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Asymptotic Theory of Dynamic Boundary Value Problems in Irregular Domains
In Physics, Chemistry, and Biology
Number Theoretic Density and Logical Limit Laws
Mathematical Methods And Models In Composites
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Special Volume in Honor of Wolfgang Sprößig
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Elliptic Mixed, Transmission and Singular Crack Problems
Polynomial Identities and Asymptotic Methods
Spectral Problems Associated with Corner Singularities of Solutions to Elliptic Equations
Global Dynamics, Phase Space Transport, Orbits Homoclinic to Resonances, and Applications
Foliations in Cauchy-Riemann Geometry
A Tour of Subriemannian Geometries, Their Geodesics and Applications
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Invited Talks from the ICIAM 2003 Congress
Proceedings of the Sixth World Congress on Computational Mechanics in Conjunction with the Second Asian-Pacific Congress on Computational Mechanics, September 5-10, 2004, Beijing, China
Multi-Layer Potentials and Boundary Problems
Arithmetic Differential Equations
Around the Research of Vladimir Maz'ya I

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Linear Water Waves World Scientific
This book considers dynamic boundary value problems in domains with singularities of two types. The first type consists of "edges" of various dimensions on the boundary; in particular, polygons, cones, lenses, polyhedra are domains of this type. Singularities of the second type are "singularly perturbed edges" such as smoothed corners and edges and small holes. A domain with singularities of such type depends on a small parameter, whereas the boundary of the limit domain (as the parameter tends to zero) has usual edges, i.e. singularities of the first type. In the transition from the limit domain to the perturbed one, the boundary near a conical point or an edge becomes smooth, isolated singular points become small cavities, and so on. In an "irregular" domain with such singularities, problems of elastodynamics, electrodynamics and some other dynamic problems are discussed. The purpose is to describe the asymptotics of solutions near singularities of the boundary. The presented results and methods have a wide range of applications in mathematical physics and engineering. The book is addressed to specialists in mathematical physics, partial differential equations, and asymptotic methods.
Computational Mechanics Cambridge University Press
The questions that have been at the center of invariant theory since the 19th century have revolved around the following themes: finiteness, computation, and special classes of invariants. This book begins with a survey of many concrete examples chosen from these themes in the algebraic, homological, and combinatorial context. In further chapters, the authors pick one or the other of these questions as a departure point and present the known answers, open problems, and methods andtools needed to obtain these answers. Chapter 2 deals with algebraic finiteness. Chapter 3 deals with combinatorial finiteness. Chapter 4 presents Noetherian finiteness. Chapter 5 addresses homological finiteness. Chapter 6 presents special classes of invariants, which deal with modular invarianttheory and its particular problems and features. Chapter 7 collects results for special classes of invariants and coinvariants such as (pseudo) reflection groups and representations of low degree. If the ground field is finite, ad The book contains numerous examples to illustrate the theory, often of more than passing interest, and an appendix on commutative graded algebra, which provides some of the required basic background. There is an extensive reference list to provide the reader withorientation to the vast literature.
Crack Theory and Edge Singularities Springer Science & Business Media
Handbook of Numerical Methods for Hyperbolic Problems explores the changes that have taken place in the past few decades regarding literature in the design, analysis and application of various numerical algorithms for solving hyperbolic equations. This volume provides concise summaries from experts in different types of algorithms, so that readers can find a variety of algorithms under different situations and readily understand their relative advantages and limitations.
Finite Element Error Analysis for PDE-constrained Optimal Control Problems American Mathematical Soc.
The book is devoted to the results on large deviations for a class of stochastic processes. Following an introduction and overview, the material is presented in three parts. Part 1 gives necessary and sufficient conditions for exponential tightness that are analogous to conditions for tightness in the theory of weak convergence. Part 2 focuses on Markov processes in metric spaces. For a sequence of such processes, convergence of Fleming's logarithmically transformed nonlinear semigroups is shown to imply the large deviation principle in a manner analogous to the use of convergence of linear semigroups in weak convergence. Viscosity solution methods provide applicable conditions for the necessary convergence. Part 3 discusses methods for verifying the comparison principle for viscosity solutions and applies the general theory to obtain a variety of new and known results on large deviations for Markov processes. In examples concerning infinite dimensional state spaces, new comparison principles are derived for a class of Hamilton-Jacobi equations in Hilbert spaces and in spaces of probability measures.
Sobolev Spaces, Their Generalizations and Elliptic Problems in Smooth and Lipschitz Domains American Mathematical Soc.
A great deal of progress has been made recently in the field of asymptotic formulas that arise in the theory of Dirac and Laplace type operators. Asymptotic Formulae in Spectral Geometry collects these results and computations into one book. Written by a leading pioneer in the field, it focuses on the functorial and special cases methods of computing asymptotic heat trace and heat content coefficients in the heat equation. It incorporates the work of many authors into the presentation, and includes a complete bibliography that serves as a roadmap to the literature on the subject. Geometers, mathematical physicists, and analysts alike will undoubtedly find this book to be the definitive book on the subject
Analysis and Simulation of Multifield Problems Springer Science & Business Media
This volume contains the proceedings of the Fifth International Conference on Complex Analysis and Dynamical Systems, held from May 22-27, 2011, in Akko (Acre), Israel. The papers cover a wide variety of topics in complex analysis and partial differential
A Special Tribute to the Work of Herbert Amann Logos Verlag Berlin GmbH
The fundamental contributions of Professor Maz'ya to the theory of function spaces and especially

Sobolev spaces are well known and often play a key role in the study of different aspects of the theory, which is demonstrated, in particular, by presented new results and reviews from world-recognized specialists. Sobolev type spaces, extensions, capacities, Sobolev inequalities, pseudo-Poincare inequalities, optimal Hardy-Sobolev-Maz'ya inequalities, Maz'ya's isocapacitary inequalities in a measure-metric space setting and many other actual topics are discussed.

Function Spaces Springer Science & Business Media

Included in this volume are the Invited Talks given at the 5th International Congress of Industrial and Applied Mathematics. The authors of these papers are all acknowledged masters of their fields, having been chosen through a rigorous selection process by a distinguished International Program Committee. This volume presents an overview of contemporary applications of mathematics, with the coverage ranging from the rhythms of the nervous system, to optimal transportation, elasto-plasticity, computational drug design, hydrodynamic and meteorological modeling, and valuation in financial markets. Many papers are direct products of the computer revolution: grid generation, multi-scale modeling, high-dimensional numerical integration, nonlinear optimization, accurate floating-point computations and advanced iterative methods. Other papers demonstrate the close dependence on developments in mathematics itself, and the increasing importance of statistics. Additional topics relate to the study of properties of fluids and fluid-flows, or add to our understanding of Partial Differential Equations.

Complex Analysis and Dynamical Systems V European Mathematical Society

Around 1980, G. Mason announced the classification of a certain subclass of an important class of finite simple groups known as ``quasithin groups''. The classification of the finite simple groups depends upon a proof that there are no unexpected groups in this subclass. Unfortunately Mason neither completed nor published his work. In the Main Theorem of this two-part book (Volumes 111 and 112 of the AMS Mathematical Surveys and Monographs series) the authors provide a proof of a stronger theorem classifying a larger class of groups, which is independent of Mason's arguments. In particular, this allows the authors to close this last remaining gap in the proof of the classification of all finite simple groups. An important corollary of the Main Theorem provides a bridge to the program of Gorenstein, Lyons, and Solomon (AMS Mathematical Surveys and Monographs, Volume 40) which seeks to give a new, simplified proof of the classification of the finite simple groups. Part II of the work (this volume) contains the proof of the Main Theorem, and the proof of the corollary classifying quasithin groups of even type. Part I (Volume 111) contains results which are used in the proof of the Main Theorem. Some of the results are known and fairly general, but their proofs are scattered throughout the literature; others are more specialized and are proved here for the first time.

The Concentration of Measure Phenomenon American Mathematical Soc.

Subriemannian geometries can be viewed as limits of Riemannian geometries. They arise naturally in many areas of pure (algebra, geometry, analysis) and applied (mechanics, control theory, mathematical physics) mathematics, as well as in applications (e.g., robotics). This book is devoted to the study of subriemannian geometries, their geodesics, and their applications. It starts with the simplest nontrivial example of a subriemannian geometry: the two-dimensional isoperimetric problem reformulated as a problem of finding subriemannian geodesics. Among topics discussed in other chapters of the first part of the book are an elementary exposition of Gromov's idea to use subriemannian geometry for proving a theorem in discrete group theory and Cartan's method of equivalence applied to the problem of understanding invariants of distributions. The second part of the book is devoted to applications of subriemannian geometry. In particular, the author describes in detail Berry's phase in quantum mechanics, the problem of a falling cat righting herself, that of a microorganism swimming, and a phase problem arising in the N-body problem. He shows that all these problems can be studied using the same underlying type of subriemannian geometry. The reader is assumed to have an introductory knowledge of differential geometry. This book that also has a chapter devoted to open problems can serve as a good introduction to this new, exciting area of mathematics.

Ergodic Theory via Joinings Springer Nature

In 1836-1837 Sturm and Liouville published a series of papers on second order linear ordinary differential operators, which started the subject now known as the Sturm-Liouville problem. In 1910 Hermann Weyl published an article which started the study of singular Sturm-Liouville problems. Since then, the Sturm-Liouville theory remains an intensely active field of research, with many applications in mathematics and mathematical physics. The purpose of the present book is (a) to provide a modern survey of some of the basic properties of Sturm-Liouville theory and (b) to bring the reader to the forefront of knowledge about some aspects of this theory. To use the book, only a basic knowledge of advanced calculus and a rudimentary knowledge of Lebesgue integration and operator theory are assumed. An extensive list of references and examples is provided and numerous open problems are given. The list of examples includes those classical equations and functions associated with the names of Bessel, Fourier, Heun, Ince, Jacobi, Jorgens, Latzko, Legendre, Littlewood-McLeod, Mathieu, Meissner, Morse, as well as examples associated with the harmonic oscillator and the hydrogen atom. Many special functions of applied mathematics and mathematical physics occur in these examples.

Concrete Operators, Spectral Theory, Operators in Harmonic Analysis and Approximation Spectral Problems Associated with Corner Singularities of Solutions to Elliptic Equations

This text focuses on the analysis of eigenvalues and eigenfunctions that describe singularities of solutions to elliptic boundary value problems in domains with corners and edges. The authors treat both classical problems of mathematical physics and general elliptic boundary value problems. The volume is divided into two parts: The first is devoted to the power-logarithmic singularities of solutions to classical boundary value problems of mathematical physics. The second deals with similar singularities for higher order elliptic equations and systems. Chapter 1 collects basic facts concerning operator pencils acting in a pair of Hilbert spaces. Related properties of ordinary differential equations with constant operator coefficients are discussed and connections with the theory of general elliptic boundary value problems in domains with conic vertices are outlined. New results are presented. Chapter 2 treats the Laplace operator as a starting point and a model for the subsequent study of angular and conic singularities of solutions. Chapter 3 considers the Dirichlet boundary condition beginning with the plane case and turning to the space problems.

Handbook of Numerical Analysis American Mathematical Soc.

Boundary value problems for partial differential equations playa crucial role in many areas of physics

and the applied sciences. Interesting phenomena are often connected with geometric singularities, for instance, in mechanics. Elliptic operators in corresponding models are then sin gular or degenerate in a typical way. The necessary structures for constructing solutions belong to a particularly beautiful and ambitious part of the analysis. Cracks in a medium are described by hypersurfaces with a boundary. Config urations of that kind belong to the category of spaces (manifolds) with geometric singularities, here with edges. In recent years the analysis on such (in general, stratified) spaces has become a mathematical structure theory with many deep relations with geometry, topology, and mathematical physics. Key words in this connection are operator algebras, index theory, quantisation, and asymptotic analysis. Motivated by Lame's system with two-sided boundary conditions on a crack we ask the structure of solutions in weighted edge Sobolov spaces and subspaces with discrete and continuous asymptotics. Answers are given for elliptic sys tems in general. We construct parametrices of corresponding edge boundary value problems and obtain elliptic regularity in the respective scales of weighted spaces. The original elliptic operators as well as their parametrices belong to a block matrix algebra of pseudo-differential edge problems with boundary and edge conditions, satisfying analogues of the Shapiro-Lopatinskij condition from standard boundary value problems. Operators are controlled by a hierarchy of principal symbols with interior, boundary, and edge components.

The Classification of Quasithin Groups American Mathematical Society(RI)

Spectral Problems Associated with Corner Singularities of Solutions to Elliptic EquationsAmerican Mathematical Soc.

Elliptic Equations in Polyhedral Domains Springer Science & Business Media

Brownian dynamics serve as mathematical models for the diffusive motion of microscopic particles of various shapes in gaseous, liquid, or solid environments. The renewed interest in Brownian dynamics is due primarily to their key role in molecular and cellular biophysics: diffusion of ions and molecules is the driver of all life. Brownian dynamics simulations are the numerical realizations of stochastic differential equations that model the functions of biological micro devices such as protein ionic channels of biological membranes, cardiac myocytes, neuronal synapses, and many more. Stochastic differential equations are ubiquitous models in computational physics, chemistry, biophysics, computer science, communications theory, mathematical finance theory, and many other disciplines. Brownian dynamics simulations of the random motion of particles, be it molecules or stock prices, give rise to mathematical problems that neither the kinetic theory of Maxwell and Boltzmann, nor Einstein’s and Langevin’s theories of Brownian motion could predict. This book takes the readers on a journey that starts with the rigorous definition of mathematical Brownian motion, and ends with the explicit solution of a series of complex problems that have immediate applications. It is aimed at applied mathematicians, physicists, theoretical chemists, and physiologists who are interested in modeling, analysis, and simulation of micro devices of microbiology. The book contains exercises and worked out examples throughout.

Asymptotic Theory of Dynamic Boundary Value Problems in Irregular Domains American Mathematical Soc.

Mixed, transmission, or crack problems belong to the analysis of boundary value problems on manifolds with singularities. The Zaremba problem with a jump between Dirichlet and Neumann conditions along an interface on the boundary is a classical example. The central theme of this book is to study mixed problems in standard Sobolev spaces as well as in weighted edge spaces where the interfaces are interpreted as edges. Parametrices and regularity of solutions are obtained within a systematic calculus of boundary value problems on manifolds with conical or edge singularities. This calculus allows singularities on the interface and homotopies between mixed and crack problems. Additional edge conditions are computed in terms of relative index results. In a detailed final chapter, the intuitive ideas of the approach are illustrated, and there is a discussion of future challenges. A special feature of the text is the inclusion of many worked-out examples which help the reader to appreciate the scope of the theory and to treat new cases of practical interest. This book is addressed to mathematicians and physicists interested in models with singularities, associated boundary value problems, and their solvability strategies based on pseudo-differential operators. The material is also useful for students in higher semesters and young researchers, as well as for experienced specialists working in analysis on manifolds with geometric singularities, the applications of index theory and spectral theory, operator algebras with symbolic structures, quantisation, and asymptotic analysis.

In Physics, Chemistry, and Biology Springer Science & Business Media

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.

Number Theoretic Density and Logical Limit Laws Elsevier

Many phenomena in engineering and mathematical physics can be modeled by means of boundary value problems for a certain elliptic differential operator in a given domain. When the differential operator under discussion is of second order a variety of tools are available for dealing with such problems, including boundary integral methods, variational methods, harmonic measure techniques, and methods based on classical harmonic analysis. When the differential operator is of higher-order (as is the case, e.g., with anisotropic plate bending when one deals with a fourth order operator) only a few options could be successfully implemented. In the 1970s Alberto Calderón, one of the founders of the modern theory of Singular Integral Operators, advocated the use of layer potentials for the treatment of higher-order elliptic boundary value problems. The present monograph represents the first systematic treatment based on this approach. This research monograph lays, for the first time, the mathematical foundation aimed at solving boundary value problems for higher-

order elliptic operators in non-smooth domains using the layer potential method and addresses a comprehensive range of topics, dealing with elliptic boundary value problems in non-smooth domains including layer potentials, jump relations, non-tangential maximal function estimates, multi-traces and extensions, boundary value problems with data in Whitney–Lebesque spaces, Whitney–Besov spaces, Whitney–Sobolev- based Lebesgue spaces, Whitney–Triebel–Lizorkin spaces,Whitney–Sobolev-based Hardy spaces, Whitney–BMO and Whitney–VMO spaces.

Mathematical Methods And Models In Composites American Mathematical Soc.

This book contains a collection of research articles and surveys on recent developments on operator theory as well as its applications covered in the IWOTA 2011 conference held at Sevilla University in the summer of 2011. The topics include spectral theory, differential operators, integral operators, composition operators, Toeplitz operators, and more. The book also presents a large number of techniques in operator theory.

Invariant Theory of Finite Groups American Mathematical Soc.

This volume contains the Proceedings of the 9th International Conference on Harmonic Analysis and Partial Differential Equations, held June 11-15, 2012, in El Escorial, Madrid, Spain. Included in this volume is the written version of the mini-course given by Jonathan Bennett on Aspects of Multilinear Harmonic Analysis Related to Transversality. Also included, among other papers, is a paper by Emmanouil Milakis, Jill Pipher, and Tatiana Toro, which reflects and extends the ideas presented in the mini-course on Analysis on Non-smooth Domains delivered at the conference by Tatiana Toro. The topics of the contributed lectures cover a wide range of the field of Harmonic Analysis and Partial Differential Equations and illustrate the fruitful interplay between the two subfields.