The book shows how the abstract methods of analytic semigroups and evolution equations in Banach spaces can be fruitfully applied to the study of parabolic problems. Particular attention is paid to optimal regularity results in linear equations. Furthermore, these results are used to study several other problems, especially fully nonlinear ones. Owing to the new unified approach chosen, known theorems are presented from a novel perspective and new results are derived. The book is self-contained. It is addressed to PhD students and researchers interested in abstract evolution equations and in parabolic partial differential equations and systems. It gives a comprehensive overview on the present state of the art in the field, teaching at the same time how to exploit its basic techniques. - - - This very interesting book provides a systematic treatment of the basic theory of analytic semigroups and abstract parabolic equations in general Banach spaces, and how this theory may be used in the study of parabolic partial differential equations; it takes into account the developments of the theory during the last fifteen years. (For instance, optimal regularity results are a typical feature of abstract parabolic equations; they are comprehensively studied in this book, and yield new and old regularity results for parabolic partial differential equations and systems. (Mathematical Reviews) Motivated by applications to fully nonlinear problems the approach is focused on classical solutions with continuous or Hölder continuous derivatives. (Zentralblatt MATH)

Parabolic Quasilinear Equations Minimizing Linear Growth Functionals

This self-contained book covers the theory of semilinear equations with sectorial operator going back to the studies of Yosida, Henry, and Pazy, which are deeply extended nowadays. The treatment emphasizes existence-uniqueness theory as a topic of functional analysis and examines abstract evolutionary equations, with applications to the Navier-Stokes system, the quasi-geostrophic equation, and fractional reaction-diffusion 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 ones. It encompasses 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

Analytic Semigroups and Optimal Regularity in Parabolic Problems

This Research Note presents some recent advances in various important domains of partial differential equations and applied mathematics including equations and systems of elliptic and parabolic type and various applications in physics, mechanics and engineering. These topics are now part of various areas of science and have experienced tremendous development during the last decades.

Superlinear Parabolic Problems

This book presents a number of analytic inequalities and their applications in partial differential equations. These include integral inequalities, differential inequalities and difference inequalities, which play a crucial role in establishing (uniform) bounds, global existence, large-time behavior, decay rates and blow-up of solutions to various classes of evolutionary differential equations. Summarizing results from a vast number of literature sources such as published papers, preprints and books, it categorizes inequalities in terms of their different properties.

Linear and Quasilinear Parabolic Problems


Nonlinear Elliptic and 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 parabolic equations and systems, functional analysis, and more.

Dynamics Reported

Moving Interfaces and Quasilinear Parabolic Evolution Equations

This volume features selected, original, and peer-reviewed papers on topics from a series of workshops on Nonlinear Partial Differential Equations for Future Applications that were held in 2017 at Tohoku University in Japan. The contributions address an abstract maximal regularity with applications to parabolic equations, stability, and bifurcation for viscous compressible Navier-Stokes equations, new estimates for a compressible Gross-Pitaevskii-Navier-Stokes system, singular limits for the Keller-Segel system in critical spaces, the dynamic programming principle for stochastic optimal control, two kinds of regularity machineries for elliptic obstacle problems, and new insight on topology of nodal sets of high-energy eigenfunctions of the Laplacian. This book aims to exhibit various theories and methods that appear in the study of...
Linear and Quasilinear Parabolic Systems: Sobolev Space Theory

This book unifies the different approaches in studying elliptic and parabolic partial differential equations with discontinuous coefficients. To the enlarging market of researchers in applied sciences, mathematics and physics, it gives concrete answers to questions suggested by nonlinear models. Providing an up-to-date survey on the results concerning elliptic and parabolic operators on a high level, the authors serve the reader in doing further research. Being themselves active researchers in the field, the authors describe both on the level of good examples and precise analysis, the crucial role played by such requirements on the coefficients as the Cordes condition, Campanato’s nearness condition, and vanishing mean oscillation condition. They present the newest results on the basic boundary value problems for operators with VMO coefficients and non-linear operators with discontinuous coefficients and state a lot of open problems in the field.

Blow-Up in Quasilinear Parabolic Equations

Abstract Parabolic Evolution Equations and their Applications

This book details the mathematical developments in total variation-based image restoration. From the reviews: "This book is devoted to PDE’s of elliptic and parabolic type associated to functionals having a linear growth in the gradient, with a special emphasis on the applications related to image restoration and nonlinear filters. The book is written with great care, paying also a lot of attention to the bibliographical and historical notes." -- ZENTRALBLATT MATH

Critical Parabolic-Type Problems

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 first two chapters introduce to the field and enable the reader to get acquainted with the main ideas by studying simple model problems, respectively of elliptic and parabolic type. The subsequent three chapters are devoted to problems with more complex structure; namely, elliptic and parabolic systems, equations with gradient depending nonlinearities, and nonlocal equations. They include many developments which reflect several aspects of current research. Although the techniques introduced in the first two chapters provide efficient tools to attack some aspects of these problems, they often display new phenomena and specifically different behaviors, whose study requires new ideas. Many open problems are mentioned and commented. The book is self-contained and up-to-date, it has a high didactic quality. It is devoted to problems that are intensively studied but have not been treated so far in depth in the book literature. The intended audience includes graduate and postgraduate students and researchers working in the field of partial differential equations and applied mathematics. The first edition of this book has become one of the standard references in the field. This second edition provides a revised text and contains a number of updates reflecting significant recent advances that have appeared in this growing field since the first edition.

R-Boundedness, Fourier Multipliers and Problems of Elliptic and Parabolic Type

MATRIX is Australia’s international and residential mathematical research institute. It facilitates new collaborations and mathematical advances through intensive residential research programs, each 1-4 weeks in duration. This book is a scientific record of the eight programs held at MATRIX in its second year, 2017: - Hypergeometric Motives and Calabi-Yau Differential Equations - Computational Inverse Problems - Integrability in Low-Dimensional Quantum Systems - Elliptic
Elliptic and Parabolic Problems

The present volume is dedicated to celebrate the work of the renowned mathematician Herbert Amann, who had a significant and decisive influence in shaping Nonlinear Analysis. Most articles published in this book, which consists of 32 articles in total, written by highly distinguished researchers, are in one way or another related to the scientific works of Herbert Amann. The contributions cover a wide range of nonlinear elliptic and parabolic equations with applications to natural sciences and engineering. Special topics are fluid dynamics, reaction-diffusion systems, bifurcation theory, maximal regularity, evolution equations, and the theory of function spaces.

Regularity Problem for Quasilinear Elliptic and Parabolic Systems

The property of maximal $L_p$-regularity for parabolic evolution equations is investigated via the concept of $L$-sectorial operators and operator-valued Fourier multipliers. As an application, we consider the $L_q$-realization of an elliptic boundary value problem of order $2m$ with operator-valued coefficients subject to general boundary conditions. We show that there is maximal $L_p$-$L_q$-regularity for the solution of the associated Cauchy problem provided the top order coefficients are bounded and uniformly continuous.

Linear and Quasilinear Parabolic Problems

In this treatise we present the semigroup approach to quasilinear evolution equations of parabolic type that has been developed over the last ten years, approximately. It emphasizes the dynamic viewpoint and is sufficiently general and flexible to encompass a great variety of concrete systems of partial differential equations occurring in science, some of those being of rather 'nonstandard' type. In particular, to date it is the only general method that applies to noncoercive systems. Although we are interested in nonlinear problems, our method is based on the theory of linear holomorphic semigroups. This distinguishes it from the theory of nonlinear contraction semigroups whose basis is a nonlinear version of the Hille Yosida theorem: the Crandall-Liggett theorem. The latter theory is well-known and well-documented in the literature. Even though it is a powerful technique having found many applications, it is limited in its scope by the fact that, in concrete applications, it is closely tied to the maximum principle. Thus the theory of nonlinear contraction semigroups does not apply to systems, in general, since they do not allow for a maximum principle. For these reasons we do not include that theory.

Elements of Nonlinear Analysis

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 parabolic equations and systems, functional analysis, and more.

Analytic Inequalities and Their Applications in PDEs

DYNAMICS REPORTED reports on recent developments in dynamical systems. Dynamical systems of course originated from ordinary differential equations. Today, dynamical systems cover a much larger area, including dynamical processes described by functional and integral
Read Online Linear And Quasilinear Parabolic Problems Volume I Abstract Linear Theory Monographs In Mathematics V 1

equations, by partial and stochastic differential equations, etc. Dynamical systems have involved remarkably in recent years. A wealth of new phenomena, new ideas and new techniques are proving to be of considerable interest to scientists in rather different fields. It is not surprising that thousands of publications on the theory itself and on its various applications are appearing. DYNAMICS REPORTED presents carefully written articles on major subjects in dynamical systems and their applications, addressed not only to specialists but also to a broader range of readers including graduate students. Topics are advanced, while detailed exposition of ideas, restriction to typical results - rather than the most general ones - and, last but not least, lucid proofs help to gain the utmost degree of clarity. It is hoped, that DYNAMICS REPORTED will be useful for those entering the field and will stimulate an exchange of ideas among those working in dynamical systems Summer 1991 Christopher K. R. T Jones Drs Kirchgraber Hans-Otto Walther Managing Editors Table of Contents Hyperbolicity and Exponential Dichotomy for Dynamical Systems Neil Fenichel 1. Introduction ......................... 2. The Main Lemma ...................... 2.3. The Linearization Theorem of Hartman and Grobman 5 4. Hyperbolic Invariant Sets: €-orbits and Stable Manifolds 6 5.

Linear And Nonlinear Parabolic Complex Equations

Linear and Quasilinear Parabolic Problems

Nonlinear Partial Differential Equations for Future Applications

Superlinear 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 Hölder continuous functions, and in Lebesgue spaces, are given. It includes related recent theorems 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.

Elliptic and Parabolic Equations with Discontinuous Coefficients

This volume discusses an in-depth theory of function spaces in an Euclidean setting, including several new features, not previously covered in the literature. In particular, it develops a unified theory of anisotropic Besov and Bessel potential spaces on Euclidean corners, with infinite-dimensional Banach spaces as targets. It especially highlights the most important subclasses of Besov spaces, namely Slobodeckii and Hölder spaces. In this case, no restrictions are imposed on the target spaces, except for reflexivity assumptions in duality results. In this general setting, the author proves sharp embedding, interpolation, and trace theorems, point-wise multiplier results, as well as Gagliardo-Nirenberg estimates and generalizations of Aubin-Lions compactness theorems. The results presented pave the way for new applications in situations where infinite-dimensional target spaces are relevant – in the realm of stochastic differential equations, for example.
The Linearly Implicit Euler Method for Quasi-linear Parabolic Differential Equations

This monograph is intended to present the fundamentals of the theory of abstract parabolic evolution equations and to show how to apply to various nonlinear diffusion equations and systems arising in science. The theory gives us a unified and systematic treatment for concrete nonlinear diffusion models. Three main approaches are known to the abstract parabolic evolution equations, namely, the semigroup methods, the variational methods, and the methods of using operational equations. In order to keep the volume of the monograph in reasonable length, we will focus on the semigroup methods. For other two approaches, see the related references in Bibliography. The semigroup methods, which go back to the invention of the analytic semigroups in the middle of the last century, are characterized by precise formulas representing the solutions of the Cauchy problem for evolution equations. The analytic semigroup $e^{tA}$ generated by a linear operator $A$ provides directly a fundamental solution to the Cauchy problem for an autonomous linear evolution equation, $tA U = F(t), 0$

Linear and Quasilinear Parabolic Problems

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.

Monotone Operators in Banach Space and Nonlinear Partial Differential Equations

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 beginning 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 (discrete semigroups) in Banach space. * Deals with both autonomous and non-autonomous equations as well as with equations with memory. * Offers a series of numerous 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.

Nonlinear Evolution Equations and Related Topics

This monograph presents a systematic theory of weak solutions in Hilbert-Sobolev spaces of initial-boundary value problems for parabolic systems of partial differential equations with general
essential and natural boundary conditions and minimal 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 measurability considerations for elements of Bochner-Sobolev spaces. This book will be particularly useful both for researchers requiring accessible and broadly applicable formulations of standard results as well as for students preparing for research in applied analysis. Readers should be familiar with the basic facts of measure theory and functional analysis, including weak derivatives and Sobolev spaces. Prior work in partial differential equations is helpful but not required.

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, Brasil 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 Dierk Schleicher, Jacobs University, Bremen, Germany

Abstract Linear Theory

Abstract: "Following the method of lines approach parabolic problems discretized in space by any usual method are discretized in time by the linearly implicit Euler method. To avoid order reduction occurring for problems with time dependent boundary conditions a modification of the method is proposed. This modified method is proved to be of uniform (i.e. independently of the space discretization) order 1 of convergence for wide classes of semi-linear and quasi-linear problems."

Linear Discrete 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 weak and entropy solutions to these equations. It will be useful for researchers and post-graduate students that specialize in the field of the theory of partial differential equations and nonlinear analysis.

Elliptic & Parabolic 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 study of abstract quasilinear parabolic evolution equations, elliptic and parabolic boundary value problems, transmission problems, one- and two-phase Stokes problems, and the equations of incompressible viscous one- and two-phase fluid flows. The theory of maximal regularity, an essential element, is also fully developed. The authors present a modern approach based on powerful tools in classical analysis, functional analysis, and vector-valued harmonic analysis. The theory is applied to problems in two-phase fluid dynamics and phase transitions, one-phase generalized Newtonian fluids, nematic liquid crystal flows, Maxwell-Stefan diffusion, and a variety of geometric evolution equations. The book also includes a discussion of the underlying physical and thermodynamic principles governing the equations of fluid flows and phase transitions, and an exposition of the geometry of moving hypersurfaces.

Second Order Parabolic Differential Equations
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 oblique derivative. The boundary value problems are considered in multiply connected domains and several methods are used.

Linear and Quasi-linear Equations of Parabolic Type

Qualitative Theory of Parabolic Equations

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 parabolic equations and systems, functional analysis, and more.

Parabolic Problems

Philippe Bénilan 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.

Proceedings of the Eighth International Colloquium on Differential Equations, Plovdiv, Bulgaria, 18-23 August, 1997

This book provides an introduction to elliptic and parabolic equations. While there are numerous monographs focusing separately on each kind of equations, there are very few books treating these two kinds of equations in combination. This book presents the related basic theories and methods to enable readers to appreciate the commonalities between these two kinds of equations as well as contrast the similarities and differences between them.

Singular Solutions of Nonlinear Elliptic and Parabolic Equations

The smoothness of solutions for quasilinear systems is one of the most important problems in modern mathematical physics. This book deals with regular or strong solutions for general quasilinear second-order elliptic and parabolic systems. Applications in solid mechanics, hydrodynamics, elasticity and plasticity are described. The results presented are based on two main ideas: the universal iterative method, and explicit, sometimes sharp, coercivity estimates in weighted spaces. Readers are assumed to have a standard background in analysis and PDEs.

Linear and Quasilinear Parabolic Problems

The objectives of this monograph are to present some topics from the theory of monotone operators and nonlinear semigroup theory which are directly applicable to the existence and uniqueness theory of initial-boundary-value problems for partial differential equations and to construct such operators as realizations of those problems in appropriate function spaces. A highlight of this presentation is the large number and variety of examples introduced to illustrate the connection between the theory of nonlinear operators and partial differential equations. These include primarily semilinear or quasilinear equations of elliptic or of parabolic type, degenerate cases with change of type, related systems and variational inequalities, and spatial boundary conditions of the usual Dirichlet, Neumann, Robin or dynamic type. The discussions of evolution
equations include the usual initial-value problems as well as periodic or more general nonlocal constraints, history-value problems, those which may change type due to a possibly vanishing coefficient of the time derivative, and other implicit evolution equations or systems including hysteresis models. The scalar conservation law and semilinear wave equations are briefly mentioned, and hyperbolic systems arising from vibrations of elastic-plastic rods are developed. The origins of a representative sample of such problems are given in the appendix.