

V.A. Morozov

Methods for Solving Incorrectly Posed Problems



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Methods for Solving Incorrectly Posed Problems V.A. Morozov, 1984-11-20 Some problems of mathematical physics and analysis can be formulated as the problem of solving the equation $AF = f$ where $A: D(A) \subset U \rightarrow F$ 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 $u \in F$ to the twin spaces U and F J Hadamard P 06 gave the following definition 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 $A \in F$ solvability condition 2 The equality $||Au|| \leq ||u||$ for any $u \in D(A)$ implies the L^2 equality $||u|| \leq ||Au||$ uniqueness condition 1 2 3 The inverse operator A^{-1} 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 Encyclopaedia of Mathematics Michiel Hazewinkel, 1989-08-31 V 1 A B v 2 C v 3 D Feynman Measure v 4 Fibonacci method H v 5 Lituus v 6 Lobachevskii Criterion for Convergence Optical Sigma Algebra v 7 Orbital Rayleigh Equation v 8 Reaction Diffusion Equation Stirling Interpolation Formula v 9 Stochastic Approximation Zygmund Class of Functions v 10 Subject Index Author Index

Surveys on Solution Methods for Inverse Problems David Colton, Heinz W. Engl, Alfred K. Louis, Joyce McLaughlin, William Rundell, 2012-12-06 Inverse problems are concerned with determining causes for observed or desired effects Problems of this type appear in many application fields both in science and in engineering The mathematical modelling of inverse problems usually leads to ill posed problems i.e problems where solutions need not exist need not be unique or may depend discontinuously on the data For this reason numerical methods for solving inverse problems are especially difficult special methods have to be developed which are known under the term regularization methods This

volume contains twelve survey papers about solution methods for inverse and ill posed problems and about their application to specific types of inverse problems e g in scattering theory in tomography and medical applications in geophysics and in image processing The papers have been written by leading experts in the field and provide an up to date account of solution methods for inverse problems

Fast Solution of Discretized Optimization Problems Karl-Heinz Hoffmann, Ronald W. Hoppe, Volker Schulz, 2012-12-06 Differential equations partial as well as ordinary are one of the main tools for the modeling of real world application problems Pursuing the ultimate aim of influencing these systems in a desired way one is confronted with the task of optimizing discretized models This volume contains selected papers presented at the International Workshop on Fast Solution of Discretized Optimization Problems which took place at the Weierstrass Institute for Applied Analysis and Stochastics in Berlin from May 08 until May 12 2000 The conference was attended by 59 scientists from 10 countries The scientific program consisted of 8 invited lectures presented by H G Bock IWR Heidelberg M Heinkenschloss Rice University Houston K Kunisch University of Graz U Langer University Linz B Mohammadi University of Montpellier J Petersson University of Linköping E Sachs University of Trier F Troltzsch Technical University of Chemnitz and 28 contributed talks The aim of this workshop was to foster the exchange of ideas between the still comparatively separated disciplines of nonlinear optimization on the one side and numerical methods for differential equations on the other side This is necessary for the successful solution of various current optimization problems in practical applications shape optimization topology optimization process optimization Therefore the organizing committee as well as the speakers have come from both these communities

partial differential equations and applications Giorgio Talenti, 2017-10-02 Written as a tribute to the mathematician Carlo Pucci on the occasion of his 70th birthday this is a collection of authoritative contributions from over 45 internationally acclaimed experts in the field of partial differential equations Papers discuss a variety of topics such as problems where a partial differential equation is coupled with unfavourable boundary or initial conditions and boundary value problems for partial differential equations of elliptic type

The Limits of Resolution Geoffrey de Villiers, E. Roy Pike, 2016-10-03 This beautiful book can be read as a novel presenting carefully our quest to get more and more information from our observations and measurements Its authors are particularly good at relating it Pierre C Sabatier This is a unique text a labor of love pulling together for the first time the remarkably large array of mathematical and statistical techniques used for analysis of resolution in many systems of importance today optical acoustical radar etc I believe it will find widespread use and value Dr Robert G W Brown Chief Executive Officer American Institute of Physics The mix of physics and mathematics is a unique feature of this book which can be basic not only for PhD students but also for researchers in the area of computational imaging Mario Bertero Professor University of Geneva a tour de force covering aspects of history mathematical theory and practical applications The authors provide a penetrating insight into the often confused topic of resolution and in doing offer a unifying approach to the subject that is applicable not only to traditional optical systems but

also modern day computer based systems such as radar and RF communications Prof Ian Proudler Loughborough University a must have for anyone interested in imaging and the spatial resolution of images This book provides detailed and very readable account of resolution in imaging and organizes the recent history of the subject in excellent fashion I strongly recommend it Michael A Fiddy Professor University of North Carolina at Charlotte This book brings together the concept of resolution which limits what we can determine about our physical world with the theory of linear inverse problems emphasizing practical applications The book focuses on methods for solving illposed problems that do not have unique stable solutions After introducing basic concepts the contents address problems with continuous data in detail before turning to cases of discrete data sets As one of the unifying principles of the text the authors explain how non uniqueness is a feature of measurement problems in science where precision and resolution is essentially always limited by some kind of noise

Parallel Operator Splitting Algorithms with Application to Imaging Inverse Problems Chuan He,Changhua Hu,2023-08-28 Image denoising image deblurring image inpainting super resolution and compressed sensing reconstruction have important application value in engineering practice and they are also the hot frontiers in the field of image processing This book focuses on the numerical analysis of ill condition of imaging inverse problems and the methods of solving imaging inverse problems based on operator splitting Both algorithmic theory and numerical experiments have been addressed The book is divided into six chapters including preparatory knowledge ill condition numerical analysis and regularization method of imaging inverse problems adaptive regularization parameter estimation and parallel solution methods of imaging inverse problem based on operator splitting Although the research methods in this book take image denoising deblurring inpainting and compressed sensing reconstruction as examples they can also be extended to image processing problems such as image segmentation hyperspectral decomposition and image compression This book can benefit teachers and graduate students in colleges and universities or be used as a reference for self study or further study of image processing technology engineers

Introduction to Inverse Problems for Differential Equations Alemdar Hasanov Hasanoğlu,Vladimir G. Romanov,2021-08-02 This book presents a systematic exposition of the main ideas and methods in treating inverse problems for PDEs arising in basic mathematical models though it makes no claim to being exhaustive Mathematical models of most physical phenomena are governed by initial and boundary value problems for PDEs and inverse problems governed by these equations arise naturally in nearly all branches of science and engineering The book s content especially in the Introduction and Part I is self contained and is intended to also be accessible for beginning graduate students whose mathematical background includes only basic courses in advanced calculus PDEs and functional analysis Further the book can be used as the backbone for a lecture course on inverse and ill posed problems for partial differential equations In turn the second part of the book consists of six nearly independent chapters The choice of these chapters was motivated by the fact that the inverse coefficient and source problems considered here are based on the basic and commonly used mathematical models

governed by PDEs These chapters describe not only these inverse problems but also main inversion methods and techniques Since the most distinctive features of any inverse problems related to PDEs are hidden in the properties of the corresponding solutions to direct problems special attention is paid to the investigation of these properties For the second edition the authors have added two new chapters focusing on real world applications of inverse problems arising in wave and vibration phenomena They have also revised the whole text of the first edition

Regularization of Inverse Problems Heinz Werner Engl, Martin Hanke, A. Neubauer, 2000-03-31 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

Dynamical Systems Method and Applications Alexander G. Ramm, Nguyen S. Hoang, 2013-06-07 Demonstrates the application of DSM to solve a broad range of operator equations The dynamical systems method DSM is a powerful computational method for solving operator equations With this book as their guide readers will master the application of DSM to solve a variety of linear and nonlinear problems as well as ill posed and well posed problems The authors offer a clear step by step systematic development of DSM that enables readers to grasp the method s underlying logic and its numerous applications Dynamical Systems Method and Applications begins with a general introduction and then sets forth the scope of DSM in Part One Part Two introduces the discrepancy principle and Part Three offers examples of numerical applications of DSM to solve a broad range of problems in science and engineering Additional featured topics include General nonlinear operator equations Operators satisfying a spectral assumption Newton type methods without inversion of the derivative Numerical problems arising in applications Stable numerical differentiation Stable solution to ill conditioned linear algebraic systems Throughout the chapters the authors employ the use of figures and tables to help readers grasp and apply new concepts Numerical examples offer original theoretical results based on the solution of practical problems involving ill conditioned linear algebraic systems and stable differentiation of noisy data Written by internationally recognized authorities on the topic Dynamical Systems Method and Applications is an excellent book for courses on numerical analysis dynamical systems operator theory and applied mathematics at the graduate level The book also serves as a valuable resource for professionals in the fields of mathematics physics and engineering

Thermal Measurements and Inverse Techniques Helcio R.B. Orlando, Olivier Fudym, Denis Maillet, Renato M. Cotta, 2011-05-24 With its uncommon presentation of instructional material regarding mathematical modeling measurements and solution of inverse problems Thermal Measurements and Inverse Techniques is a one stop reference for those dealing with various aspects of heat transfer Progress in mathematical modeling of complex industrial and environmental systems has e

Inverse Methods in Action Pierre C. Sabatier, 2012-12-06 This volume contains the Proceedings of a meeting held at Montpellier from November 27th to December 1st 1989 and entitled Inverse Problems

Multicentennial Meeting It was held in honor of two major centennials the foundation of Montpellier University in 1289 and the French Revolution of 1789 The meeting was one of a series of annual meetings on interdisciplinary aspects of inverse problems organized in Montpellier since 1972 and known as RCP 264 The meeting was sponsored by the Centre National de la Recherche Scientifique contract GR 264 and by the Direction des Recherches et Etudes Techniques contract 88 CO 283 The Proceedings are presented by chapters on different topics the choice of topic often being arbitrary The chapter titles are Tomographic Inverse Problems Distributed Parameters Inverse Problems Spectral Inverse Problems Exact Methods Theoretical Imaging Wave Propagation and Scattering Problems Imaging and Numerical Methods Miscellaneous Problems Inverse Methods and Applications to Nonlinear Problems In each chapter but the first the papers have been sorted alphabetically according to author In the first chapter a set of theoretical papers is presented first then more applied ones There are so many well known and excellent lectures that I will not try to refer to them all here the reader will be easily convinced by reading the Table of Contents My comments at the conference are summarized by the short scientific introduction at the beginning of the volume Transport Theory Paul Nelson,2023-05-31 This book includes seminal papers on technical subjects transport theory invariant imbedding and integral equations presented as contributions to honour George Milt Wing in celebration of his 65th birth anniversary in 1988 *Inverse Problems and Inverse Scattering of Plane Waves* D.N. Roy,L. S. Couchman,2001-10-04 The purpose of this text is to present the theory and mathematics of inverse scattering in a simple way to the many researchers and professionals who use it in their everyday research While applications range across a broad spectrum of disciplines examples in this text will focus primarily but not exclusively on acoustics The text will be especially valuable for those applied workers who would like to delve more deeply into the fundamentally mathematical character of the subject matter Practitioners in this field comprise applied physicists engineers and technologists whereas the theory is almost entirely in the domain of abstract mathematics This gulf between the two if bridged can only lead to improvement in the level of scholarship in this highly important discipline This is the book's primary focus *Motion-Free Super-Resolution* Subhasis Chaudhuri,Joshi Manjunath,2006-06-20 Motion Free Super Resolution is a compilation of very recent work on various methods of generating super resolution SR images from a set of low resolution images The current literature on this topic deals primarily with the use of motion cues for the purpose of generating SR images These cues have it is shown their advantages and disadvantages In contrast this book shows that cues other than motion can also be used for the same purpose and addresses both the merits and demerits of these new techniques Motion Free Super Resolution supersedes much of the lead author's previous edited volume Super Resolution Imaging and includes an up to date account of the latest research efforts in this fast moving field This sequel also features a style of presentation closer to that of a textbook with an emphasis on teaching and explanation rather than scholarly presentation **Estimation Techniques for Distributed Parameter Systems** H.T. Banks,K. Kunisch,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 problems 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 fundamental 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 endeavor 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 frustrated to see that my friends working on modeling where producing existence 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 prove that my least squares objective function was differentiable. But with my experience growing I became convinced that after the inverse problem has been properly trimmed the nonlinear least squares problem the one solved on the computer should be Quadratically Q wellposed that is both well posed and optimizable. Optimizability ensures that a global minimizer of the least squares function can actually be found using efficient 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 classical 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 absence of parasitic local minima or stationary points.

Advances in Electronics and Electron Physics, 1989-08-23 *Advances in Electronics and Electron Physics* *Handbook of Analytic Computational Methods in Applied Mathematics* George Anastassiou, 2019-06-03 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

Reviewing **Methods For Solving Incorrectly Posed Problems**: Unlocking the Spellbinding Force of Linguistics

In a fast-paced world fueled by information and interconnectivity, the spellbinding force of linguistics has acquired newfound prominence. Its capacity to evoke emotions, stimulate contemplation, and stimulate metamorphosis is actually astonishing. Within the pages of "**Methods For Solving Incorrectly Posed Problems**," an enthralling opus penned by a highly acclaimed wordsmith, readers set about an immersive expedition to unravel the intricate significance of language and its indelible imprint on our lives. Throughout this assessment, we shall delve in to the book is central motifs, appraise its distinctive narrative style, and gauge its overarching influence on the minds of its readers.

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