Numerical Solution Of Ill Posed Cauchy File Type

Conjugate Gradient Type Methods for Ill-Posed ProblemsWell-posed, Ill-posed, and Intermediate Problems with ApplicationsRegularization Methods for Ill-posed ProblemsNumerical Regularization for Atmospheric Inverse ProblemsNumerical Methods of Solving Ill-posed Problems of Dielectric SpectrometryNumerical Methods for the Solution of Ill-Posed ProblemsHandbook of Analytic Computational Methods in Applied MathematicsThe Numerical Treatment of Integral EquationsInverse Problems and ApplicationsNumerical Methods for Inverse ProblemsRegularization of Ill-Posed Problems by Iteration MethodsOptimal Methods for Ill-Posed ProblemsHandbook of Mathematical GeodesyThe Mollification Method and the Numerical Solution of Ill-Posed ProblemsNumerical Methods for Solving Inverse Problems of Mathematical PhysicsNonlinear Ill-Posed ProblemsIll-Posed and Inverse ProblemsIll-Posed Problems: Theory and ApplicationsOptimization and Regularization for Computational Inverse Problems and ApplicationsRegularization Methods for Ill-posed ProblemsExperimental and Numerical Methods for Solving Ill-posed Inverse ProblemsIll-posed Problems in Natural SciencesRegularization of Inverse ProblemsComputational Methods for Applied Inverse ProblemsInverse and Ill-posed ProblemsRegularization Algorithms for Ill-Posed ProblemsAn Introduction to the Mathematical Theory of Inverse ProblemsIll-Posed Problems with A Priori InformationMethods for Solving Incorrectly Posed ProblemsIll-posed Problems of Mathematical Physics and AnalysisSolutions of Ill-posed ProblemsIll-posed Problems of Mathematical Physics and AnalysisA Taste of Inverse ProblemsInformation Computing and ApplicationsOptimization Techniques in Computer VisionLinear and Nonlinear Inverse Problems with Practical ApplicationsInverse and Ill-Posed ProblemsComputational Methods for Inverse ProblemsInverse and Ill-posed ProblemsRank-Deficient and Discrete Ill-Posed Problems

Conjugate Gradient Type Methods for Ill-Posed Problems

Some problems of mathematical physics and analysis can be formulated as the problem of solving the equation f € F, (1) Au = f, where A: DA C U + F is an operator with a non-empty domain of definition D , in a metric space U, with range in a metric space F. The metrics A on U and F will be denoted by P and P ' respectively. Relative u F to the twin spaces U and F, J. Hadamard P-06] gave the following defini tion of correctness: the problem (1) is said to be well-posed (correct, properly posed) if the following conditions are satisfied: (1) The range of the value Q of the operator A coincides with A F ("sol vabi li ty" condition); (2) The equality AU = AU for any u ,u € DA implies the I 2 l 2 equality u = u ("uniqueness" condition); l 2 (3) The inverse operator A-I is continuous on F ("stability" condition). Any reasonable mathematical formulation of a physical problem requires that conditions (1)-(3) be satisfied. That is why Hadamard postulated that any "ill-posed" (improperly posed) problem, that is to say, one which does not satisfy conditions (1)-(3), is non-physical. Hadamard also gave the now classical example of an ill-posed problem, namely, the Cauchy problem for the Laplace equation.

Well-posed, Ill-posed, and Intermediate Problems with Applications

This volume arose from the Third Annual Workshop on Inverse Problems, held in Stockholm on May 2-6, 2012. The proceedings present new analytical developments and numerical methods for solutions of inverse and ill-posed problems, which consistently pose complex challenges to the development of effective numerical methods. The book highlights recent research focusing on reliable numerical techniques for the solution of inverse problems, with relevance to a range of fields including acoustics, electromagnetics, optics, medical imaging, and geophysics.

Regularization Methods for Ill-posed Problems

This book presents practical optimization techniques used in image processing and computer vision problems. Ill-posed problems are introduced and used as examples to show how each type of problem is related to typical image processing and computer vision problems. Unconstrained optimization gives the best solution based on numerical minimization of a single, scalar-valued objective function or cost function. Unconstrained optimization problems have been intensively studied, and many algorithms and tools have been developed to solve them. Most practical optimization problems, however, arise with a set of constraints. Typical examples of constraints include: (i) pre-specified pixel intensity range, (ii) smoothness or correlation with neighboring information, (iii) existence on a certain contour of lines or curves, and (iv) given statistical or spectral characteristics of the solution. Regularized optimization is a special method used to solve a class of constrained optimization problems. The term regularization refers to the transformation of an objective function with constraints into a different objective function, automatically reflecting constraints in the unconstrained minimization process. Because of its simplicity and efficiency, regularized optimization has many application areas, such as image restoration, image reconstruction, optical flow estimation, etc. Optimization plays a major role in a wide variety of theories for image processing and computer vision. Various optimization techniques are used at different levels for these problems, and this volume summarizes and explains these techniques as applied to image processing and computer vision.

Numerical Regularization for Atmospheric Inverse Problems

The Inverse and Ill-Posed Problems Series is a series of monographs publishing postgraduate level information on inverse and ill-posed problems for an international readership of professional scientists and researchers. The series aims to publish works which involve both theory and applications in, e.g., physics, medicine, geophysics, acoustics, electrodynamics, tomography, and ecology.

Numerical Methods of Solving Ill-posed Problems of Dielectric Spectrometry

Uses a strong computational and truly interdisciplinary treatment to introduce applied inverse theory. The author created the Mollification Method as a means of dealing with ill-posed problems. Although the presentation focuses on problems with origins in mechanical engineering, many of the ideas and techniques can be easily applied to a broad range of situations.

Numerical Methods for the Solution of Ill-Posed Problems

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.

Handbook of Analytic Computational Methods in Applied Mathematics

The Numerical Treatment of Integral Equations

Here is an overview of modern computational stabilization methods for linear inversion, with applications to a variety of problems in audio processing, medical imaging, tomography, seismology, astronomy, and other areas. Rank-deficient problems involve matrices that are either exactly or nearly rank deficient. Such problems often arise in connection with noise suppression and other problems where the goal is to suppress unwanted disturbances of the given measurements. Discrete ill-posed problems arise in connection with the numerical treatment of inverse problems, where one typically wants to compute information about some interior properties using exterior measurements. Examples of inverse problems are image restoration and tomography, where one needs to improve blurred images or reconstruct pictures from raw data. This book describes, in a common framework, new and existing numerical methods for the analysis and solution of rank-deficient and discrete ill-posed problems. The emphasis is on insight into the stabilizing properties of the algorithms and on the efficiency and reliability of the computations. The setting is that of numerical linear algebra rather than abstract functional analysis, and the theoretical development is complemented with numerical examples and figures that illustrate the features of the various algorithms.

Inverse Problems and Applications

Following Keller [119] we call two problems inverse to each other if the for mulation of each of them requires full or partial knowledge of the other. By this definition, it is obviously arbitrary which of the two problems we call the direct and which we call the inverse problem. But usually, one of the problems has been studied earlier and, perhaps, in more detail. This one is usually called the direct problem, whereas the other is the inverse problem. However, there is often another, more important difference between these two problems. Hadamard (see [91]) introduced the concept of a well-posed problem, originating from the philosophy that the mathematical model of a physical problem has to have the properties of uniqueness, existence, and stability of the solution. If one of the properties fails to hold, he called the problem ill-posed. It turns out that many interesting and important inverse in science lead to ill-posed problems, while the corresponding di problems rect problems are well-posed. Often, existence and uniqueness can be forced by enlarging or reducing the solution space (the space of "models"). For restoring stability, however, one has to change the topology of the spaces, which is in many cases impossible because of the presence of measurement errors. At first glance, it seems to be impossible to compute the solution of a problem numerically if the solution of the problem does not depend continuously on the data, i. e. , for the case of ill-posed problems.

Numerical Methods for Inverse Problems

Presents current theories and methods for obtaining approximate solutions of basic classes of incorrectly posed problems. The book provides simple conditions of optimality and the optimality of the order of regular methods for solving a wide class of unsteady problems.

Regularization of Ill-Posed Problems by Iteration Methods

This thesis examines solution methods for large linear systems of equations with a matrix of ill-determined rank and an error-contaminated right-hand side. The numerical solution is delicate, because the matrix is very ill-conditioned and may be singular. To solve such systems, one replaces the system with one that is less sensitive to error a process known as regularization. This thesis focuses on the regularization method known as truncated iteration. A new algorithm is presented and compared to other existing methods.

Optimal Methods for Ill-Posed Problems

This specialized and authoritative book contains an overview of modern approaches to constructing approximations to solutions of ill-posed operator equations, both linear and nonlinear. These approximation schemes form a basis for implementable numerical algorithms for the stable solution of operator equations arising in contemporary mathematical modeling, and in particular when solving inverse problems of mathematical physics. The book presents in detail stable solution methods for ill-posed problems using the methodology of iterative regularization of classical iterative schemes and the techniques of finite dimensional and finite difference approximations of the problems under study. Special attention is paid to ill-posed Cauchy problems for linear operator differential equations and to ill-posed variational inequalities and optimization problems. The readers are expected to have basic knowledge in functional analysis and differential equations. The book will be of interest to applied mathematicians and specialists in mathematical modeling and inverse problems, and also to advanced students in these fields. Contents Introduction Regularization Methods For Linear Equations Finite Difference Methods Iterative Regularization Methods Finite-Dimensional Iterative Processes Variational Inequalities and Optimization Problems

Handbook of Mathematical Geodesy

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 Mollification Method and the Numerical Solution of Ill-Posed Problems

Recent years have been characterized by the increasing amountofpublications in the field ofso-called ill-posed problems. This is easilyunderstandable because we observe the rapid progress of a relatively young branch ofmathematics, ofwhich the first results date back to about 30 years ago. By now, impressive results have been achieved both in the theory ofsolving ill-posed problems and in the applicationsofalgorithms using modem computers. To mention just one field, one can name the computer tomography which could not possibly have been developed without modem tools for solving ill-posed problems. When writing this book, the authors tried to define the place and role of ill posed problems in modem mathematics. In a few words, we define the theory of ill-posed problems as the theory of approximating functions with approximately given arguments in functional spaces. The difference between well-posed and ill posed problems is concerned with the fact that the latter are associated with discontinuous functions. This approach is followed by the authors throughout the whole book. We hope that the theoretical results will be of interest to researchers working in approximation theory and functional analysis. As for particular algorithms for solving ill-posed problems, the authors paid general attention to the principles ofconstructing such algorithms as the methods for approximating discontinuous functions with approximately specified arguments. In this way it proved possible to define the limits of applicability of regularization techniques.

Numerical Methods for Solving Inverse Problems of Mathematical Physics

This two-volume set of CCIS 391 and CCIS 392 constitutes the refereed proceedings of the Fourth International Conference on Information Computing and Applications, ICICA 2013, held in Singapore, in August 2013. The 126 revised full papers presented in both volumes were carefully reviewed and selected from 665 submissions. The papers are organized in topical sections on Internet computing and applications; engineering management and applications; intelligent computing and applications; control engineering and applications; cloud and evolutionary computing; knowledge management and applications; computational statistics and applications.

Nonlinear Ill-Posed Problems

Ill-Posed and Inverse Problems

This monograph reports recent advances of inversion theory and recent developments with practical applications in frontiers of sciences, especially inverse design and novel computational methods for inverse problems. Readers who do research in applied mathematics, engineering, geophysics, biomedicine, image processing, remote sensing, and environmental science will benefit from the contents since the book incorporates a background of using statistical and non-statistical methods, e.g., regularization and optimization techniques for solving practical inverse problems.

Ill-Posed Problems: Theory and Applications

Optimization and Regularization for Computational Inverse Problems and Applications

Working computationally in applied mathematics is the very essence of dealing with real-world problems in science and engineering. Approximation theory-on the borderline between pure and applied mathematics- has always supplied some of the most innovative ideas, computational methods, and original approaches to many types of problems. The f

Regularization Methods for Ill-posed Problems

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.

Experimental and Numerical Methods for Solving Ill-posed Inverse Problems

The retrieval problems arising in atmospheric remote sensing belong to the class of the - called discrete ill-posed problems. These problems are unstable under data perturbations, and can be solved by numerical regularization methods, in which the solution is stabilized by taking additional information into account. The goal of this research monograph is to present and analyze numerical algorithms for atmospheric retrieval. The book is aimed at physicists and engineers with some ba- ground in numerical linear algebra and matrix computations. Although there are many practical details in this book, for a robust and ef?cient implementation of all numerical algorithms, the reader should consult the literature cited. The data model adopted in our analysis is semi-stochastic. From a practical point of view, there are no signi?cant differences between a semi-stochastic and a determin- tic framework; the differences are relevant from a theoretical point of view, e.g., in the convergence and convergence rates analysis. After an introductory chapter providing the state of the art in passive atmospheric remote sensing, Chapter 2 introduces the concept of ill-posedness for linear discrete eq- tions. To illustrate the dif?culties associated with the solution of discrete ill-posed pr- lems, we consider the temperature retrieval by nadir sounding and analyze the solvability of the discrete equation by using the singular value decomposition of the forward model matrix.

Ill-posed Problems in Natural Sciences

The text demonstrates the methods for proving the existence (if at all) and finding of inverse and ill-posed problems solutions in linear algebra, integral and operator equations, integral geometry, spectral inverse problems, and inverse scattering problems. It is given comprehensive background material for linear ill-posed problems and for coefficient inverse problems for hyperbolic, parabolic, and elliptic equations. A lot of examples for inverse problems from physics, geophysics, biology, medicine, and other areas of application of mathematics are included.

Regularization of Inverse Problems

This book is devoted to the mathematical theory of regularization methods and gives an account of the currently available results about regularization methods for linear and nonlinear ill-posed problems. Both continuous and iterative regularization methods are considered in detail with special emphasis on the development of parameter choice and stopping rules which lead to optimal convergence rates.

Computational Methods for Applied Inverse Problems

Numerical Methods of Solving Ill-Posed Problems of Dielectric Spectrometry

Inverse and Ill-posed Problems

The book covers fundamentals of the theory of optimal methods for solving ill-posed problems, as well as ways to obtain accurate and accurate-by-order error estimates for these methods. The methods described in the current book are used to solve a number of inverse problems in mathematical physics. Contents Modulus of continuity of the inverse operator and methods for solving ill-posed problems Lavrent'ev methods for constructing approximate solutions of linear operator equations of the first kind Tikhonov regularization method Projection-regularization method Inverse heat exchange problems

Regularization Algorithms for Ill-Posed Problems

M.M. Lavrentiev is the author of many fundamental scientific results in many directions of mathematics and its applications, such as differential equations, inverse and ill-posed problems, tomography, numerical and applied mathematics. His results in the theory of inverse problems for differential equations and in tomography are well known all over the world. To honour him on the occasion of his 70th birthday renowned scientists in this field of mathematics, both from East and West, have contributed to this special collection of papers on ill-posed and inverse problems, which will be of interest to anyone working in this field.

An Introduction to the Mathematical Theory of Inverse Problems

Provides a basic understanding of both the underlying mathematics and the computational methods used to solve inverse problems.

Ill-Posed Problems with A Priori Information

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.

Methods for Solving Incorrectly Posed Problems

This book deals with one of the key problems in applied mathematics, namely the investigation into and providing for solution stability in solving equations with due allowance for inaccuracies in set initial data, parameters and coefficients of a mathematical model for an object under study, instrumental function, initial conditions, etc., and also with allowance for miscalculations, including roundoff errors. Until recently, all problems in mathematics, physics and engineering were divided into two classes: well-posed problems and ill-posed problems. The authors introduce a third class of problems: intermediate ones, which are problems that change their property of being well- or ill-posed on equivalent transformations of governing equations, and also problems that display the property of being either well- or ill-posed depending on the type of the functional space used. The book is divided into two parts: Part one deals with general properties of all three classes of mathematical, physical and engineering problems with approaches to solve them; Part two deals with several stable models for solving inverse ill-posed problems, illustrated with numerical examples.

Ill-posed Problems of Mathematical Physics and Analysis

The first international conference ''Ill-Posed Problems in Natural Sciences'' was held in Moscow, August 1991. This Proceedings volume contains selected papers by well-known specialists in the theory and applications of ill-posed and inverse problems. The book covers a wide spectrum of topics such as theoretical mathematical physics, numerical methods in medicine, astrophysics, geophysics, electrodynamics, tomography, mass and heat transport theory, optics and other fields.

Solutions of Ill-posed Problems

Physical formulations leading to ill-posed problems Basic concepts of the theory of ill-posed problems Analytic continuation Boundary value problems for differential equations Volterra equations Integral geometry Multidimensional inverse problems for linear differential equations

Ill-posed Problems of Mathematical Physics and Analysis

The conjugate gradient method is a powerful tool for the iterative solution of self-adjoint operator equations in Hilbert space.This volume summarizes and extends the developments of the past decade concerning the applicability of the conjugate gradient method (and some of its variants) to ill posed problems and their regularization. Such problems occur in applications from almost all natural and technical sciences, including astronomical and geophysical imaging, signal analysis, computerized tomography, inverse heat transfer problems, and many more This Research Note presents a unifying analysis of an entire family of conjugate gradient type methods. Most of the results are as yet unpublished, or obscured in the Russian literature. Beginning with the original results by Nemirovskii and others for minimal residual type methods, equally sharp convergence results are then derived with a different technique for the classical Hestenes-Stiefel algorithm. In the final chapter some of these results are extended to selfadjoint indefinite operator equations. The main tool for the analysis is the connection of conjugate gradient type methods to real orthogonal polynomials, and elementary properties of these polynomials. These prerequisites are provided in a first chapter. Applications to image reconstruction and inverse heat transfer problems are pointed out, and exemplarily numerical results are shown for these applications.

A Taste of Inverse Problems

Many problems in science, technology and engineering are posed in the form of operator equations of the first kind, with the operator and RHS approximately known. But such problems often turn out to be ill-posed, having no solution, or a non-unique solution, and/or an unstable solution. Non-existence and non-uniqueness can usually be overcome by settling for `generalised' solutions, leading to the need to develop regularising algorithms. The theory of ill-posed problems has advanced greatly since A. N. Tikhonov laid its foundations, the Russian original of this book (1990) rapidly becoming a classical monograph on the topic. The present edition has been completely updated to consider linear ill-posed problems with or without a priori constraints (non-negativity, monotonicity, convexity, etc.). Besides the theoretical material, the book also contains a FORTRAN program library. Audience: Postgraduate students of physics, mathematics, chemistry, economics, engineering. Engineers and scientists interested in data processing and the theory of ill-posed problems.

Information Computing and Applications

Written by leading experts, this book provides a clear and comprehensive survey of the “status quo” of the interrelating process and cross-fertilization of structures and methods in mathematical geodesy. Starting with a foundation of functional analysis, potential theory, constructive approximation, special function theory, and inverse problems, readers are subsequently introduced to today’s least squares approximation, spherical harmonics reflected spline and wavelet concepts, boundary value problems, Runge-Walsh framework, geodetic observables, geoidal modeling, ill-posed problems and regularizations, inverse gravimetry, and satellite gravity gradiometry. All chapters are self-contained and can be studied individually, making the book an ideal resource for both graduate students and active researchers who want to acquaint themselves with the mathematical aspects of modern geodesy.

Optimization Techniques in Computer Vision

Iteration regularization, i.e., utilization of iteration methods of any form for the stable approximate solution of ill-posed problems, is one of the most important but still insufficiently developed topics of the new theory of ill-posed problems. In this monograph, a general approach to the justification of iteration regulari zation algorithms is developed, which allows us to consider linear and nonlinear methods from unified positions. Regularization algorithms are the 'classical' iterative methods (steepest descent methods, conjugate direction methods, gradient projection methods, etc.) complemented by the stopping rule depending on level of errors in input data. They are investigated for solving linear and nonlinear operator equations in Hilbert spaces. Great attention is given to the choice of iteration index as the regularization parameter and to estimates of errors of approximate solutions. Stabilizing properties such as smoothness and shape constraints imposed on the solution are used. On the basis of these investigations, we propose and establish efficient regularization algorithms for stable numerical solution of a wide class of ill-posed problems. In particular, descriptive regularization algorithms, utilizing a priori information about the qualitative behavior of the sought solution and ensuring a substantial saving in computational costs, are considered for model and applied problems in nonlinear thermophysics. The results of calculations for important applications in various technical fields (a continuous casting, the treatment of materials and perfection of heat-protective systems using laser and composite technologies) are given.

Linear and Nonlinear Inverse Problems with Practical Applications

"Optimization and Regularization for Computational Inverse Problems and Applications" focuses on advances in inversion theory and recent developments with practical applications, particularly emphasizing the combination of optimization and regularization for solving inverse problems. This book covers both the methods, including standard regularization theory, Fejer processes for linear and nonlinear problems, the balancing principle, extrapolated regularization, nonstandard regularization, nonlinear gradient method, the nonmonotone gradient method, subspace method and Lie group method; and the practical applications, such as the reconstruction problem for inverse scattering, molecular spectra data processing, quantitative remote sensing inversion, seismic inversion using the Lie group method, and the gravitational lensing problem. Scientists, researchers and engineers, as well as graduate students engaged in applied mathematics, engineering, geophysics, medical science, image processing, remote sensing and atmospheric science will benefit from this book. Dr. Yanfei Wang is a Professor at the Institute of Geology and Geophysics, Chinese Academy of Sciences, China. Dr. Sc. Anatoly G. Yagola is a Professor and Assistant Dean of the Physical Faculty, Lomonosov Moscow State University, Russia. Dr. Changchun Yang is a Professor and Vice Director of the Institute of Geology and Geophysics, Chinese Academy of Sciences, China.

Inverse and Ill-Posed Problems

The text demonstrates the methods for proving the existence (if at all) and finding of inverse and ill-posed problems solutions in linear algebra, integral and operator equations, integral geometry, spectral inverse problems, and inverse scattering problems. It is given comprehensive background material for linear ill-posed problems and for coefficient inverse problems for hyperbolic, parabolic, and elliptic equations. A lot of examples for inverse problems from physics, geophysics, biology, medicine, and other areas of application of mathematics are included.

Computational Methods for Inverse Problems

Inverse and Ill-posed Problems

In this book, the authors present a number of examples which lead to ill-posed problems arising with the processing and interpretation of data of physical measurements. Basic postulates and some results in the general theory of ill-posed problems follow. The exposition also includes problems of analytic continuation from continua and discrete sets, analogous problems of continuation of solutions of elliptic and parabolic equations, the main ill-posed boundary value problem for partial differential equations, and results on the theory of Volterra equations of the first kind. A very broad presentation is given of modern results on the problem of uniqueness in integral geometry and on inverse problems for partial differential equations.

Rank-Deficient and Discrete Ill-Posed Problems

Inverse problems need to be solved in order to properly interpret indirect measurements. Often, inverse problems are ill-posed and sensitive to data errors. Therefore one has to incorporate some sort of regularization to reconstruct significant information from the given data. This book presents the main achievements that have emerged in regularization theory over the past 50 years, focusing on linear ill-posed problems and the development of methods that can be applied to them. Some of this material has previously appeared only in journal articles. A Taste of Inverse Problems: Basic Theory and Examples rigorously discusses state-of-the-art inverse problems theory, focusing on numerically relevant aspects and omitting subordinate generalizations;presents diverse real-world applications, important test cases, and possible pitfalls; and treats these applications with the same rigor and depth as the theory.