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# Inverse Spectral Theory Pure And Applied Mathematics

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**Inverse Spectral Theory Pure And Applied Mathematics:**

   *Inverse Spectral Theory* Jürgen Pöschel,Eugene Trubowitz,1987     *Inverse Spectral Theory (Pure and Applied Mathematics)* Louie J. Bryant,2015-08-14 Thought provoking and accessible in approach this updated and expanded second edition of the Inverse Spectral Theory Pure and Applied Mathematics provides a user friendly introduction to the subject Taking a clear structural framework it guides the reader through the subject s core elements A flowing writing style combines with the use of illustrations and diagrams throughout the text to ensure the reader understands even the most complex of concepts This succinct and enlightening overview is a required reading for advanced graduate level students We hope you find this book useful in shaping your future career Feel free to send us your enquiries related to our publications to info risepress pw Rise Press    **A First Course in Spectral Theory** Milivoje Lukić,2023-01-04 The central topic of this book is the spectral theory of bounded and unbounded self adjoint operators on Hilbert spaces After introducing the necessary prerequisites in measure theory and functional analysis the exposition focuses on operator theory and especially the structure of self adjoint operators These can be viewed as infinite dimensional analogues of Hermitian matrices the infinite dimensional setting leads to a richer theory which goes beyond eigenvalues and eigenvectors and studies self adjoint operators in the language of spectral measures and the Borel functional calculus The main approach to spectral theory adopted in the book is to present it as the interplay between three main classes of objects self adjoint operators their spectral measures and Herglotz functions which are complex analytic functions mapping the upper half plane to itself Self adjoint operators include many important classes of recurrence and differential operators the later part of this book is dedicated to two of the most studied classes Jacobi operators and one dimensional Schr dinger operators This text is intended as a course textbook or for independent reading for graduate students and advanced undergraduates Prerequisites are linear algebra a first course in analysis including metric spaces and for parts of the book basic complex analysis Necessary results from measure theory and from the theory of Banach and Hilbert spaces are presented in the first three chapters of the book Each chapter concludes with a number of helpful exercises    <u>Spectral Theory of Infinite-Area Hyperbolic Surfaces</u> David Borthwick,2016-07-12 This text introduces geometric spectral theory in the context of infinite area Riemann surfaces providing a comprehensive account of the most recent developments in the field For the second edition the context has been extended to general surfaces with hyperbolic ends which provides a natural setting for development of the spectral theory while still keeping technical difficulties to a minimum All of the material from the first edition is included and updated and new sections have been added Topics covered include an introduction to the geometry of hyperbolic surfaces analysis of the resolvent of the Laplacian scattering theory resonances and scattering poles the Selberg zeta function the Poisson formula distribution of resonances the inverse scattering problem Patterson Sullivan theory and the dynamical approach to the zeta function The new sections cover the latest developments in the field including the spectral gap resonance asymptotics near

the critical line and sharp geometric constants for resonance bounds A new chapter introduces recently developed techniques for resonance calculation that illuminate the existing results and conjectures on resonance distribution The spectral theory of hyperbolic surfaces is a point of intersection for a great variety of areas including quantum physics discrete groups differential geometry number theory complex analysis and ergodic theory This book will serve as a valuable resource for graduate students and researchers from these and other related fields Review of the first edition The exposition is very clear and thorough and essentially self contained the proofs are detailed The book gathers together some material which is not always easily available in the literature To conclude the book is certainly at a level accessible to graduate students and researchers from a rather large range of fields Clearly the reader would certainly benefit greatly from it Colin Guillarmou Mathematical Reviews Issue 2008 h **Spectral Theory of Operator Pencils, Hermite-Biehler Functions, and their Applications** Manfred Möller,Vyacheslav Pivovarchik,2015-06-11 The theoretical part of this monograph examines the distribution of the spectrum of operator polynomials focusing on quadratic operator polynomials with discrete spectra The second part is devoted to applications Standard spectral problems in Hilbert spaces are of the form A I for an operator A and self adjoint operators are of particular interest and importance both theoretically and in terms of applications A characteristic feature of self adjoint operators is that their spectra are real and many spectral problems in theoretical physics and engineering can be described by using them However a large class of problems in particular vibration problems with boundary conditions depending on the spectral parameter are represented by operator polynomials that are quadratic in the eigenvalue parameter and whose coefficients are self adjoint operators The spectra of such operator polynomials are in general no more real but still exhibit certain patterns The distribution of these spectra is the main focus of the present volume For some classes of quadratic operator polynomials inverse problems are also considered The connection between the spectra of such quadratic operator polynomials and generalized Hermite Biehler functions is discussed in detail Many applications are thoroughly investigated such as the Regge problem and damped vibrations of smooth strings Stieltjes strings beams star graphs of strings and quantum graphs Some chapters summarize advanced background material which is supplemented with detailed proofs With regard to the reader s background knowledge only the basic properties of operators in Hilbert spaces and well known results from complex analysis are assumed **Inverse Problems and Applications** Gunther Uhlmann,2013 Inverse problems lie at the heart of contemporary scientific inquiry and technological development Applications include a variety of medical and other imaging techniques which are used for early detection of cancer and pulmonary edema location of oil and mineral deposits in the Earth s interior creation of astrophysical images from telescope data finding cracks and interfaces within materials shape optimization model identification in growth processes and modeling in the life sciences among others The expository survey essays in this book describe recent developments in inverse problems and imaging including hybrid or couple physics methods arising in medical imaging Calderon s problem and electrical

impedance tomography inverse problems arising in global seismology and oil exploration inverse spectral problems and the study of asymptotically hyperbolic spaces It is suitable for graduate students and researchers interested in inverse problems and their applications *Spectral Theory and Partial Differential Equations* James V Ralston,Grigoriĭ Il'ich Eskin,Leonid Friedlander,John B. Garnett,2015 Contains the proceedings of the Conference on Spectral Theory and Partial Differential Equations held in honor of James Ralston s 70th Birthday Papers cover important topics in spectral theory and partial differential equations such as inverse problems both analytical and algebraic minimal partitions and Pleijel s Theorem spectral theory for a model in Quantum Field Theory and beams on Zoll manifolds **Sturm?Liouville Operators, Their Spectral Theory, and Some Applications** Fritz Gesztesy,Roger Nichols,Maxim Zinchenko,2024-09-24 This book provides a detailed treatment of the various facets of modern Sturm Liouville theory including such topics as Weyl Titchmarsh theory classical renormalized and perturbative oscillation theory boundary data maps traces and determinants for Sturm Liouville operators strongly singular Sturm Liouville differential operators generalized boundary values and Sturm Liouville operators with distributional coefficients To illustrate the theory the book develops an array of examples from Floquet theory to short range scattering theory higher order KdV trace relations elliptic and algebro geometric finite gap potentials reflectionless potentials and the Sodin Yuditskii class as well as a detailed collection of singular examples such as the Bessel generalized Bessel and Jacobi operators A set of appendices contains background on the basics of linear operators and spectral theory in Hilbert spaces Schatten von Neumann classes of compact operators self adjoint extensions of symmetric operators including the Friedrichs and Krein von Neumann extensions boundary triplets for ODEs Krein type resolvent formulas sesquilinear forms Nevanlinna Herglotz functions and Bessel functions *Fredholm and Local Spectral Theory II* Pietro Aiena,2018-11-24 This monograph concerns the relationship between the local spectral theory and Fredholm theory of bounded linear operators acting on Banach spaces The purpose of this book is to provide a first general treatment of the theory of operators for which Weyl type or Browder type theorems hold The product of intensive research carried out over the last ten years this book explores for the first time in a monograph form results that were only previously available in journal papers Written in a simple style with sections and chapters following an easy natural flow it will be an invaluable resource for researchers in Operator Theory and Functional Analysis The reader is assumed to be familiar with the basic notions of linear algebra functional analysis and complex analysis *Spectral Analysis, Differential Equations and Mathematical Physics: A Festschrift in Honor of Fritz Gesztesy's 60th Birthday* Helge Holden,Barry Simon,Gerald Teschl,2013-07-08 This volume contains twenty contributions in the area of mathematical physics where Fritz Gesztesy made profound contributions There are three survey papers in spectral theory differential equations and mathematical physics which highlight in particu **Quantum Inversion Theory and Applications** H.V.v. Geramb,2018-05-29 This volume covers aspects of Schr dinger equation inversion for the purposeof determining interaction potentials in particle nuclear and

atomic physics from experimental data It includes reviews and reports on the latest developments in mathematics supersymmetric quantum mechanics inversion for fixed l nucleon nucleon potentials inversion of fixed E optical potentials and their generalizations Also included are some topics on nonlinear differential equations relating to theSchr dinger or other equations of particle nuclear atomic and molecular physics which can be solved by inverse scattering transformations The material collected in this volume gives a clear picture of the status ofresearch in this rapidly growing field The book addresses students and young scientists as well as researchers in theoretical physics and functional analysis      Geometric Structures on Manifolds William M. Goldman,2022-12-20 The theory of geometric structures on manifolds which are locally modeled on a homogeneous space of a Lie group traces back to Charles Ehresmann in the 1930s although many examples had been studied previously Such locally homogeneous geometric structures are special cases of Cartan connections where the associated curvature vanishes This theory received a big boost in the 1970s when W Thurston put his geometrization program for 3 manifolds in this context The subject of this book is more ambitious in scope Unlike Thurston s eight 3 dimensional geometries it covers structures which are not metric structures such as affine and projective structures This book describes the known examples in dimensions one two and three Each geometry has its own special features which provide special tools in its study Emphasis is given to the interrelationships between different geometries and how one kind of geometric structure induces structures modeled on a different geometry Up to now much of the literature has been somewhat inaccessible and the book collects many of the pieces into one unified work This book focuses on several successful classification problems Namely fix a geometry in the sense of Klein and a topological manifold Then the different ways of locally putting the geometry on the manifold lead to a moduli space Often the moduli space carries a rich geometry of its own reflecting the model geometry The book is self contained and accessible to students who have taken first year graduate courses in topology smooth manifolds differential geometry and Lie groups      Inverse Problems and Applications Plamen Stefanov,András Vasy,Maciej Zworski,2014-05-05 This volume contains the proceedings of two conferences on Inverse Problems and Applications held in 2012 to celebrate the work of Gunther Uhlmann The first conference was held at the University of California Irvine from June 18 22 2012 and the second was held at Zhejiang University Hangzhou China from September 17 21 2012 The topics covered include inverse problems in medical imaging scattering theory geometry and image processing and the mathematical theory of cloaking as well as methods related to inverse problems      Spectral Theory of Random Matrices Vyacheslav L. Girko,2016-08-23 Spectral Theory of Random Matrices      *Nonlinear Oscillations of Hamiltonian PDEs* Massimiliano Berti,2007-10-01 Many partial differential equations PDEs that arise in physics can be viewed as infinite dimensional Hamiltonian systems This monograph presents recent existence results of nonlinear oscillations of Hamiltonian PDEs particularly of periodic solutions for completely resonant nonlinear wave equations The text serves as an introduction to research in this fascinating and rapidly growing field Graduate students and researchers

interested in variational techniques and nonlinear analysis applied to Hamiltonian PDEs will find inspiration in the book

    <u>Multidimensional Periodic Schrödinger Operator</u> Oktay Veliev,2019-08-02 This book describes the direct and inverse problems of the multidimensional Schr dinger operator with a periodic potential a topic that is especially important in perturbation theory constructive determination of spectral invariants and finding the periodic potential from the given Bloch eigenvalues It provides a detailed derivation of the asymptotic formulas for Bloch eigenvalues and Bloch functions in arbitrary dimensions while constructing and estimating the measure of the iso energetic surfaces in the high energy regime Moreover it presents a unique method proving the validity of the Bethe Sommerfeld conjecture for arbitrary dimensions and arbitrary lattices Using the perturbation theory constructed it determines the spectral invariants of the multidimensional operator from the given Bloch eigenvalues Some of these invariants are explicitly expressed by the Fourier coefficients of the potential making it possible to determine the potential constructively using Bloch eigenvalues as input data Lastly the book presents an algorithm for the unique determination of the potential This updated second edition includes an additional chapter that specifically focuses on lower dimensional cases providing the basis for the higher dimensional considerations of the chapters that follow     *Lyapunov Inequalities and Applications* Ravi P. Agarwal,Martin Bohner,Abdullah Özbekler,2021-04-12 This book provides an extensive survey on Lyapunov type inequalities It summarizes and puts order into a vast literature available on the subject and sketches recent developments in this topic In an elegant and didactic way this work presents the concepts underlying Lyapunov type inequalities covering how they developed and what kind of problems they address This survey starts by introducing basic applications of Lyapunov s inequalities It then advances towards even order odd order and higher order boundary value problems Lyapunov and Hartman type inequalities systems of linear nonlinear and quasi linear differential equations recent developments in Lyapunov type inequalities partial differential equations linear difference equations and Lyapunov type inequalities for linear half linear and nonlinear dynamic equations on time scales as well as linear Hamiltonian dynamic systems Senior undergraduate students and graduate students of mathematics engineering and science will benefit most from this book as well as researchers in the areas of ordinary differential equations partial differential equations difference equations and dynamic equations Some background in calculus ordinary and partial differential equations and difference equations is recommended for full enjoyment of the content

    <u>Handbook of Differential Equations: Ordinary Differential Equations</u> Flaviano Battelli,Michal Feckan,2008-08-19 This handbook is the fourth volume in a series of volumes devoted to self contained and up to date surveys in the theory of ordinary differential equations with an additional effort to achieve readability for mathematicians and scientists from other related fields so that the chapters have been made accessible to a wider audience Covers a variety of problems in ordinary differential equations Pure mathematical and real world applications Written for mathematicians and scientists of many related fields     **One-Dimensional Turbulence and the Stochastic Burgers Equation** Alexandre Boritchev,Sergei

Kuksin,2021-07-01 This book is dedicated to the qualitative theory of the stochastic one dimensional Burgers equation with small viscosity under periodic boundary conditions and to interpreting the obtained results in terms of one dimensional turbulence in a fictitious one dimensional fluid described by the Burgers equation The properties of one dimensional turbulence which we rigorously derive are then compared with the heuristic Kolmogorov theory of hydrodynamical turbulence known as the K41 theory It is shown in particular that these properties imply natural one dimensional analogues of three principal laws of the K41 theory the size of the Kolmogorov inner scale the 2 3 2 3 law and the Kolmogorov Obukhov law The first part of the book deals with the stochastic Burgers equation including the inviscid limit for the equation its asymptotic in time behavior and a theory of generalised L 1 L1 solutions This section makes a self consistent introduction to stochastic PDEs The relative simplicity of the model allows us to present in a light form many of the main ideas from the general theory of this field The second part dedicated to the relation of one dimensional turbulence with the K41 theory could serve for a mathematical reader as a rigorous introduction to the literature on hydrodynamical turbulence all of which is written on a physical level of rigor **Introduction to Quantum Graphs** Gregory Berkolaiko,Peter Kuchment,2013 A quantum graph is a graph considered as a one dimensional complex and equipped with a differential operator Hamiltonian Quantum graphs arise naturally as simplified models in mathematics physics chemistry and engineering when one considers propagation of waves of various nature through a quasi one dimensional e g meso or nano scale system that looks like a thin neighborhood of a graph Works that currently would be classified as discussing quantum graphs have been appearing since at least the 1930s and since then quantum graphs techniques have been applied successfully in various areas of mathematical physics mathematics in general and its applications One can mention for instance dynamical systems theory control theory quantum chaos Anderson localization microelectronics photonic crystals physical chemistry nano sciences superconductivity theory etc Quantum graphs present many non trivial mathematical challenges which makes them dear to a mathematician s heart Work on quantum graphs has brought together tools and intuition coming from graph theory combinatorics mathematical physics PDEs and spectral theory This book provides a comprehensive introduction to the topic collecting the main notions and techniques It also contains a survey of the current state of the quantum graph research and applications

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