Sobolev Spaces Their Generalizations And Elliptic Problems In Smooth And Lipschitz Domains Springer Monographs In Mathematics

This textbook provides an introduction to representations of general ∗-algebras by unbounded operators on Hilbert space, a topic that naturally arises in quantum mechanics but has so far only been properly treated in advanced monographs aimed at researchers. The book covers both the general theory of unbounded representation theory on Hilbert space as well as representations of important special classes of ∗-algebra, such as the Weyl algebra and enveloping algebras associated to unitary representations of Lie groups. A broad scope of topics are treated in book form for the first time, including group graded ∗-algebras, the transition probability of states, Archimedean quadratic modules, noncommutative Positivstellensätze, induced representations, well-behaved representations and representations on rigged modules. Making advanced material accessible to graduate students, this book will appeal to students and researchers interested in advanced functional analysis and mathematical physics, and with many exercises it can be used for courses on the representation theory of Lie groups and its application to quantum physics. A rich selection of material and bibliographic notes also make it a valuable reference.

The book is based on the lecture course "Function spaces", which the author gave for more than 10 years in the People's Friendship University of Russia (Moscow). The idea to write this book was proposed by Professors H. Triebel and H.-J. SchmeiBer in May-June 1993, when the author gave a short lecture course for post-graduate students in the Friedrich-Schiller University Jena. The initial plan to write a short book for post-graduate students was trans formed to wider aims after the work on the book had started. Finally, the book is intended both for graduate and post-graduate students and for researchers, who are interested in applying the theory of Sobolev spaces. Moreover, the methods used in the book allow us to include, in a natural way, some recent results, which have been published only in journals. Nowadays there exist numerous variants and generalizations of Sobolev spaces and it is clear that this variety is inevitable since different problems in real analysis and partial differential equations give rise to different spaces of Sobolev type. However, it is more or less clear that an attempt to develop a theory, which includes all these spaces, would not be effective. On the other hand, the basic ideas of the investigation of such spaces have very much in common.

Stochastic partial differential equations (SPDEs, for short) are the mathematical models of choice for space time evolutions corrupted by noise. Although in many settings it is known that the resulting SPDEs have a unique solution, in general, this solution is not given explicitly. Thus, in order to make those mathematical models ready to use for real life applications, appropriate numerical algorithms are needed. To increase efficiency, it would be tempting to design suitable adaptive schemes based, e.g., on wavelets. However, it is not a priori clear whether such adaptive strategies can outperform well-established uniform alternatives. Their theoretical justification requires a rigorous regularity analysis in so-called non-linear approximation scales of Besov spaces. In this thesis the regularity of (semi-)linear second order SPDEs of Itô type on general bounded Lipschitz domains is analysed. The non-linear approximation scales of Besov spaces are used to measure the regularity with respect to the space variable, the time regularity being measured first in terms of integrability and afterwards in terms of Hölder norms. In particular, it is shown that in specific situations the spatial Besov regularity of the solution in the non-linear approximation scales is generically higher than its corresponding classical Sobolev regularity. This indicates that it is worth developing spatially adaptive wavelet methods for solving SPDEs instead of using uniform alternatives.

Wavelets is a carefully organized and edited collection of extended survey papers addressing key topics in the mathematical foundations and applications of wavelet theory. The first part of the book is devoted to the fundamentals of wavelet analysis. The construction of wavelet bases and the fast computation of the wavelet transform in both continuous and discrete settings is covered. The theory of frames, dilation equations, and local Fourier bases are also presented. The second part of the book discusses applications in signal analysis, while the third part covers operator analysis and partial differential equations. Each chapter in these sections provides an up-to-date introduction to such topics as sampling theory, probability and statistics, compression, numerical analysis, turbulence, operator theory, and harmonic analysis. The book is ideal for a general scientific and engineering audience, yet it is mathematically precise. It will be an especially useful reference for harmonic analysts, partial differential equation researchers, signal processing engineers, numerical analysts, fluids researchers, and applied mathematicians.

Sobolev Type Inequalities

History of Functional Analysis

Besov Regularity of Stochastic Partial Differential Equations on Bounded Lipschitz Domains

Analysis as a Life

Sobolev Spaces, Their Generalizations and Elliptic Problems in Smooth and Lipschitz Domains

This book presents a systematic treatment of generalized Orlicz spaces (also known as Musielak–Orlicz spaces) with minimal assumptions on the generating ?-function. It introduces and develops a technique centered on the use of equivalent ?-functions. Results from classical functional analysis are presented in detail and new material is included on harmonic analysis. Extrapolation is used to prove, for example, the boundedness of Calderón–Zygmund operators. Finally, central results are provided for Sobolev spaces, including Poincaré and Sobolev–Poincaré inequalities in norm and modular forms. Primarily aimed at researchers and PhD students interested in Orlicz spaces or generalized Orlicz spaces, this book can be used as a basis for advanced graduate courses in analysis.

This volume is dedicated to our teacher and friend Hans Triebel. The core of the book is based on lectures given at the International Conference "Function Spaces, Differential Operators and Nonlinear Analysis" (FSDONA--01) held in Teistungen, Thuringia / Germany, from June 28 to July 4,2001, in honour of his 65th birthday. This was the fifth in a series of meetings organised under the same name by scientists from Finland (Helsinki, Oulu) , the Czech Republic (Prague, Plzen) and Germany (Jena) promoting the collaboration of specialists in East and West, working in these fields. This conference was a very special event because it celebrated Hans Triebel's extraordinary impact on mathematical analysis. The development of the mod ern theory of function spaces in the last 30 years and its application to various branches in both pure and applied mathematics is deeply influenced by his lasting contributions. In a series of books Hans Triebel has given systematic treatments of the theory of function spaces from different points of view, thus revealing its interdependence with interpolation theory, harmonic analysis, partial differential equations, nonlinear operators, entropy, spectral theory and, most recently, anal ysis on fractals. The presented collection of papers is a tribute to Hans Triebel's distinguished work. The book is subdivided into three parts: • Part I contains the two invited lectures by O.V. Besov (Moscow) and D.E. Edmunds (Sussex) having a survey character and honouring Hans Triebel's contributions.

This invaluable research monograph presents a unified and fascinating theory of generalized functionals of Brownian motion and other fundamental processes such as fractional Brownian motion and Levy process — covering the classical Wiener–Ito class including the generalized functionals of Hida as special cases, among others. It presents a thorough and comprehensive treatment of the Wiener–Sobolev spaces and their duals, as well as Malliavin calculus with their applications. The presentation is lucid and logical, and is based on a solid foundation of analysis and topology. The monograph develops the notions of compactness and weak compactness on these abstract Fock spaces and their duals, clearly demonstrating their nontrivial applications to stochastic differential equations in finite and infinite dimensional Hilbert spaces, optimization and optimal control problems.Readers will find the book an interesting and easy read as materials are presented in a systematic manner with a complete analysis of classical and generalized functionals of scalar Brownian motion, Gaussian random fields and their vector versions in the increasing order of generality. It starts with abstract Fourier analysis on the Wiener measure space where a striking similarity of the celebrated Riesz–Fischer theorem for separable Hilbert spaces and the space of Wiener–Ito functionals is drawn out, thus providing a clear insight into the subject.

Special problems of functional analysis Variational methods in mathematical physics The theory of hyperbolic partial differential equations Comments Appendix: Methode nouvelle a resoudre le probleme de Cauchy pour les equations lineaires hyperboliques normales Comments on the appendix Bibliography Index

Applications in Analysis and Partial Differential Equations

Dedicated to Heinrich Begehr on the Occasion of his 80th Birthday

Fourier Analysis and Partial Differential Equations

Sobolev Spaces

Function Spaces, Differential Operators and Nonlinear Analysis

Function Spaces and Applications

This book provides a comprehensive introduction to modern global variational theory on fibred spaces. It is based on differentiation and integration theory of differential forms on smooth manifolds, and on the concepts of global analysis and geometry such as jet prolongations of manifolds, mappings, and Lie groups. The book will be invaluable for researchers and PhD students in differential geometry, global analysis, differential equations on manifolds, and mathematical physics, and for the readers who wish to undertake further rigorous study in this broad interdisciplinary field. Featured topics - Analysis on manifolds - Differential forms on jet spaces - Global variational functionals - Euler-Lagrange mapping - Helmholtz form and the inverse problem - Symmetries and the Noether's theory of conservation laws - Regularity and the Hamilton theory - Variational sequences - Differential invariants and natural variational principles - First book on the geometric foundations of Lagrange structures - New ideas on global variational functionals - Complete proofs of all theorems - Exact treatment of variational principles in field theory, inc. general relativity - Basic structures and tools: global analysis, smooth manifolds, fibred spaces

This volume mark's the centenary of the birth of the outstanding mathematician of the 20th century, Sergey Sobolev. It includes new results on the latest topics of the theory of Sobolev spaces, partial differential equations, analysis and mathematical physics.

Sobolev spaces play an outstanding role in modern analysis, in particular, in the theory of partial differential equations and its applications in mathematical physics. They form an indispensable tool in approximation theory, spectral theory, differential geometry etc. The theory of these spaces is of interest in itself being a beautiful domain of mathematics. The present volume includes basics on Sobolev spaces, approximation and extension theorems, embedding and compactness theorems, their relations with isoperimetric and isocapacitary inequalities, capacities with applications to spectral theory of elliptic differential operators as well as pointwise inequalities for derivatives. The selection of topics is mainly influenced by the author's involvement in their study, a considerable part of the text is a report on his work in the field. Part of this volume first appeared in German as three booklets of Teubner-Texte zur Mathematik (1979, 1980). In the Springer volume "Sobolev Spaces", published in English in 1985, the material was expanded and revised. The present 2nd edition is enhanced by many recent results and it includes new applications to linear and nonlinear partial differential equations. New historical comments, five new chapters and a significantly augmented list of references aim to create a broader and modern view of the area.

Sobolev spaces become the established and universal language of partial differential equations and mathematical analysis. Among a huge variety of problems where Sobolev spaces are used, the following important topics are the focus of this volume: boundary value problems in domains with singularities, higher order partial differential equations, local polynomial approximations, inequalities in Sobolev-Lorentz spaces, function spaces in cellular domains, the spectrum of a Schrodinger operator with negative potential and other spectral problems, criteria for the complete integration of systems of differential equations with applications to differential geometry, some aspects of differential forms on Riemannian manifolds related to Sobolev inequalities, Brownian motion on a Cartan-Hadamard manifold, etc. Two short biographical articles on the works of Sobolev in the 1930s and the foundation of Akademgorodok in Siberia, supplied with unique archive photos of S. Sobolev are included.

Generalized Functions, Operator Theory, and Dynamical Systems

Boundary Stabilization of Parabolic Equations

Probability Theory, Function Theory, Mechanics

Mathematical Modeling and Supercomputer Technologies

Introduction to Global Variational Geometry

Fundamentals of Applied Functional Analysis

Evolution equations of hyperbolic or more general p-evolution type form an active field of current research. This volume aims to collect some recent advances in the area in order to allow a quick overview of ongoing research. The contributors are first rate mathematicians. This collection of research papers is centred around parametrix constructions and microlocal analysis; asymptotic constructions of solutions; energy and dispersive estimates; and associated spectral transforms. Applications concerning elasticity and general relativity complement the volume. The book gives an overview of a variety of ongoing current research in the field and, therefore, allows researchers as well as students to grasp new aspects and broaden their understanding of the area.

This is a translation of the fifth and final volume in a special cycle of publications in commemoration of the 50th anniversary of the Steklov Mathematical Institute of the Academy of Sciences in the USSR. The purpose of the special cycle was to present surveys of work on certain important trends and problems pursued at the Institute. Because the choice of the form and character of the surveys were left up to the authors, the surveys do not necessarily form a comprehensive overview, but rather represent the authors' perspectives on the important developments. The survey papers in this collection range over a variety of areas, including - probability theory and mathematical statistics, metric theory of functions, approximation of functions, descriptive set theory, spaces with an indefinite metric, group representations, mathematical problems of mechanics and spaces of functions of several real variables and some applications.

This book discusses advances in maximal function methods related to Poincaré and Sobolev inequalities, pointwise estimates and approximation for Sobolev functions, Hardy's inequalities, and partial differential equations. Capacities are needed for fine properties of Sobolev functions and characterization of Sobolev spaces with zero boundary values. The authors consider several uniform quantitative conditions that are self-improving, such as Hardy's inequalities, capacity density conditions, and reverse Hölder inequalities. They also study Muckenhoupt weight properties of distance functions and combine these with weighted norm inequalities; notions of dimension are then used to characterize density conditions and to give sufficient and necessary conditions for Hardy's inequalities. At the end of the book, the theory of weak solutions to the p p-Laplace equation and the use of maximal function techniques is this context are discussed. The book is directed to researchers and graduate students interested in applications of geometric and harmonic analysis in Sobolev spaces and partial differential equations.

The series is devoted to the publication of high-level monographs which cover the whole spectrum of current nonlinear analysis and applications in various fields, such as optimization, control theory, systems theory, mechanics, engineering, and other sciences. One of its main objectives is to make available to the professional community expositions of results and foundations of methods that play an important role in both the theory and applications of nonlinear analysis. Contributions which are on the borderline of nonlinear analysis and related fields and which stimulate further research at the crossroads of these areas are particularly welcome. Editor-in-Chief Jürgen Appell, Würzburg, Germany Honorary and Advisory Editors Catherine Bandle, Basel, Switzerland Alain Bensoussan, Richardson, Texas, USA Avner Friedman, Columbus, Ohio, USA Umberto Mosco, Worcester, Massachusetts, USA Louis Nirenberg, New York, USA Alfonso Vignoli, Rome, Italy Editorial Board Manuel del Pino, Bath, UK, and Santiago, Chile Mikio Kato, Nagano, Japan Wojciech Kryszewski, Toru ń , Poland Vicen ţ iu D. R ă dulescu, Kraków, Poland Simeon Reich, Haifa, Israel Please submit book proposals to Jürgen Appell. Titles in planning include Lucio Damascelli and Filomena Pacella, Morse Index of Solutions of Nonlinear Elliptic Equations (2019) Tomasz W. Dlotko and Yejuan Wang, Critical Parabolic-Type Problems (2019) Rafael Ortega, Periodic Differential Equations in the Plane: A Topological Perspective (2019) Ireneo Peral Alonso and Fernando Soria, Elliptic and Parabolic Equations Involving the Hardy-Leray Potential (2020) Cyril Tintarev, Profile Decompositions and Cocompactness: Functional-Analytic Theory of Concentration Compactness (2020) Takashi Suzuki, Semilinear Elliptic Equations: Classical and Modern Theories (2021)

Sobolev Spaces in Mathematics II

Some Applications of Functional Analysis in Mathematical Physics

Theoretical Aspects and Applications

Functional Analysis, Sobolev Spaces and Partial Differential Equations

Encyclopedia of Statistical Sciences, Volume 12

Spectral Theory and Differential Operators

This is a book comprising selected papers of colleagues and friends of Heinrich Begehr on the occasion of his 80th birthday. It aims at being a tribute to the excellent achievements of Heinrich Begehr in complex analysis and complex differential equations, and especially to his prominent role as one of the creators and long-time leader of the International Society for Analysis, its Applications and Computation (ISAAC).

This book, which is based on several courses of lectures given by the author at the Independent University of Moscow, is devoted to Sobolev-type spaces and boundary value problems for linear elliptic partial differential equations. Its main focus is on problems in non-smooth (Lipschitz) domains for strongly elliptic systems. The author, who is a prominent expert in the theory of linear partial differential equations, spectral theory and pseudodifferential operators, has included his own very recent findings in the present book. The book is well suited as a modern graduate textbook, utilizing a thorough and clear format that strikes a good balance between the choice of material and the style of exposition. It can be used both as an introduction to recent advances in elliptic equations and boundary value problems and as a valuable survey and reference work. It also includes a good deal of new and extremely useful material not available in standard textbooks to date. Graduate and post-graduate students, as well as specialists working in the fields of partial differential equations, functional analysis, operator theory and mathematical physics will find this book particularly valuable.

Sobolev Spaces presents an introduction to the theory of Sobolev Spaces and other related spaces of function, also to the imbedding characteristics of these spaces. This theory is widely used in pure and Applied Mathematics and in the Physical Sciences. This second edition of Adam's 'classic' reference text contains many additions and much modernizing and refining of material. The basic premise of the book remains unchanged: Sobolev Spaces is intended to provide a solid foundation in these spaces for graduate students and researchers alike. Self-contained and accessible for readers in other disciplines Written at elementary level making it accessible to graduate students

Variational Techniques for Elliptic Partial Differential Equations, intended for graduate students studying applied math, analysis, and/or numerical analysis, provides the necessary tools to understand the structure and solvability of elliptic partial differential equations. Beginning with the necessary definitions and theorems from distribution theory, the book gradually builds the functional analytic framework for studying elliptic PDE using variational formulations. Rather than introducing all of the prerequisites in the first chapters, it is the introduction of new problems which motivates the development of the associated analytical tools. In this way the student who is encountering this material for the first time will be aware of exactly what theory is needed, and for which problems. Features A detailed and rigorous development of the theory of Sobolev spaces on Lipschitz domains, including the trace operator and the normal component of vector fields An integration of functional analysis concepts involving Hilbert spaces and the problems which can be solved with these concepts, rather than separating the two Introduction to the analytical tools needed for physical problems of interest like time-harmonic waves, Stokes and Darcy flow, surface differential equations, Maxwell cavity problems, etc. A variety of problems which serve to reinforce and expand upon the material in each chapter, including applications in fluid and solid mechanics

An Invitation to Unbounded Representations of ∗-Algebras on Hilbert Space

Proceedings of the Fifth International School

The Hans Triebel Anniversary Volume

with Applications to Elliptic Partial Differential Equations

Sobolev Spaces in Mathematics I

Generalized Functionals of Brownian Motion and Their Applications

This second edition is fully updated, covering in particular new types of coherent states (the so-called Gazeau-Klauder coherent states, nonlinear coherent states, squeezed states, as used now routinely in quantum optics) and various generalizations of wavelets (wavelets on manifolds, curvelets, shearlets, etc.). In addition, it contains a new chapter on coherent state quantization and the related probabilistic aspects. As a survey of the theory of coherent states, wavelets, and some of their generalizations, it emphasizes mathematical principles, subsuming the theories of both wavelets and coherent states into a single analytic structure. The approach allows the user to take a classical-like view of quantum states in physics. Starting from the standard theory of coherent states over Lie groups, the authors generalize the formalism by associating coherent states to group representations that are square integrable over a homogeneous space; a further step allows one to dispense with the group context altogether. In this context, wavelets can be generated from coherent states of the affine group of the real line, and higher-dimensional wavelets arise from coherent states of other groups. The unified background makes transparent an entire range of properties of wavelets and coherent states. Many concrete examples, such as coherent states from semisimple Lie groups, Gazeau-Klauder coherent states, coherent states for the relativity groups, and several kinds of wavelets, are discussed in detail. The book concludes with a palette of potential applications, from the quantum physically oriented, like the quantum-classical transition or the construction of adequate states in quantum information, to the most innovative techniques to be used in data processing. Intended as an introduction to current research for graduate students and others entering the field, the mathematical discussion is self-contained. With its extensive references to the research literature, the first edition of the book is already a proven compendium for physicists and mathematicians active in the field, and with full coverage of the latest theory and results the revised second edition is even more valuable.

This volume compiles research results from the fifth Function Spaces International Conference, held in Poznan, Poland. It presents key advances, modern applications and analyses of function spaces and contains two special sections recognizing the contributions and influence of Wladyslaw Orlicz and Genadil Lozanowskii.

This book constitutes selected and revised papers from the 20th International Conference on Mathematical Modeling and Supercomputer Technologies, MMST 2020, held in Nizhny Novgorod, Russia, in November 2020. Due to the COVID-19 pandemic the conference was held online. The 25 full papers and 8 short papers presented in the volume were thoroughly reviewed and selected from the 106 submissions. They are organized in topical secions on computational methods for mathematical models analysis; computation in optimization and optimal control; supercomputer simulation.

Developed from the proceedings an international conference held in 1997, Function Spaces and Applications presents the work of leading mathematicians in the vital and rapidly growing field of functional analysis.

Function Spaces and Potential Theory

20th International Conference, MMST 2020, Nizhny Novgorod, Russia, November 23 – 27, 2020, Revised Selected Papers

Treatise on Analysis

Variational Methods

Wavelets

Nonlinear Functionals of Fundamental Stochastic Processes

Treatise on Analysis, Volume 10–VIII provides information pertinent to the study of the most common boundary problems for partial differential equations. This book presents the study of Cauchy's problem in its most elementary form. Comprised of one chapter, this volume begins with an overview of Hilbert-von Neumann spectral theory and explores all possible boundary conditions related to spectral theory. This text then examines the link of Cauchy's problem with the behavior of the equation's characteristics. This book discusses as well the case of linear elliptic operators. The reader is also introduced to Sobolev spaces and some of their generalizations that provide an essential tool in the study of these elliptic problems, and their manipulation requires delicate upper bounds to obtain the best possible results. This book is a valuable resource for mathematicians.

This book is an updated version of the classic 1987 monograph "Spectral Theory and Differential Operators".The original book was a cutting edge account of the theory of bounded and closed linear operators in Banach and Hilbert spaces relevant to spectral problems involving differential equations. It is accessible to a graduate student as well as meeting the needs of seasoned researchers in mathematics and mathematical physics. This revised edition corrects various errors, and adds extensive notes to the end of each chapter which describe the considerable progress that has been made on the topic in the last 30 years.

This textbook is a completely revised, updated, and expanded English edition of the important Analyse fonctionnelle (1983). In addition, it contains a wealth of problems and exercises (with solutions) to guide the reader. Uniquely, this book presents in a coherent, concise and unified way the main results from functional analysis together with the main results from the theory of partial differential equations (PDEs). Although there are many books on functional analysis and many on PDEs, this is the first to cover both of these closely connected topics. Since the French book was first published, it has been translated into Spanish, Italian, Japanese, Korean, Romanian, Greek and Chinese. The English edition makes a welcome addition to this list.

This monograph presents a technique, developed by the author, to design asymptotically exponentially stabilizing finite-dimensional boundary proportional-type feedback controllers for nonlinear parabolic-type equations. The potential control applications of this technique are wide ranging in many research areas, such as Newtonian fluid flows modeled by the Navier-Stokes equations; electrically conducted fluid flows; phase separation modeled by the Cahn-Hilliard equations; and deterministic or stochastic semi-linear heat equations arising in biology, chemistry, and population dynamics modeling. The text provides answers to the following problems, which are of great practical importance: Designing the feedback law using a minimal set of eigenfunctions of the linear operator obtained from the linearized equation around the target state Designing observers for the considered control systems Constructing time-discrete controllers requiring only partial knowledge of the state After reviewing standard notations and results in functional analysis, linear algebra, probability theory and PDEs, the author describes his novel stabilization algorithm. He then demonstrates how this abstract model can be applied to stabilization problems involving magnetohydrodynamic equations, stochastic PDEs, nonsteady-states, and more. Boundary Stabilization of Parabolic Equations will be of particular interest to researchers in control theory and engineers whose work involves systems control. Familiarity with linear algebra, operator theory, functional analysis, partial differential equations, and stochastic partial differential equations is required.

Advanced Courses of Mathematical Analysis V

Function Spaces

Recent Advances in Intuitionistic Fuzzy Logic Systems

The Fifth Conference

Sobolev Spaces of Fractional Order, Nemytskij Operators, and Nonlinear Partial Differential Equations

Evolution Equations of Hyperbolic and Schrödinger Type

This volume provides an introduction to modern concepts of linear and nonlinear functional analysis. Its purpose is also to provide an insight into the variety of deeply interlaced mathematical tools applied in the study of nonlinear problems.

"..carefully and thoughtfully written and prepared with, in my opinion, just the right amount of detail included...will certainly be a primary source that I shall turn to." Proceedings of the Edinburgh Mathematical Society

ENCYCLOPEDIA OF STATISTICAL SCIENCES

History of Functional Analysis presents functional analysis as a rather complex blend of algebra and topology, with its evolution influenced by the development of these two branches of mathematics. The book adopts a narrower definition—one that is assumed to satisfy various algebraic and topological conditions. A moment of reflections shows that this already covers a large part of modern analysis, in particular, the theory of partial differential equations. This volume comprises nine chapters, the first of which focuses on linear differential equations and the Sturm-Liouville problem. The succeeding chapters go on to discuss the ""crypto-integral"" equations, including the Dirichlet principle and the Beer-Neumann method; the equation of vibrating membranes, including the contributions of Poincare and H.A. Schwarz's 1885 paper; and the idea of infinite dimension. Other chapters cover the crucial years and the definition of Hilbert space, including Fredholm's discovery and the contributions of Hilbert; duality and the definition of normed spaces, including the Hahn-Banach theorem and the method of the gliding hump and Baire category; spectral theory after 1900, including the theories and works of F. Riesz, Hilbert, von Neumann, Weyl, and Carleman; locally convex spaces and the theory of distributions; and applications of functional analysis to differential and partial differential equations. This book will be of interest to practitioners in the fields of mathematics and statistics.

Direct Methods in the Theory of Elliptic Equations

Maximal Function Methods for Sobolev Spaces

Orlicz Spaces and Generalized Orlicz Spaces

Asymptotics, Estimates and Nonlinearities

Theoretical Tools and Advanced Applications

Sobolev Spaces on Domains

This book was first published in 2001. It provides an introduction to Fourier analysis and partial differential equations and is intended to be used with courses for beginning graduate students. With minimal prerequisites the authors take the reader from fundamentals to research topics in the area of nonlinear evolution equations. The first part of the book consists of some very classical material, followed by a discussion of the theory of periodic distributions and the periodic Sobolev spaces. The authors then turn to the study of linear and nonlinear equations in the setting provided by periodic distributions. They assume only some familiarity with Banach and Hilbert spaces and the elementary properties of bounded linear operators. After presenting a fairly complete discussion of local and global well-posedness for the nonlinear Schrödinger and the Korteweg-de Vries equations, they turn their attention, in the two final chapters, to the non-periodic setting, concentrating on problems that do not occur in the periodic case.

"The present collection of papers dedicated to Academician Ivan Matveevic Vinogradov on his eighty-fifth birthday, is a continuation of volume 142 in this series. The papers--original work on various chapter of number theory, analysis and also their applications-are of interest to specialists and graduate students in mathematics." -- Title page verso.

This open access book presents a comprehensive survey of modern operator techniques for boundary value problems and spectral theory, employing abstract boundary mappings and Weyl functions. It includes self-contained treatments of the extension theory of symmetric operators and relations, spectral characterizations of selfadjoint operators in terms of the analytic properties of Weyl functions, form methods for semibounded operators, and functional analytic models for reproducing kernel Hilbert spaces. Further, it illustrates these abstract methods for various applications, including Sturm-Liouville operators, canonical systems of differential equations, and multidimensional Schrödinger operators, where the abstract Weyl function appears as either the classical Titchmarsh-Weyl coefficient or the Dirichlet-to-Neumann map. The book is a valuable reference text for researchers in the areas of differential equations, functional analysis, mathematical physics, and system theory. Moreover, thanks to its detailed exposition of the theory, it is also accessible and useful for advanced students and researchers in other branches of natural sciences and engineering.

This book aims at providing an overview of state-of-the-art in both the theory and methods of intuitionistic fuzzy logic, partial differential equations and numerical methods in informatics. It covers topics such as fuzzy intuitionistic Hilbert spaces, intuitionistic fuzzy differential equations, fuzzy intuitionistic metric spaces, and numerical methods for differential equations. It reports on applications such as fuzzy real time scheduling, intelligent control, diagnostics and time series prediction. Chapters were carefully selected among contributions presented at the second edition of the International Conference on Intuitionistic Fuzzy Sets and Mathematical Science, ICIFSMAS, held on April 11-13, 2018, at Al Akhawayn University of Ifrane, in Morocco.

Collection of Papers Dedicated to Academician Ivan Matveevic Vinogradov on His Eighty-fifth Birthday

Proceedings of a Conference Paris, June 1988

Variational Techniques for Elliptic Partial Differential Equations

Mathematics and Applications

Analytic Number Theory, Mathematical Anaylsis and Their Applications

Coherent States, Wavelets, and Their Generalizations

This volume contains recent papers by several specialists in different fields of mathematical analysis. It offers a reasonably wide perspective of the current state of research, and new trends, in areas related to measure theory, harmonic analysis, non-associative structures in functional analysis and summability in locally convex spaces. Those interested in researching any areas of mathematical analysis will find here numerous suggestions on possible topics with an important impact today. Often, the contributions are presented in an expository nature and this makes the discussed topics accessible to a more general audience. Contents:Measurability and Semi-Continuity of Multifunctions (B Cascales)Introduction to Interpolation Theory (F Cobos)Optimality of Function Spaces in Sobolev Embeddings (L Pick)Derivations and Projections on Jordan Triples: An introduction to Nonassociative Algebra, Continuous Cohomology, and Quantum Functional Analysis (B Russo)Weighted Inequalities and Extrapolation (J Duoandikoetxea)A Note on the Off-Diagonal Muckenhoupt–Wheeden Conjecture (D Cruz-Uribe, J M Martell and C Pérez)On the Interplay Between Nonlinear Partial Differential Equations and Game Theory (J D Rossi)The Radon–Nikodým Theorem for Vector Measures and Integral Representation of Operators on Banach Function Spaces (E A Sánchez Pérez)The Orlicz–Pettis Theorem for Multiplier Convergent Series (C Swartz) Readership: Graduate students in mathematics and researchers in mathematical analysis.

In the framework of the "Annee non lineaire" (the special nonlinear year) sponsored by the C.N.R.S. (the French National Center for Scien tific Research), a meeting was held in Paris in June 1988. It took place in the Conference Hall of the Ministere de la Recherche and had as an organizing theme the topic of "Variational Problems." Nonlinear analysis has been one of the leading themes in mathemat ical research for the past decade. The use of direct variational methods has been particularly successful in understanding problems arising from physics and geometry. The growth of nonlinear analysis is largely due to the wealth of ap plications from various domains of sciences and industrial applica tions. Most of the papers gathered in this volume have their origin in applications: from mechanics, the study of Hamiltonian systems, from physics, from the recent mathematical theory of liquid crystals, from geometry, relativity, etc. Clearly, no single volume could pretend to cover the whole scope of nonlinear variational problems. We have chosen to concentrate on three main aspects of these problems, organizing them roughly around the following topics: 1. Variational methods in partial differential equations in mathemat ical physics 2. Variational problems in geometry 3. Hamiltonian systems and related topics.

Nečas' book Direct Methods in the Theory of Elliptic Equations, published 1967 in French, has become a standard reference for the mathematical theory of linear elliptic equations and systems. This English edition, translated by G. Tronel and A. Kufner, presents Nečas' work essentially in the form it was published in 1967. It gives a timeless and in some sense definitive treatment of a number issues in variational methods for elliptic systems and higher order equations. The text is recommended to graduate students of partial differential equations, postdoctoral associates in Analysis, and scientists working with linear elliptic systems. In fact, any researcher using the theory of elliptic systems will benefit from having the book in his library. The volume gives a self-contained presentation of the elliptic theory based on the "direct method", also known as the variational method. Due to its universality and close connections to numerical approximations, the variational method has become one of the most important approaches to the elliptic theory. The method does not rely on the maximum principle or other special properties of the scalar second order elliptic equations, and it is ideally suited for handling systems of equations of arbitrary order. The prototypical examples of equations covered by the theory are, in addition to the standard Laplace equation, Lame's system of linear elasticity and the biharmonic equation (both with variable coefficients, of course). General ellipticity conditions are discussed and most of the natural boundary condition is covered. The necessary foundations of the function space theory are explained along the way, in an arguably optimal manner. The standard boundary regularity requirement on the domains is the Lipschitz continuity of the boundary, which "when going beyond the scalar equations of second order" turns out to be a very natural class. These choices reflect the author's opinion that the Lame system and the biharmonic equations are just as important as the Laplace equation, and that the class of the domains with the Lipschitz continuous boundary (as opposed to smooth domains) is the most natural class of domains to consider in connection with these equations and their applications.

Nobel prize winner Ilya Prigogine writes in his preface: "Irreversibility is a challenge to mathematics...[which] leads to generalized functions and to an extension of spectral analysis beyond the conventional Hilbert space theory." Meeting this challenge required new mathematical formulations-obstacles met and largely overcome thanks primarily to the contributors to this volume." This compilation of works grew out of material presented at the "Hyperfunctions, Operator Theory and Dynamical Systems" symposium at the International Solvay Institutes for Physics and Chemistry in 1997. The result is a coherently organized collective work that moves from general, widely applicable mathematical methods to ever more specialized physical applications. Presented in two sections, part one describes Generalized Functions and Operator Theory, part two addresses Operator Theory and Dynamical Systems. The interplay between mathematics and physics is now more necessary than ever-and more difficult than ever, given the increasing complexity of theories and methods.

Boundary Value Problems, Weyl Functions, and Differential Operators