Spectral Problems Associated With Corner Singularities Of Solutions To Elliptic Equations Mathematical Surveys And Monographs

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.

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This book gives a state of the art approach to the study of polynomial identities satisfied by a given algebra by combining methods of ring theory, combinatorics, and representation theory of groups with analysis. The idea of applying analytical methods to the theory of polynomial identities appeared in the early 1970s and this approach has become one of the most powerful tools of the theory. A PI-algebra is any algebra satisfying at least one nontrivial polynomial identity.This includes the polynomial rings in one or several variables, the Grassmann algebra, finite-dimensional algebras, and many other algebras occurring naturally in mathematics. The core of the book is the proof that the sequence of co dimensions of any PI-algebra has integral exponential growth - the PI-exponent of the algebra. Later chapters further apply these results to subjects such as a characterization of varieties of algebras having polynomial growth and a classification of varieties that are minimal for a given exponent. Results are extended to graded algebras and algebras with involution. The book concludes with a study of the numerical invariants and their asymptotics in the class of Lie algebras. Even in algebras that are close to being associative, the behavior of the sequences of co dimensions can be wild. The material is suitable for graduate students and research mathematicians interested in polynomial

identity algebras.
This is the English translation of the book originally published in 1987. It is a faithful reproduction of the original, supplemented by a new Foreword and brought up to date by a short postscript. The book gives an introduction by a specialist in contemporary mathematical logic to the model-theoretic study of groups, i.e., into what can be said about groups, and for that matter; about all the traditional algebraic objects.The author introduces the groups of finite Morley rank (those satisfying the most restrictive assumptions from the point of view of logic), and highlights their resemblance to algebraic groups, of which they are the prototypes. (All the necessary prerequisites from algebraic geometry are included in the book.) Then, whenever possible, generalizations of properties of groups of finite Morley type to broader classes of superstables and stable groups are described. The exposition in the first four chapters can be understood by mathematicians who have some knowledge of logic (model theory). The last three chapters are intended for specialists in mathematical logic.
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
This book investigates the close relation between quite sophisticated function spaces, the regularity of solutions of partial differential equations (PDEs) in these spaces and the link with the numerical solution of such PDEs. It

consists of three parts. Part I, the introduction, provides a quick guide to function spaces and the general concepts needed. Part II is the heart of the monograph and deals with the regularity of solutions in Besov and fractional Sobolev spaces. In particular, it studies regularity estimates of PDEs of elliptic, parabolic and hyperbolic type on non smooth domains. Linear as well as nonlinear equations are considered and special attention is paid to PDEs of parabolic type. For the classes of PDEs investigated a justification is given for the use of adaptive numerical schemes. Finally, the last part has a slightly different focus and is concerned with traces in several function spaces such as Besov- and Triebel-Lizorkin spaces, but also in quite general smoothness Morrey spaces. The book is aimed at researchers and graduate students working in regularity theory of PDEs and function spaces, who are looking for a comprehensive treatment of the above listed topics.

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
The analysis and simulation of multifield problems have recently become one of the most actual and vivid areas of research. Although the individual subproblems of complex technical and physical phenomena often are understood separately, their interaction and coupling create not only new difficulties but also a complete new level and quality of interacting coupled field problems. Presented by leading experts this book includes recent results in these fields from the International Conference on Multifield Problems, April 8-10, 2002 at the University of Stuttgart, Germany.
This book shows how a study of generating series (power series in the additive case and Dirichlet series in the multiplicative case), combined with structure theorems for the finite models of a sentence, lead to general and powerful results on limit laws, including $0 - 1$ laws. The book is unique in its approach to giving a combined treatment of topics from additive as well as from multiplicative number theory, in the setting of abstract number systems, emphasizing the remarkable parallels in the two subjects.Much evidence is collected to support the thesis that local results in additive systems lift to global results in multiplicative systems. All necessary material is given to understand thoroughly the method of Compton for proving logical limit laws, including a full treatment of Ehrenfeucht-Fraisse games, the Feferman-Vaught Theorem, and Skolem's quantifier elimination for

finite Boolean algebras. An intriguing aspect of the book is to see so many interesting tools from elementary mathematics pull together to answer the question: What is the probability that a randomly chosen structure has a given property? Prerequisites are undergraduate analysis and some exposure to abstract systems.

This book collects many of the presented papers, as plenary presentations, mini-symposia invited presentations, or contributed talks, from the European Conference on Numerical Mathematics and Advanced Applications (ENUMATH) 2017. The conference was organized by the University of Bergen, Norway from September 25 to 29, 2017. Leading experts in the field presented the latest results and ideas in the designing, implementation, and analysis of numerical algorithms as well as their applications to relevant, societal problems. ENUMATH is a series of conferences held every two years to provide a forum for discussing basic aspects and new trends in numerical mathematics and scientific and industrial applications. These discussions are upheld at the highest level of international expertise. The first ENUMATH conference was held in Paris in 1995 with successive conferences being held at various locations across Europe, including Heidelberg (1997), Jyvaskyla (1999), lschia Porto (2001), Prague (2003), Santiago de Compostela (2005), Graz (2007), Uppsala (2009), Leicester (2011), Lausanne (2013), and Ankara (2015).

This volume contains the proceedings of the Eighth International Conference on Scientific Computing and Applications, held April 1-4, 2012, at the University of Nevada, Las Vegas. The papers in this volume cover topics such as finite element methods, multiscale methods, finite difference methods, spectral methods, collocation methods, adaptive methods, parallel computing, linear solvers, applications to fluid flow, nano-optics, biofilms, finance, magnetohydrodynamics flow, electromagnetic waves, the fluid-structure interaction problem, and stochastic PDEs. This book will serve as an excellent reference for graduate students and researchers interested in scientific computing and its applications.

This introductory and self-contained book gathers as much explicit mathematical results on the linear-elastic and heat-conduction solutions in the neighborhood of singular points in two-dimensional domains, and singular edges and vertices in three-dimensional domains. These are presented in an engineering terminology for practical usage. The author treats the mathematical formulations from an engineering viewpoint and presents high-order finite-element methods for the computation of singular solutions in isotropic and anisotropic materials, and multi-material interfaces. The proper interpretation of the results in engineering practice is advocated, so that the computed data can be correlated to experimental observations. The book is divided into fourteen chapters, each containing several sections. Most of it (the first nine Chapters) addresses two-dimensional domains, where only singular points exist. The solution in a vicinity of these points admits an asymptotic expansion composed of eigenpairs and associated generalized flux/stress intensity factors (GFIFs/GSIFs), which are being computed analytically when possible or by finite element methods otherwise. Singular points associated with weakly coupled thermoelasticity in the vicinity of singularities are also addressed and thermal GSIFs are computed. The computed data is important in engineering practice for predicting failure initiation in brittle material on a daily basis. Several failure laws for two-dimensional domains with V-notches are presented and their validity is examined by comparison to experimental observations. A sufficient simple and reliable condition for predicting failure initiation (crack formation) in micron level electronic devices, involving singular points, is still a topic of active research and interest, and is addressed herein. Explicit singular solutions in the vicinity of vertices and edges in three-dimensional domains are provided in the remaining five chapters. New methods for the computation of generalized edge flux/stress intensity functions along singular edges are presented and demonstrated by several example problems from the field of fracture mechanics; including anisotropic domains and bimaterial interfaces. Circular edges are also presented and the author concludes with some remarks on open questions. This well illustrated book will appeal to both applied mathematicians and engineers working in the field of fracture mechanics and singularities.

This work provides a posteriori error analysis for mathematical idealizations in modeling boundary value problems, especially those arising in mechanical applications, and for numerical approximations of numerous nonlinear var- tional problems. An error estimate is called a posteriori if the computed solution is used in assessing its accuracy. A posteriori error estimation is central to m- suring, controlling and minimizing errors in modeling and numerical appr- imations. In this book, the main mathematical tool for the developments of a posteriori error estimates is the duality theory of convex analysis, documented in the well-known book by Ekeland and Temam ([49]). The duality theory has been found useful in mathematical programming, mechanics, numerical analysis, etc. The book is divided into six chapters. The first chapter reviews some basic notions and results from functional analysis, boundary value problems, elliptic variational inequalities, and finite element approximations. The most relevant part of the duality theory and convex analysis is briefly reviewed in Chapter 2.

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.
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.
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.
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.
This monograph offers a rigorous mathematical treatment of the scattering theory of quantum N-particle systems in an external constant magnetic field. In particular, it addresses the question of asymptotic completeness, a classification of all possible trajectories of such systems according to their asymptotic behavior.

The book adopts the so-called time-dependent approach to scattering theory, which relies on a direct study of the Schrodinger unitary group for large times. The modern methods of spectral and scattering theory introduced in the 1980s and 1990s, including the Mourre theory of positive commutators, propagation estimates, and geometrical techniques, are presented and heavily used. Additionally, new methods were developed by the authors in order to deal with the (much less understood) phenomena due to the presence of the magnetic field.The book is a good starting point for graduate students and researchers in mathematical physics who wish to move into this area of research. It includes expository material, research work previously available only in the form of journal articles, as well as some new unpublished results. The treatment of the subject is comprehensive and largely self-contained, and the text is carefully written with attention to detail.

This is the first monograph which systematically treats elliptic boundary value problems in domains of polyhedral type. The authors mainly describe their own recent results focusing on the Dirichlet problem for linear strongly elliptic systems of arbitrary order, Neumann and mixed boundary value problems for second order systems, and on boundary value problems for the stationary Stokes and Navier-Stokes systems. A feature of the book is the systematic use of Green's matrices. Using estimates for the elements of these matrices, the authors obtain solvability and regularity theorems for the solutions in weighted and non-weighted Sobolev and Holder spaces. Some classical problems of mathematical physics (Laplace and biharmonic equations, Lame system) are considered as examples. Furthermore, the book contains maximum modulus estimates for the solutions and their derivatives. The exposition is self-contained, and an introductory chapter provides background material on the theory of elliptic boundary value problems in domains with smooth boundaries and in domains with conical points. The book is destined for graduate students and researchers working in elliptic partial differential equations and applications.

This research monograph develops an arithmetic analogue of the theory of ordinary differential equations: functions are replaced here by integer numbers, the derivative operator is replaced by a ``Fermat quotient operator'', and differential equations (viewed as functions on jet spaces) are replaced by ``arithmetic differential equations''. The main application of this theory concerns the construction and study of quotients of algebraic curves by correspondences with infinite orbits. Any such quotient reduces to a point in usual algebraic geometry. But many quotients as above cease to be trivial (and become quite interesting) if one enlarges algebraic geometry by using arithmetic differential equations in place of algebraic equations. The book partly follows a series of papers written by the author; however, a substantial part of the material presented here has never been published before. For most of the book the only prerequisites are the basic facts of algebraic geometry and number theory.

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. 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.
The book contains a systematic treatment of the qualitative theory of elliptic boundary value problems for linear and quasilinear second order equations in non-smooth domains. The authors concentrate on the following fundamental results: sharp estimates for strong and weak solutions, solvability of the boundary value problems, regularity assertions for solutions near singular points. Key features: * New the Hardy – Friedrichs – Wirtinger type inequalities as well as new integral inequalities related to the Cauchy problem for a differential equation. * Precise exponents of the solution decreasing rate near boundary singular points and best

possible conditions for this. * The question about the influence of the coefficients smoothness on the regularity of solutions. * New existence theorems for the Dirichlet problem for linear and quasilinear equations in domains with conical points. * The precise power modulus of continuity at singular boundary point for solutions of the Dirichlet, mixed and the Robin problems. * The behaviour of weak solutions near conical point for the Dirichlet problem for m – Laplacian. * The behaviour of weak solutions near a boundary edge for the Dirichlet and mixed problem for elliptic quasilinear equations with triple degeneration. * Precise exponents of the solution decreasing rate near boundary singular points and best possible conditions for this. * The question about the influence of the coefficients smoothness on the regularity of solutions. * New existence theorems for the Dirichlet problem for linear and quasilinear equations in domains with conical points. * The precise power modulus of continuity at singular boundary point for solutions of the Dirichlet, mixed and the Robin problems. * The behaviour of weak solutions near conical point for the Dirichlet problem for m - Laplacian. * The behaviour of weak solutions near a boundary edge for the Dirichlet and mixed problem for elliptic quasilinear equations with triple degeneration.

These notes provide an introduction to the theory of spherical harmonics in an arbitrary dimension as well as an overview of classical and recent results on some aspects of the approximation of functions by spherical polynomials and numerical integration over the unit sphere. The notes are intended for graduate students in

the mathematical sciences and researchers who are interested in solving problems involving partial differential and integral equations on the unit sphere, especially on the unit sphere in three-dimensional Euclidean space. Some related work for approximation on the unit disk in the plane is also briefly discussed, with results being generalizable to the unit ball in more dimensions.
Mark Vishik's Partial Differential Equations seminar held at Moscow State University was one of the world's leading seminars in PDEs for over 40 years. This book celebrates Vishik's eightieth birthday. It comprises new results and survey papers written by many renowned specialists who actively participated over the years in Vishik's seminars. Contributions include original developments and methods in PDEs and related fields, such as mathematical physics, tomography, and symplectic geometry. Papers discuss linear and nonlinear equations, particularly linear elliptic problems in angles and general unbounded domains, linear elliptic problems with a parameter for mixed order systems, infinite-dimensional Schrodinger equations, Navier-Stokes equations, and nonlinear Maxwell equations. The book ends on a historical note with a paper about Vishik's seminar as a whole and a list of selected talks given from 1964 through 1989. The book is suitable for graduate students and researchers in pure and applied mathematics and mathematical physics.

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.

Topics of this volume are close to scientific interests of Professor Maz'ya and use, directly or indirectly, the fundamental influential Maz'ya's works penetrating, in a sense, the theory of PDEs. In particular, recent advantages in the study of semilinear elliptic equations, stationary Navier-Stokes equations, the Stokes system in convex polyhedra, periodic scattering problems, problems with perturbed boundary at a conic point, singular perturbations arising in elliptic shells and other important problems in mathematical physics are presented.

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.

This book 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. Chapter 4 investigates some mixed boundary conditions. The Stokes system is discussed in Chapters 5 and 6, and Chapter 7 concludes with the Dirichlet problem for the polyharmonic operator. Chapter 8 studies the Dirichlet problem for general elliptic differential equations of order $2m$ in an angle.In Chapter 9, an asymptotic formula for the distribution of eigenvalues of operator pencils corresponding to general elliptic boundary value problems in an angle is obtained. Chapters 10 and 11 discuss the Dirichlet problem for elliptic systems of differential equations of order 2 in an n-dimensional cone. Chapter 12 studies the Neumann problem for general elliptic systems, in particular with eigenvalues of the corresponding operator pencil in the strip $\mid {\Re} \lambda - m + /2n \mid \leq 1/2$. It is shown that only integer numbers contained in this strip are eigenvalues. Applications are placed within chapter introductions and as special sections at the end of chapters. Prerequisites include standard PDE and functional analysis courses.

From a review of the first edition: Beautifully written and well organized ... indispensable for those interested in certain areas of mathematical physics ... for the expert and beginner alike. The author deserves to be congratulated both for his work in unifying a subject and for showing workers in the field new directions for future development. --Zentralblatt MATH This is a second edition of a well-known book on the theory of trace ideals in the algebra of operators in a Hilbert space. Because of the theory's many different applications, the book was widely used and much in demand. For this second edition, the author has added four chapters on the closely related theory of rank one perturbations of self-adjoint operators. He has also included a comprehensive index and an addendum describing some developments since the original notes were published. This book continues to be a vital source of information for those interested in the theory of trace ideals and in its applications to various areas of mathematical physics.
This monograph presents a comprehensive treatment of second order divergence form elliptic operators with bounded measurable t-independent coefficients in spaces of fractional smoothness, in Besov and weighted Lp classes. The authors establish: (1) Mapping properties for the double and single layer potentials, as well as the Newton potential; (2) Extrapolation-type solvability results:

the fact that solvability of the Dirichlet or Neumann boundary value problem at any given Lp space automatically assures their solvability in an extended range of Besov spaces; (3) Well-posedness for the non-homogeneous boundary value problems. In particular, the authors prove well-posedness of the non-homogeneous Dirichlet problem with data in Besov spaces for operators with real, not necessarily symmetric, coefficients.

This book consists of invited survey articles and research papers in the scientific areas of the "International Workshop on Operator Algebras, Operator Theory and Applications," which was held in Lisbon in July 2016. Reflecting recent developments in the field of algebras of operators, operator theory and matrix theory, it particularly focuses on groupoid algebras and Fredholm conditions, algebras of approximation sequences, C* algebras of convolution type operators, index theorems, spectrum and numerical range of operators, extreme supercharacters of infinite groups, quantum dynamics and operator algebras, and inverse eigenvalue problems. Establishing bridges between the three related areas of operator algebras, operator theory, and matrix theory, the book is aimed at researchers and graduate students who use results from these areas.

Together with the companion volume by the same author, Operators, Functions, coed Systems: An Easy Reading.

Volume 2: Model Operator and Systems, Mathematical Surveys and Monographs, Vol. 93, AMS, 2002, this unique work combines four major topics of modern analysis and its applications: A. Hardy classes of holomorphic functions. B. Spectral theory of Hankel and Toeplitz operators, Hardy classes of holomorphic functions is known to be the most powerful tool in complex analysis for a variety of applications, starting with Fourier series, through the Riemann ?-function, all the way to Wiener's theory of signal processing. Spectral theory of Hankel and Toeplitz operators becomes the supporting pillar for a large part of harmonic and complex analysis and for many of their applications. In this book, moment problems, Nevanlinna-Pick and CarathTodory interpolation, and the best rational approximations are considered to illustrate the power of Hankel and Toeplitz operators. The book is geared toward a wide audience of readers, from graduate students to professional mathematicians, interested in operator theory and functions of a complex variable. Tire two volumes develop an elementary approach while retaining an expert level that can be applied in advanced analysis and selected applications. Subject of this work is the analysis of numerical methods for the solution of optimal control problems governed by elliptic partial differential equations. Such problems arise, if one does not only want to simulate technical or physical processes but also wants to optimize them with the help of one or more influence variables. In many practical applications these influence variables, so called controls, cannot be chosen arbitrarily, but have to fulfill certain inequality constraints. The numerical treatment of such control constrained optimal control problems requires a discretization of the underlying infinite dimensional function spaces. To guarantee the quality of the numerical solution one has to estimate and to quantify the resulting approximation errors. In this thesis a priori error

estimates for finite element discretizations are proved in case of corners or edges in the underlying domain and nonsmooth coefficients in the partial differential equation. These facts influence the regularity properties of the solution and require adapted meshes to get optimal convergence rates. Isotropic and anisotropic refinement strategies are given and error estimates in polygonal and prismatic domains are proved. The theoretical results are confirmed by numerical tests.
This volume includes several invited lectures given at the International Workshop "Analysis, Partial Differential Equations and Applications", held at the Mathematical Department of Sapienza University of Rome, on the occasion of the 70th birthday of Vladimir G. Maz'ya, a renowned mathematician and one of the main experts in the field of pure and applied analysis. The book aims at spreading the seminal ideas of Maz'ya to a larger audience in faculties of sciences and engineering. In fact, all articles were inspired by previous works of Maz'ya in several frameworks, including classical and contemporary problems connected with boundary and initial value problems for elliptic, hyperbolic and parabolic operators, Schrödinger-type equations, mathematical theory of elasticity, potential theory, capacity, singular integral operators, p-Laplacians, functional analysis, and approximation theory. Maz'ya is author of more than 450 papers and 20 books. In his long career he obtained many astonishing and frequently cited results in the theory of harmonic potentials on non-smooth domains, potential and capacity theories, spaces of functions with bounded variation, maximum principle for higher-order elliptic equations, Sobolev multipliers, approximate approximations, etc. The topics included in this volume will be particularly useful to all researchers who are interested in achieving a deeper understanding of the large expertise of Vladimir Maz'ya.
It was undoubtedly a necessary task to collect all the results

on the concentration of measure during the past years in a monograph. The author did this very successfully and the book is an important contribution to the topic. It will surely influence further research in this area considerably. The book is very well written, and it was a great pleasure for the reviewer to read it. --Mathematical Reviews The observation of the concentration of measure phenomenon is inspired by isoperimetric inequalities. A familiar example is the way the uniform measure on the standard sphere S^n becomes concentrated around the equator as the dimension gets large. This property may be interpreted in terms of functions on the sphere with small oscillations, an idea going back to Levy. The phenomenon also occurs in probability, as a version of the law of large numbers, due to Emile Borel. This book offers the basic techniques and examples of the concentration of measure phenomenon. The concentration of measure phenomenon was put forward in the early seventies by V. Milman in the asymptotic geometry of Banach spaces. It is of powerful interest in applications in various areas, such as geometry, functional analysis and infinite-dimensional integration, discrete mathematics and complexity theory, and probability theory. Particular emphasis is on geometric, functional, and probabilistic tools to reach and describe measure concentration in a number of settings. The book presents concentration functions and inequalities, isoperimetric and functional examples, spectrum and topological applications, product measures, entropic and transportation methods, as well as aspects of M. Talagrand's deep investigation of concentration in product spaces and its application in discrete mathematics and probability theory, supremum of Gaussian and empirical processes, spin glass, random matrices, etc. Prerequisites are a basic background in measure theory, functional analysis, and probability theory. This book provides a representative selection of the most relevant, innovative, and useful mathematical methods and models applied to the analysis and characterization of composites and their behaviour on micro-, meso-, and macroscale. It establishes the fundamentals for meaningful and accurate theoretical and computer modelling of these materials in the future. Although the book is primarily concerned with fibre-reinforced composites, which have ever-increasing applications in fields such as aerospace, many of the results presented can be applied to other kinds of composites. The topics covered include: scaling and homogenization procedures in composite structures, thin plate and wave solutions in anisotropic materials, laminated structures, instabilities, fracture and damage analysis of composites, and highly efficient methods for simulation of composites manufacturing. The results presented are useful in the design, fabrication, testing, and industrial applications of composite components and structures. The book is written by well-known experts in different areas of applied mathematics, physics, and composite engineering and is an essential source of reference for graduate and doctoral students, as well as researchers. It is also suitable for non-experts in composites who wish to have an overview of both the mathematical methods and models used in this area and the related open problems requiring further research.

This book gives a self-contained and up-to-date account of mathematical results in the linear theory of water waves. The study of waves has many applications, including the prediction of behavior of floating bodies (ships, submarines, tension-leg platforms etc.), the calculation of wave-making resistance in naval architecture, and the description of wave patterns over bottom topography in geophysical hydrodynamics. The first section deals with time-harmonic waves. Three linear boundary value problems serve as the approximate mathematical models for these types of water

waves. The next section uses a plethora of mathematical techniques in the investigation of these three problems. The techniques used in the book include integral equations based on Green's functions, various inequalities between the kinetic and potential energy and integral identities which are indispensable for proving the uniqueness theorems. The so-called inverse procedure is applied to constructing examples of non-uniqueness, usually referred to as 'trapped nodes.'
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.
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.