorithms. This unifying approach also helps researchers—from statisticians working on parameter estimation to image scientists processing scanning data to mathematicians involved in theoretical and applied optimization—discover useful related algorithms in areas outside of their expertise.

An Introduction to Data Analysis and Uncertainty Quantification for Inverse Problems-Luis Tenorio 2017-07-06 Inverse problems are found in many applications, such as medical imaging, engineering, astronomy, and geophysics, among others. To solve an inverse problem is to recover an object from noisy, usually indirect observations. Solutions to inverse problems are subject to many potential sources of error introduced by approximate mathematical models, regularization methods, numerical approximations for efficient computations, noisy data, and limitations in the number of observations; thus it is important to include an assessment of the uncertainties as part of the solution. Such assessment is interdisciplinary by nature, as it requires, in addition to knowledge of the particular application, methods from applied mathematics, probability, and statistics. This book bridges applied mathematics and statistics by providing a basic introduction to probability and statistics for uncertainty quantification in the context of inverse problems, as well as an introduction to statistical regularization of inverse problems. The author covers basic statistical inference, introduces the framework of ill-posed inverse problems, and explains statistical questions that arise in their applications. An Introduction to Data Analysis and Uncertainty Quantification for Inverse Problems÷includes many examples that explain techniques which are useful to address general problems arising in uncertainty quantification, Bayesian and non-Bayesian statistical methods and discussions of their complementary roles, and analysis of a real data set to illustrate the methodology covered throughout the book.

Inverse Problems in the Mathematical Sciences-Charles W. Groetsch 2013-12-14 Inverse problems are immensely important in modern science and technology. However, the broad mathematical issues raised by inverse problems receive scant attention in the university curriculum. This book aims to remedy this state of affairs by supplying an accessible introduction, at a modest mathematical level, to the alluring field of inverse problems. Many models of inverse problems from science and engineering are dealt with and nearly a hundred exercises, of varying difficulty, involving mathematical analysis, numerical treatment, or modelling of inverse problems, are provided. The main themes of the book are: causation problem modeled as integral equations; model identification problems, posed as coefficient determination problems in differential equations; the functional analytic framework for inverse problems; and a survey of the principal numerical methods for inverse problems. An extensive annotated bibliography furnishes leads on the history of inverse problems and a guide to the frontiers of current research.

Geophysical Data Analysis: Discrete Inverse Theory-William Menke 2012-12-02 Geophysical Data Analysis: Discrete Inverse Theory is an introductory text focusing on discrete inverse theory that is concerned with parameters that either are truly discrete or can be adequately approximated as discrete. Organized into 12 chapters, the book's opening chapters provide a general background of inverse problems and their corresponding solution, as well as some of the basic concepts from probability theory that are applied throughout the text. Chapters 3-7 discuss the solution of the canonical inverse problem, that is, the linear problem with Gaussian statistics, and discussions on problems that are non-Gaussian and nonlinear are covered in Chapters 8 and 9. Chapters 10-12 present examples of the use of inverse theory and a discussion on the numerical algorithms that must be employed to solve inverse problems on a computer. This book is of value to graduate students and many college seniors in the applied sciences.

Groundwater Flow and Quality Modelling-E. Custodio 1988-02-29 Proceedings of the NATO Advanced Research Workshop on Advances in Analytical and Numerical Groundwater Flow and Quality Modelling, Lisbon, Portugal, June 2-6, 1987

Time Series Analysis and Inverse Theory for Geophysicists-David Gubbins 2004-03-18 The first textbook covering spectral analysis and geophysical data inversion for undergraduate and graduate students.

Inverse Problems-Charles W. Groetsch 1999-12-31 Problem solving in mathematics is often thought of as a one way process. For example: take two numbers and multiply them together. However for each problem there is also an inverse problem which runs in the opposite direction: now take a number and find a pair of factors. Such problems are considerably more important, in mathematics and throughout science, than they might first appear. This book concentrates on these inverse problems and how they can be usefully introduced to undergraduate students. A historical introduction sets the scene and gives a cultural context for the rest of the book. Chapters dealing with inverse problems in calculus, differential equations and linear algebra then follow and the book concludes with suggestions for further reading. Whatever their own field of expertise, this will be an essential purchase for anyone interested in the teaching of mathematics.

Computational Uncertainty Quantification for Inverse Problems-Johnathan M. Bardsley 2018-08-01 This book is an introduction to both computational inverse problems and uncertainty quantification (UQ) for inverse problems. The book also presents more advanced material on Bayesian methods and UQ, including Markov chain Monte Carlo sampling methods for UQ in inverse problems. Each chapter contains MATLAB® code that implements the algorithms and generates the figures, as well as a large number of exercises accessible to both graduate students and researchers. Computational Uncertainty Quantification for Inverse Problems is intended for graduate students, researchers, and applied scientists. It is appropriate for courses on computational inverse problems, Bayesian methods for inverse problems, and UQ methods for inverse problems.

Inverse Problems in Engineering Mechanics II-G.S. Dulikravich 2000-12-11 Inverse Problems are found in many areas of engineering mechanics and there are many successful applications e.g. in non-destructive testing and characterization of material properties by ultrasonic or X-ray techniques, thermography, etc. Generally speaking, inverse problems are concerned with the determination of the input and the characteristics of a system, given certain aspects of its output. Mathematically, such problems are ill-posed and have to be overcome through development of new computational schemes, regularization techniques, objective functionals, and experimental procedures. Following the IUTAM Symposium on these topics, held in May 1992 in Tokyo, another in November 1994 in Paris, and also the more recent ISIP'98 in March 1998 in Nagano, it was concluded that it would be fruitful to gather regularly with researchers and engineers for an exchange of the newest research ideas. The most recent Symposium of this series "International Symposium on Inverse Problems in Engineering Mechanics (ISIP2000)" was held in March of 2000 in Nagano, Japan, where recent developments in inverse problems in engineering mechanics and related topics were discussed. The following general areas in inverse problems in engineering mechanics were the subjects of ISIP2000: mathematical and computational aspects of inverse problems, parameter or system identification, shape determination, sensitivity analysis, optimization, material property characterization, ultrasonic non-destructive testing, elastodynamic inverse problems, thermal inverse problems, and other engineering applications. The papers in these proceedings provide a state-of-the-art review of the research on inverse problems in engineering mechanics and it is hoped that some breakthrough in the research can be made and that technology transfer will be stimulated and accelerated due to their publication.

Inverse and Ill-Posed Problems-Heinz W. Engl 2014-05-10 Inverse and Ill-Posed Problems is a collection of papers presented at a seminar of the same title held in Austria in June 1986. The papers discuss inverse problems in various disciplines; mathematical solutions of integral equations of the first kind; general considerations for ill-posed problems; and the various regularization methods for integral and operator equations of the first kind. Other papers deal with applications in tomography, inverse scattering, detection of radiation sources, optics, partial differential equations, and parameter estimation problems. One paper discusses three topics on ill-posed problems, namely, the imposition of specified types of discontinuities on solutions of ill-posed problems, the use of generalized cross validation as a data based termination rule for iterative methods, and also a parameter estimation problem in reservoir modeling. Another paper investigates a statistical method to determine the truncation level in Eigen function expansions and for Fredholm equations of the first kind where the data contains some errors. Another paper examines the use of singular function expansions in the inversion of severely ill-posed problems arising in confocal scanning microscopy, particle sizing, and velocimetry. The collection can benefit many mathematicians, students, and professor of calculus, statistics, and advanced mathematics.

The Magnetotelluric Method-Alan D. Chave 2012-04-26 The magnetotelluric method is a technique for imaging the electrical conductivity and structure of the Earth, from the near surface down to the 410 km transition zone and beyond. This book forms the first comprehensive overview of magnetotellurics from the salient physics and its mathematical representation, to practical implementation in the field, data processing, modeling and geological interpretation. Electromagnetic induction in 1-D, 2-D and 3-D media is explored, building from first principles, and with thorough coverage of the practical techniques of time series processing, distortion, numerical modeling and

inversion. The fundamental principles are illustrated with a series of case histories describing geological applications. Technical issues, instrumentation and field practices are described for both land and marine surveys. This book provides a rigorous introduction to magnetotellurics for academic researchers and advanced students and will be of interest to industrial practitioners and geoscientists wanting to incorporate rock conductivity into their interpretations.

Recent Trends in Computational Science and Engineering-Serdar Celebi 2018-05-30 Computational science and engineering (CSE) is a broad multidisciplinary and integrative area including a variety of applications in science, engineering, numerical methods, applied mathematics, and computer science disciplines. The book covers a collection of different types of applications and visions to various disciplinary key aspects, which comprises both problem-driven and methodology-driven approaches at the same time. These selected applications are: Computational and information technologies for numerical models and large unstructured data processing Evolution of matrix computations and new concepts in computing Inverse problems covering both classical and newer approaches Integro-differential scheme (IDS) that combines finite volume and finite difference methods Smart city wireless networks Signal processing methods

Inverse Methods for Atmospheric Sounding-Clive D. Rodgers 2000 Annotation Rodgers (U. of Oxford) provides graduate students and other researchers a background to the inverse problem and its solution, with applications relating to atmospheric measurements. He introduces the stages in the reverse order than the usual approach in order to develop the learner's intuition about the nature of the inverse problem. Annotation copyrighted by Book News, Inc., Portland, OR.

Geophysical Inverse Theory and Regularization Problems-Michael S. Zhdanov 2002-04-24 This book presents state-of-the-art geophysical inverse theory developed in modern mathematical terminology. The book brings together fundamental results developed by the Russian mathematical school in regularization theory and combines them with the related research in geophysical inversion carried out in the West. It presents a detailed exposition of the methods of regularized solution of inverse problems based on the ideas of Tikhonov regularization, and shows the different forms of their applications in both linear and nonlinear methods of geophysical inversion. This text is the first to treat many kinds of inversion and imaging techniques in a unified mathematical manner. The book is divided in five parts covering the foundations of the inversion theory and its applications to the solution of different geophysical inverse problems, including potential field, electromagnetic, and seismic methods. The first part is an introduction to inversion theory. The second part contains a description of the basic methods of solution of the linear and nonlinear inverse problems using regularization. The following parts treat the application of regularization methods in gravity and magnetic, electromagnetic, and seismic inverse problems. The key connecting idea of these applied parts of the book is the analogy between the solutions of the forward and inverse problems in different geophysical methods. The book also includes chapters related to the modern technology of geophysical imaging, based on seismic and electromagnetic migration. This volume is unique in its focus on providing a link between the methods used in gravity, electromagnetic, and seismic imaging and inversion, and represents an exhaustive treatise on inversion theory.

Comprehensive Electrocardiology-Peter W. Macfarlane 2010-11-05 New edition of the classic complete reference book for cardiologists and trainee cardiologists on the theory and practice of electrocardiography, one of the key modalities used for evaluating cardiology patients and deciding on appropriate management strategies.