Linear and Quasilinear Parabolic Problems Volume I Abstract Linear Theory
Monographs In Mathematics V 1 | 3597267cbeced6100c3f8c924e792a73

Linear and Quasilinear Parabolic Problems
Cubic Spline Collocation Method for Quasilinear Parabolic Equations

This monograph presents a systematic theory of weak solutions in Hilbert–Schwartz spaces of initial-boundary value problems for parabolic systems of partial differential equations with general essential and natural boundary conditions and minimal regularity hypotheses on coefficients. Applications to quasilinear systems are given, including local existence for large data, global existence near an attractor, the Leray and Hopf theorems for the Navier–Stokes equations and results concerning invariant regions. Supplementary material is provided, including a self-contained treatment of the calculus of Sobolev functions on the boundaries of Lipschitz domains and a thorough discussion of the implications for Sobolev–Hoelder regularity. This will be particularly useful for researches investigating non-local and non-linear problems, as well as for students preparing for research in applied analysis. Additional topics include: existence for large data, uniqueness for smooth data, stability, and bifurcation for comparable Navier–Stokes equations, new estimates for a compressible Navier-Stokes system, singular limits for dynamical systems, and optimal control problems for boundary and point control systems, parabolic moving boundary problems.

Linear and Quasilinear Parabolic Problems: Sobolev Space Theory

This book deals mainly with linear and nonlinear parabolic equations and systems of second order. It first transforms the real forms of parabolic equations and systems into complex forms, and then discusses several initial boundary value problems and Cauchy problems for quasilinear and nonlinear parabolic complex equations of second order with smooth coefficients or measurable coefficients. Parabolic complex equations are discussed in the nonlinear case and the boundary conditions usually include the initial irregular obstacle derivative. The boundary value problems are considered in multiply connected domains and several methods are used.

On Convergence of Solutions to Equilibria for Quasilinear Parabolic Problems

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Linear Discrete Parabolic Problems

The volume originates from the ‘Conference on Nonlinear Parabolic Problems’ held in celebration of Herbert Amann’s 70th birthday at the Banach Center in Bedlewo, Poland. It features a collection of peer-reviewed research papers by recognized experts highlighting recent advances in fields of Herbert Amann’s interest such as nonlinear evolution equations, fluid dynamics, quasi-linear systems, functional analysis, and more.

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Undetermined Coefficient Problems for Quasi-Linear Parabolic Equations

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Pseudo-Differential Operators, Singularities, Applications

Linear and Quasilinear Parabolic Problems

Linear and Quasilinear Parabolic Problems

This volume introduces a unified, self-contained study of linear discrete parabolic problems through reducing the starting discrete problem to the Cauchy problem for an evolution equation in discrete time. Accessible to graduate students, the book contains a general stability theory of discrete evolution equations in Banach space and gives applications of this theory to the analysis of various classes of modern discretization methods, among others, Runge-Kutta and linear multistep methods as well as operator splitting methods. Key features: * Presents a unified approach to examining discretization methods for parabolic equations. * Highlights a stability theory of discrete evolution equations. * Deals with both autonomous and non-autonomous equations as well as with equations with memory. * Offers a series of well-posedness and convergence results for various discretization methods as applied to abstract parabolic equations; among others, Runge-Kutta and linear multistep methods as well as certain operator splitting methods. * Provides comments of results and historical remarks after each chapter.

Strong solutions for quasi-linear elliptic-parabolic problems with time-dependent obstacles

Parabolic Problems

The Linearly Implicit Euler Method for Quasi-Linear Parabolic Differential Equations

“This book covers some of the main aspects of nonlinear analysis. It concentrates on stressing the fundamental ideas instead of elaborating on the intricacies of the more esoteric aspect encompass[a] many methods of dynamical systems in quite simple and original settings. I recommend this book to anyone interested in the main and essential concepts of nonlinear analysis as well as the relevant methodologies and applications.” ---MATHEMATICAL REVIEWS

Nonlinear Evolution Equations and Related Topics

The volume originates from the 'Conference on Nonlinear Parabolic Problems' held in celebration of Herbert Amann’s 70th birthday at the Banach Center in Bedlewo, Poland. It features a collection of peer-reviewed research papers by recognized experts highlighting recent advances in fields of Herbert Amann's interest such as nonlinear evolution equations, fluid dynamics, quasilinear parabolic equations and systems, functional analysis, and more.

Moving Interfaces and Quasilinear Parabolic Evolution Equations

Homogenization of Quasilinear Parabolic Problems by the Method of Rothe and Two Scale Convergence

Analytic Inequalities and Their Applications in PDEs

Our research efforts during the grant period were concerned with undetermined coefficient problems in partial differential equations focusing on three distinct areas: problems where the unknown coefficients depend only on the dependent variables; problems giving rise to first order equations where the boundary conditions and the coefficients of the equations have a nonlocal dependence on the variables; and problems which are the result of nonlocal dependence on the equations. These types of problems are three particular cases, one of which is global invariance, and the others are the problems that are the result of nonlocal dependence on the equations. The grant supported our research efforts during the grant period.

Elements of Nonlinear Analysis

The aim of the Exposition is to present new and important developments in pure and applied mathematics. Well established in the community over more than two decades, the series offers a large library of mathematical works, including several important classics. The volumes supply thorough and detailed explanations of the methods and ideas essential to the topics in question. In addition, they convey their relationships to other parts of mathematics. The series is addressed to advanced readers interested in a thorough study of the subject. It is intended for researchers and professionals in the field.

Inverse Problems in Diffusion Processes

This book presents a number of analytic inequalities and their applications in partial differential equations. These include integral inequalities, differential inequalities of weak and strong type solutions to these quasilinear equations and applied to abstract parabolic equations, among others. In addition, Runge-Kutta and linear multistep methods as well as certain operator splitting methods are studied in detail. Provides comments of results and historical remarks after each chapter.

Superlinear Parabolic Problems

Abstract Parabolic Evolution Equations and their Applications

Functional Analytic Methods for Evolution Equations

In this monograph, the authors develop a comprehensive approach for the mathematical analysis of a wide array of problems involving moving interfaces. It includes an in-depth discussion of abstract nonlinear parabolic problems, singular perturbations, transmission problems, and criticality phenomena for nonlinear boundary conditions. The book also includes a discussion of the underlying physical and thermodynamic principles governing the equations of fluid flow and phase transitions, and an exposition of the geometry of moving hypersurfaces.

Recent Progress on Reaction-diffusion Systems and Viscosity Solutions

Global solutions for quasilinear parabolic problems

A modified version of the usual cubic spline collocation method is proposed and analyzed for quasilinear parabolic problems. Continuous time estimates of order O(h sup 4) are obtained, via arguments based on certain discrete inner-products, for a uniform mesh and sufficiently smooth solutions. Two types of collocation at the boundary are considered and shown to yield O(h sup 4) and O(h sup 4/7) rates of convergence.

Parabolic Problems

This monograph looks at several trends of investigation of singular solutions of nonlinear elliptic and parabolic equations. It discusses results on the existence and properties of such solutions, both global and local, as well as applications to other equations. It will be useful for researchers and postgraduate students who specialize in the field of the theory of partial differential equations and nonlinear analysis.

Inverse Problems in Partial Differential Equations

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Quasilinear Parabolic Problems with Nonlinear Boundary Conditions

Nowadays there is an increasing emphasis on all aspects of adaptively generating a grid that evolves with the solution of a PDE. Another challenge is to develop efficient higher-order one-step integration methods which can handle very stiff equations and which allow us to accommodate a spatial grid in each time step without any specific difficulties. In this monograph a combination of both error-controlled grid refinement and one-step methods of Rosenbrock-type is presented. It is my intention to impart the beauty and complexity found in the theoretical investigation of the adaptive algorithm proposed here, in its realization and in solving non-trivial complex problems. I hope that this method will find many more interesting applications. Berlin-Dahlem, May 2000 Jens Lang

Acknowledgements

I have looked forward to writing this section since it is a pleasure for me to thank all friends who made this work possible and provided valuable input. I would like to express my gratitude to Peter Deuflhard for giving me the opportunity to work in the field of Scientific Computing. I have benefited immensely from his help to get the right perspectives, and from his continuous encouragement and support over several years. He certainly will forgive me the use of Rosenbrock methods rather than extrapolation methods to integrate in time.

Singular Solutions of Nonlinear Elliptic and Parabolic Equations

This collection of expository papers encompasses both the theoretical and physical application side of inverse problems in diffusion processes.

Analytic Semigroups and Optimal Regularity in Parabolic Problems

This treatise gives an exposition of the functional analytical approach to quasilinear parabolic evolution equations, developed to a large extent by the author during the last 10 years. This approach is based on the theory of linear nonautonomous parabolic evolution equations and on interpolation-extrapolation techniques. It is the only general method that applies to noncoercive quasilinear parabolic systems under nonlinear boundary conditions. The present first volume is devoted to a detailed study of nonautonomous linear parabolic evolution equations in general Banach spaces. It contains a careful exposition of the constant domain case, leading to some improvements of the classical Sobolevskii-Tanabe results. It also includes recent results for equations possessing constant interpolation spaces. In addition, systematic presentations of the theory of maximal regularity in spaces of continuous and H"older continuous functions, and in Lebesgue spaces, are given. It includes related recent advances in the field of harmonic analysis in Banach spaces and on operators possessing bounded imaginary powers. Lastly, there is a complete presentation of the technique of interpolation-extrapolation spaces and of evolution equations in those spaces, containing many new results.

Linear And Nonlinear Parabolic Complex Equations

This book is devoted to the qualitative study of solutions of superlinear elliptic and parabolic partial differential equations and systems. This class of problems contains, in particular, a number of reaction-diffusion systems which arise in various mathematical models, especially in chemistry, physics and biology. The book is self-contained and up-to-date, taking special care on the didactical preparation of the material. It is devoted to problems that are intensively studied but have not been treated thus far in depth in the book literature.

Local Existence, Uniqueness, and Smooth Dependence for Nonsmooth Quasilinear Parabolic Problems

The aim of the series is to present new and important developments in pure and applied mathematics. Well established in the community over two decades, it offers a large library of mathematics including several important classics. The volumes supply thorough and detailed expositions of the methods and ideas essential to the topics in question. In addition, they convey their relationships to other parts of mathematics. The series is addressed to advanced readers wishing to thoroughly study the topic. Editorial Board Lev Birbrair, Universidade Federal do Ceará, Fortaleza, Brazil Victor P. Maslov, Russian Academy of Sciences, Moscow, Russia Walter D. Neumann, Columbia University, New York, USA Markus J. Pflaum, University of Colorado, Boulder, USA Dieter Schleicher, Jacobs University, Bremen, Germany

Adaptive Multilevel Solution of Nonlinear Parabolic PDE Systems

Philippe Benilan was a most original and charismatic mathematician who had a deep and decisive impact on the theory of Nonlinear Evolution Equations. Dedicated to him, Nonlinear Evolution Equations and Related Topics contains research papers written by highly distinguished mathematicians. They are all related to Philippe Benilan’s work and reflect the present state of this most active field. The contributions cover a wide range of nonlinear and linear equations.

Qualitative Theory of Parabolic Equations