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Mathematical Perspectives on Theoretical Physics - Nirmala Prakash 2003-09-02
This book presents the basics of mathematics that are needed for learning the physics of today. It describes briefly the theories of groups and operators, finite- and infinite-dimensional algebras, concepts of symmetry and supersymmetry, and then delineates their relations to theories of relativity and black holes, classical and quantum physics, electroweak fields and Yang-Mills. It concludes with a chapter on (the complex theory of) strings and superstrings and their link to black holes — an idea that fascinates both the physicist and the mathematician. Contents:Complex Functions, Riemann Surfaces and Two-Dimensional Conformal Field Theory (an Introduction)Elements of Group Theory and Group RepresentationsA Primer on OperatorsBasics of Algebras and Related ConceptsInfinite-Dimensional AlgebrasThe Role of Symmetry in Physics and MathematicsAll That's Super — An IntroductionGravitation, Relativity and Black HolesBasics of Quantum TheoryTheory of Yang–Mills and the Yang–Mills–Higgs MechanismStrings and Superstrings (Elementary Aspects) Readership: Upper level undergraduates, graduate students, lecturers and researchers in theoretical physics, mathematical physics, quantum physics and astrophysics as well as Yang-Mills and superstring theory.
The Theory of Symmetry Actions in Quantum Mechanics - Gianni Cassinelli 2004-10-27
This is a book about representing symmetry in quantum mechanics. The book is on a graduate and/or researcher level and it is written with an attempt to be concise, to respect conceptual clarity and mathematical rigor. The basic structures of quantum mechanics are used to identify the automorphism group of quantum mechanics. The main concept of a symmetry action is defined as a group homomorphism from a given group, the group of symmetries, to the automorphism group of quantum mechanics. The structure of symmetry actions is determined under the assumption that the symmetry group is a Lie group. The Galilei invariance is used to illustrate the general theory by giving a systematic presentation of a Galilei invariant elementary particle. A brief description of the Galilei invariant wave equations is also given.
The Scope and History of Commutative and Noncommutative Harmonic Analysis - George W. Mackey 2005-04-08
"When I was invited to speak at the conference on the history of analysis given at Rice University [in 1977], I decided that it might be interesting to review the history of mathematics and physics in the last three hundred years or so with heavy emphasis on those parts in which harmonic analysis had played a decisive or at least a major role. I was pleased and somewhat astonished to find how much of both subjects could be included under this rubric ... The picture that gradually emerged as the various details fell into place was one that I found very beautiful, and the process of seeing it do so left me in an almost constant state of euphoria. I would like to believe that others can be led to see this picture by reading my paper, and to facilitate this I have included a large number of short expositions of topics which are not widely understood by non-specialists." --from the Preface This volume, containing the paper mentioned above as well as five other reprinted papers by Mackey, presents a sweeping view of the importance, utility, and beauty of harmonic analysis and its connections to other areas of mathematics and science. A seventh paper, written exclusively for this volume, attempts to unify certain themes that emerged after major discoveries in 1967 and 1968 in the areas of Lie algebras, strong interaction physics, statistical mechanics, and nonlinear partial differential equations--discoveries that may at first glance appear to be independent, but which are in fact deeply interrelated. Information for our distributors: Copublished with the London Mathematical Society beginning with volume 4. Members of the LMS may order directly from the AMS at the AMS member price. The LMS is registered with the Charity Commissioners.
Philosophy of Physics - Jeremy Butterfield 2007
The ambition of this volume is twofold: to provide a comprehensive overview of the field and to serve as an indispensable reference work for anyone who wants to work in it. For example, any philosopher who hopes to make a contribution to the topic of the classical-quantum correspondence will have to begin by consulting Klaas Landsman's chapter. The organization of this volume, as well as the choice of topics, is based on the conviction that the important problems in the philosophy of physics arise from studying the foundations of the fundamental theories of physics. It follows that there is no sharp line to be drawn between philosophy of physics and physics itself. Some of the best work in the philosophy of physics is being done by physicists, as witnessed by the fact that several of the contributors to the volume are theoretical physicists: viz., Ellis, Emch, Harvey, Landsman, Rovelli, 't Hooft, the last of whom is a Nobel laureate. Key features - Definitive discussions of the philosophical implications of modern physics - Masterly expositions of the fundamental theories of modern physics - Covers all three main pillars of modern physics: relativity theory, quantum theory, and thermal physics - Covers the new sciences grown from these theories: for example, cosmology from relativity theory; and quantum information and quantum computing, from quantum theory - Contains special Chapters that address crucial topics that arise in several different theories, such as symmetry and determinism - Written by very distinguished theoretical physicists, including a Nobel Laureate, as well as by philosophers - Definitive discussions of the philosophical implications of modern physics - Masterly expositions of the fundamental theories of modern physics - Covers all three main pillars of modern physics: relativity theory, quantum theory, and thermal physics - Covers the new sciences that have grown from these theories: for example, cosmology from relativity theory; and quantum information and quantum computing, from quantum theory - Contains special Chapters that address crucial topics that arise in several different theories, such as symmetry and determinism - Written by very distinguished theoretical physicists, including a Nobel Laureate, as well as by philosophers
Probability Measures on Groups - H. Heyer 2006-11-17
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Infinite-dimensional Representations of 2-groups - John C. Baez 2012
A “2-group'' is a category equipped with a multiplication satisfying laws like those of a group. Just as groups have representations on vector spaces, 2-groups have representations on “2-vector spaces'', which are categories analogous to vector spaces. Unfortunately, Lie 2-groups typically have few representations on the finite-dimensional 2-vector spaces introduced by Kapranov and Voevodsky. For this reason, Crane, Sheppeard and Yetter introduced certain infinite-dimensional 2-vector spaces called ``measurable categories'' (since they are closely related to measurable fields of Hilbert spaces), and used these to study infinite-dimensional representations of certain Lie 2-groups. Here they continue this work.

They begin with a detailed study of measurable categories. Then they give a geometrical description of the measurable representations, intertwiners and 2-intertwiners for any skeletal measurable 2-group. They study tensor products and direct sums for representations, and various concepts of subrepresentation. They describe direct sums of intertwiners, and sub-intertwiners--features not seen in ordinary group representation theory and study irreducible and indecomposable representations and intertwiners. They also study “irretractable'' representations--another feature not seen in ordinary group representation theory. Finally, they argue that measurable categories equipped with some extra structure deserve to be considered “separable 2-Hilbert spaces'', and compare this idea to a tentative definition of 2-Hilbert spaces as representation categories of commutative von Neumann algebras.
Representation Theory of Semisimple Groups - Anthony W. Knapp 2016-06-02
In this classic work, Anthony W. Knapp offers a survey of representation theory of semisimple Lie groups in a way that reflects the spirit of the subject and corresponds to the natural learning process. This book is a model of exposition and an invaluable resource for both graduate students and researchers. Although theorems are always stated precisely, many illustrative examples or classes of examples are given. To support this unique approach, the author includes for the reader a useful 300-item bibliography and an extensive section of notes.
Harmonic Analysis on Commutative Spaces - Joseph Albert Wolf 2007
This book starts with the basic theory of topological groups, harmonic analysis, and unitary representations. It then concentrates on geometric structure, harmonic analysis, and unitary representation theory in commutative spaces. Those spaces form a simultaneous generalization of compact groups, locally compact abelian groups, and riemannian symmetric spaces. Their geometry and function theory is an increasingly active topic in mathematical research, and this book brings the reader up to the frontiers of that research area with the recent classifications of weakly symmetric spaces and of Gelfand pairs. Part 1, ""General Theory of Topological Groups"", is an introduction with many examples, including all of the standard semisimple linear Lie groups and the Heisenberg groups. It presents the construction of Haar measure, the invariant integral, the convolution product, and the Lebesgue spaces. Part 2, ""Representation Theory and Compact Groups"", provides background at a slightly higher level.Besides the basics, it contains the Mackey Little-Group method and its application to Heisenberg groups, the Peter-Weyl Theorem, Cartan's highest weight theory, the Borel-Weil Theorem, and invariant function algebras. Part 3, ""Introduction to Commutative Spaces"", describes that area up to its recent resurgence. Spherical functions and associated unitary representations are developed and applied to harmonic analysis on G/K and to uncertainty principles. Part 4, ""Structure and Analysis for Commutative Spaces"", summarizes riemannian symmetric space theory as a role model, and with that orientation delves into recent research on commutative spaces. The results are explicit for spaces G/K of nilpotent or reductive type, and the recent structure and classification theory depends on those cases. Parts 1 and 2 are accessible to first-year graduate students. Part 3 takes a bit of analytic sophistication but generally is accessible to graduate students. Part 4 is intended for mathematicians beginning their research careers as well as mathematicians interested in seeing just how far one can go with this unified view of algebra, geometry, and analysis.
Quantum Theory, Groups and Representations - Peter Woit 2017-11-01
This text systematically presents the basics of quantum mechanics, emphasizing the role of Lie groups, Lie algebras, and their unitary representations. The mathematical structure of the subject is brought to the fore, intentionally avoiding significant overlap with material from standard physics courses in quantum mechanics and quantum field theory. The level of presentation is attractive to mathematics students looking to learn about both quantum mechanics and representation theory, while also appealing to physics students who would like to know more about the mathematics underlying the subject. This text showcases the numerous differences between typical mathematical and physical treatments of the subject. The latter portions of the book focus on central mathematical objects that occur in the Standard Model of particle physics, underlining the deep and intimate connections between mathematics and the physical world. While an elementary physics course of some kind would be helpful to the reader, no specific background in physics is assumed, making this book accessible to students with a grounding in multivariable calculus and linear algebra. Many exercises are provided to develop the reader's understanding of and facility in quantum-theoretical concepts and calculations.
Symmetry in Physics - Robert T. Sharp 2004-01-01
Papers in this volume are based on the Workshop on Symmetries in Physics held at the Centre de recherches mathematiques (University of Montreal) in memory of Robert T. Sharp. Contributed articles are on a variety of topics revolving around the theme of symmetry in physics. The preface presents a biographical and scientific retrospect of the life and work of Robert Sharp. Other articles in the volume represent his diverse range of interests, including representation theoretic methods for Lie algebras, quantization techniques and foundational considerations, modular group invariants and applications to conformal models, various physical models and equations, geometric calculations with symmetries, and pedagogical methods for developing spatio-temporal intuition. The book is suitable for graduate students and researchers interested in group theoretic methods, symmetries, and mathematical physics.
Unitary Group Representations in Physics, Probability, and Number Theory - George Whitelaw Mackey 1989

Representation Theory and Harmonic Analysis of Wreath Products of Finite Groups - Tullio Ceccherini-Silberstein 2014-01-16
This book presents an introduction to the representation theory of wreath products of finite groups and harmonic analysis on the corresponding homogeneous spaces. The reader will find a detailed description of the theory of induced representations and Clifford theory, focusing on a general formulation of the little group method. This provides essential tools for the determination of all irreducible representations of wreath products of finite groups. The exposition also includes a detailed harmonic analysis of the finite lamplighter groups, the hyperoctahedral groups, and the wreath product of two symmetric groups. This relies on the generalised Johnson scheme, a new construction of finite Gelfand pairs. The exposition is completely self-contained and accessible to anyone with a basic knowledge of representation theory. Plenty of worked examples and several exercises are provided, making this volume an ideal textbook for graduate students. It also represents a useful reference for more experienced researchers.
Symmetries and Laplacians - David Gurarie 2007-12-21
Designed as an introduction to harmonic analysis and group representations, this book examines concepts, ideas, results, and techniques related to symmetry groups and Laplacians. Its exposition is based largely on examples and applications of general theory, covering a wide range of topics rather than delving deeply into any particular area. Author David Gurarie, a Professor of Mathematics at Case Western Reserve University, focuses on discrete or continuous geometrical objects and structures, such as regular graphs, lattices, and symmetric Riemannian manifolds. Starting with the basics of representation theory, Professor Gurarie discusses commutative harmonic analysis, representations of compact and finite groups, Lie groups, and the Heisenberg group and semidirect products. Among numerous applications included are integrable hamiltonian systems, geodesic flows on symmetric spaces, and the spectral theory of the Hydrogen atom (Schrodinger operator with Coulomb potential) explicated by its Runge-Lenz symmetry. Three helpful appendixes include supplemental information, and the text concludes with references, a list of frequently used notations, and an index.
Representation Theory of Lie Groups - Oxford S. R. C./L. M. S. Research Symposium on Representations of Lie Groups 1979
In 1977 a symposium was held in Oxford to introduce Lie groups and their representations to non-

specialists.

Representations of *-Algebras, Locally Compact Groups, and Banach *-Algebraic Bundles - J. M.G. Fell 1988-04-15

This is an all-encompassing and exhaustive exposition of the theory of infinite-dimensional Unitary Representations of Locally Compact Groups and its generalization to representations of Banach algebras. The presentation is detailed, accessible, and self-contained (except for some elementary knowledge in algebra, topology, and abstract measure theory). In the later chapters the reader is brought to the frontiers of present-day knowledge in the area of Mackey normal subgroup analysisand its generalization to the context of Banach *-Algebraic Bundles.

Encyclopaedia of Mathematics - Michiel Hazewinkel 2012-12-06

This ENCYCLOPAEDIA OF MATHEMATICS aims to be a reference work for all parts of mathe matics. It is a translation with updates and editorial comments of the Soviet Mathematical Encyclopaedia published by 'Soviet Encyclopaedia Publishing House' in five volumes in 1977-1985. The annotated translation consists of ten volumes including a special index volume. There are three kinds of articles in this ENCYCLOPAEDIA. First of all there are survey-type articles dealing with the various main directions in mathematics (where a rather fme subdivi sion has been used). The main requirement for these articles has been that they should give a reasonably complete up-to-date account of the current state of affairs in these areas and that they should be maximally accessible. On the whole, these articles should be understandable to mathematics students in their first specialization years, to graduates from other mathematical areas and, depending on the specific subject, to specialists in other domains of science, en gineers and teachers of mathematics. These articles treat their material at a fairly general level and aim to give an idea of the kind of problems, techniques and concepts involved in the area in question. They also contain background and motivation rather than precise statements of precise theorems with detailed definitions and technical details on how to carry out proofs and constructions. The second kind of article, of medium length, contains more detailed concrete problems, results and techniques.

Theory and Applications of the Poincaré Group - Young Suh Kim 2012-12-06

Special relativity and quantum mechanics, formulated early in the twentieth century, are the two most important scientific languages and are likely to remain so for many years to come. In the 1920's, when quantum mechanics was developed, the most pressing theoretical problem was how to make it consistent with special relativity. In the 1980's, this is still the most pressing problem. The only difference is that the situation is more urgent now than before, because of the significant quantity of experimental data which need to be explained in terms of both quantum mechanics and special relativity. In unifying the concepts and algorithms of quantum mechanics and special relativity, it is important to realize that the underlying scientific language for both disciplines is that of group theory. The role of group theory in quantum mechanics is well known. The same is true for special relativity. Therefore, the most effective approach to the problem of unifying these two important theories is to develop a group theory which can accommodate both special relativity and quantum mechanics. As is well known, Eugene P. Wigner is one of the pioneers in developing group theoretical approaches to relativistic quantum mechanics. His 1939 paper on the inhomogeneous Lorentz group laid the foundation for this important research line. It is generally agreed that this paper was somewhat ahead of its time in 1939, and that contemporary physicists must continue to make real efforts to appreciate fully the content of this classic work.

Harmonic Analysis of Spherical Functions on Real Reductive Groups - Ramesh Gangolli 2012-12-06

Analysis on Symmetric spaces, or more generally, on homogeneous spaces of semisimple Lie groups, is a subject that has undergone a vigorous development in recent years, and has become a central part of contemporary mathematics. This is only to be expected, since homogeneous spaces and group representations arise naturally in diverse contexts ranging from Number theory and Geometry to Particle Physics and Polymer Chemistry. Its explosive growth sometimes makes it difficult to realize that it is actually relatively young as mathematical theories go. The early ideas in the subject (as is the case with many others) go back to Elie Cart an and Hermann Weyl who studied the compact symmetric spaces in the 1930's. However its full development did not begin until the 1950's when Gel'fand and Harish Chandra dared to dream of a theory of representations that included all semisimple Lie groups. Harish-Chandra's theory of spherical functions was essentially complete in the late 1950's, and was to prove to be the forerunner of his monumental work on harmonic analysis on reductive groups that has inspired a whole generation of mathematicians. It is the harmonic analysis of spherical functions on symmetric spaces, that is at the focus of this book. The fundamental questions of harmonic analysis on symmetric spaces involve an interplay of the geometric, analytical, and algebraic aspects of these spaces. They have therefore attracted a great deal of attention, and there have been many excellent expositions of the themes that are characteristic of this subject.

Algebra, Geometry and Mathematical Physics - Abdenacer Makhlouf 2014-06-17

This book collects the proceedings of the Algebra, Geometry and Mathematical Physics Conference, held at the University of Haute Alsace, France, October 2011. Organized in the four areas of algebra, geometry, dynamical symmetries and conservation laws and mathematical physics and applications, the book covers deformation theory and quantization; Hom-algebras and n-ary algebraic structures; Hopf algebra, integrable systems and related math structures; jet theory and Weil bundles; Lie theory and applications; non-commutative and Lie algebra and more. The papers explore the interplay between research in contemporary mathematics and physics concerned with generalizations of the main structures of Lie theory aimed at quantization and discrete and non-commutative extensions of differential calculus and geometry, non-associative structures, actions of groups and semi-groups, non-commutative dynamics, non-commutative geometry and applications in physics and beyond. The book benefits a broad audience of researchers and advanced students.

Representations of Linear Groups - Rolf Berndt 2007-12-22

This is an elementary introduction to the representation theory of real and complex matrix groups. The text is written for students in mathematics and physics who have a good knowledge of differential/integral calculus and linear algebra and are familiar with basic facts from algebra, number theory and complex analysis. The goal is to present the fundamental concepts of representation theory, to describe the connection between them, and to explain some of their background. The focus is on groups which are of particular interest for applications in physics and number theory (e.g. Gell-Mann's eightfold way and theta functions, automorphic forms). The reader finds a large variety of examples which are presented in detail and from different points of view.

Representation Theory of Finite Group Extensions - Tullio Ceccherini-Silberstein 2022-12-31

This monograph adopts an operational and functional analytic approach to the following problem: given a short exact sequence (group extension) $1 \to N \to G \to H \to 1$ of finite groups, describe the irreducible representations of G by means of the structure of the group extension. This problem has attracted many mathematicians, including I. Schur, A.H. Clifford, and G. Mackey and, more recently, M. Isaacs, B. Huppert, Y.G. Berkovich & E.M. Zhmud, and J.M.G. Fell & R.S. Doran. The main topics are, on the one hand, Clifford Theory and the Little Group Method (of Mackey and Wigner) for induced representations, and, on the other hand, Kirillov’s Orbit Method (for step-2 nilpotent groups of odd order) which establishes a natural and powerful correspondence between Lie rings and nilpotent groups. As an application, a detailed description is given of the representation theory of the alternating groups, of metacyclic, quaternionic, dihedral groups, and of the (finite) Heisenberg group. The Little Group Method may be applied if and only if a suitable unitary 2-cocycle (the Mackey obstruction) is trivial. To overcome this obstacle, (unitary) projective representations are introduced and corresponding Mackey and Clifford theories are developed. The commutant of an induced representation and the relative Hecke algebra is also examined. Finally, there is a comprehensive exposition of the theory of projective representations for finite Abelian groups which is applied to obtain a complete description of the irreducible representations of finite metabelian groups of odd order.

Quantum Field Theory III: Gauge Theory - Eberhard Zeidler 2011-08-17

In this third volume of his modern introduction to quantum field theory, Eberhard Zeidler examines the mathematical and physical aspects of gauge theory as a principle tool for describing the four fundamental forces which act in the universe: gravitative, electromagnetic, weak interaction and strong interaction. Volume III concentrates on the classical aspects of gauge theory, describing the four fundamental forces by the curvature of appropriate fiber bundles. This must be supplemented by the crucial, but elusive

quantization procedure. The book is arranged in four sections, devoted to realizing the universal principle force equals curvature: Part I: The Euclidean Manifold as a Paradigm Part II: Ariadne's Thread in Gauge Theory Part III: Einstein's Theory of Special Relativity Part IV: Ariadne's Thread in Cohomology For students of mathematics the book is designed to demonstrate that detailed knowledge of the physical background helps to reveal interesting interrelationships among diverse mathematical topics. Physics students will be exposed to a fairly advanced mathematics, beyond the level covered in the typical physics curriculum. Quantum Field Theory builds a bridge between mathematicians and physicists, based on challenging questions about the fundamental forces in the universe (macrocosmos), and in the world of elementary particles (microcosmos).

Elements of the Representation Theory of the Jacobi Group - Rolf Berndt 2012-01-03

Combining algebraic groups and number theory, this volume gathers material from the representation theory of this group for the first time, doing so for both local (Archimedean and non-Archimedean) cases as well as for the global number field case.

Operational Quantum Physics - Paul Busch 2009-01-29

Operational Quantum Physics offers a systematic presentation of quantum mechanics which makes exhaustive use of the full probabilistic structure of this theory. Accordingly the notion of an observable as a positive operator valued (POV) measure is explained in great detail, and the ensuing quantum measurement theory is developed and applied both to a resolution of long-standing conceptual and interpretational puzzles in the foundations of quantum mechanics, and to an analysis of various recent fundamental experiments. The book, or different parts of it, may be of interest to advanced students or researchers in quantum physics, to philosophers of physics, and to mathematicians working in operator valued measures.

Probability on Compact Lie Groups - David Applebaum 2014-06-26

Probability theory on compact Lie groups deals with the interaction between “chance” and “symmetry,” a beautiful area of mathematics of great interest in its own sake but which is now also finding increasing applications in statistics and engineering (particularly with respect to signal processing). The author gives a comprehensive introduction to some of the principle areas of study, with an emphasis on applicability. The most important topics presented are: the study of measures via the non-commutative Fourier transform, existence and regularity of densities, properties of random walks and convolution semigroups of measures and the statistical problem of deconvolution. The emphasis on compact (rather than general) Lie groups helps readers to get acquainted with what is widely seen as a difficult field but which is also justified by the wealth of interesting results at this level and the importance of these groups for applications. The book is primarily aimed at researchers working in probability, stochastic analysis and harmonic analysis on groups. It will also be of interest to mathematicians working in Lie theory and physicists, statisticians and engineers who are working on related applications. A background in first year graduate level measure theoretic probability and functional analysis is essential; a background in Lie groups and representation theory is certainly helpful but the first two chapters also offer orientation in these subjects.

Geometry of Quantum Theory - V.S. Varadarajan 2007-12-03

Available for the first time in soft cover, this book is a classic on the foundations of quantum theory. It examines the subject from a point of view that goes back to Heisenberg and Dirac and whose definitive mathematical formulation is due to von Neumann. This view leads most naturally to the fundamental questions that are at the basis of all attempts to understand the world of atomic and subatomic particles.

Unitary Representations and Harmonic Analysis - M. Sugiura 1990-03-01

The principal aim of this book is to give an introduction to harmonic analysis and the theory of unitary representations of Lie groups. The second edition has been brought up to date with a number of textual changes in each of the five chapters, a new appendix on Fatou's theorem has been added in connection with the limits of discrete series, and the bibliography has been tripled in length.

Differential Geometrical Methods in Theoretical Physics - K. Bleuler 2013-06-29

Proceedings of the NATO Advanced Research Workshop and the 16th International Conference, Como, Italy, August 24-29, 1987

Stochastic Analysis and Mathematical Physics II - Rolando Rebolledo 2012-12-06

The seminar on Stochastic Analysis and Mathematical Physics of the Ca tholic University of Chile, started in Santiago in 1984, has being followed and enlarged since 1995 by a series of international workshops aimed at pro moting a wide-spectrum dialogue between experts on the fields of classical and quantum stochastic analysis, mathematical physics, and physics. This volume collects most of the contributions to the Fourth Interna tional Workshop on Stochastic Analysis and Mathematical Physics (whose Spanish abbreviation is "ANESTOC"; in English, "STAMP"), held in San tiago, Chile, from January 5 to 11, 2000. The workshop style stimulated a vivid exchange of ideas which finally led to a number of written con tributions which I am glad to introduce here. However, we are currently submitted to a sort of invasion of proceedings books, and we do not want to increase our own shelves with a new one of the like. On the other hand, the editors of conference proceedings have to use different exhausting and com pulsive strategies to persuade authors to write and provide texts in time, a task which terrifies us. As a result, this volume is aimed at smoothly start ing a new kind of publication. What we would like to have is a collection of books organized like our seminar.

Encyclopaedia of Mathematics - M. Hazewinkel 2013-12-01

Induced Representations of Locally Compact Groups - Eberhard Kaniuth 2013

"Locally compact groups arise in many diverse areas of mathematics, the physical sciences, and engineering and the presence of the group is usually felt through unitary representations of the group. This observation underlies the importance of understanding such representations and how they may be constructed, combined, or decomposed. Of particular importance are the irreducible unitary representations. In the middle of the last century, G.W. Mackey initiated a program to develop a systematic method for identifying all the irreducible unitary representations of a given locally compact group G. We denote the set of all unitary equivalence classes of irreducible unitary representations of G by G. Mackey's methods are only effective when G has certain restrictive structural characteristics; nevertheless, time has shown that many of the groups that arise in important problems are appropriate for Mackey's approach. The program Mackey initiated received contributions from many researchers with some of the mostsubstantial advances made by R.J. Blattner and J.M.G. Fell. Fell'swork is particularly important in studying Gas a topological space. At the core of this program is the inducing construction, which is a method of building a unitary representation of a group from a representation of a subgroup"--

Ergodic Theory and Topological Dynamics of Group Actions on Homogeneous Spaces - M. Bachir Bekka 2000-05-11

This book, first published in 2000, focuses on developments in the study of geodesic flows on homogenous spaces.

Group Representations, Ergodic Theory, and Mathematical Physics - Robert S. Doran 2008

George Mackey was an extraordinary mathematician of great power and vision. His profound contributions to representation theory, harmonic analysis, ergodic theory, and mathematical physics left a rich legacy for researchers that continues today. This book is based on lectures presented at an AMS special session held in January 2007 in New Orleans dedicated to his memory. The papers, written especially for this volume by internationally-known mathematicians and mathematical physicists, range from expository and historical surveys to original high-level research articles. The influence of Mackey's fundamental ideas is apparent throughout. The introductory article contains recollections from former students, friends, colleagues, and family as well as a biography describing his distinguished career as a mathematician at Harvard, where he held the Landon D. Clay Professorship of Mathematics. Topics examined here include recent results on induced representations, virtual groups, the Mackey Machine and crossed products, representations of Baumslag-Solitar groups, the Radon transform and the heat equation, groupoids in the study of wavelets, and quantum theory. The in-depth historical surveys of Mackey's work on representation theory, ergodic theory, and physics, together with recent developments inspired by his fundamental work will be of considerable interest to both graduate students and researchers alike.

Applications of Group Theory in Physics and Mathematical Physics - Mosh Flato 1985-12-31

The past decade has seen a renewal in the close ties between mathematics and physics. The Chicago Summer Seminar on Applications of Group Theory in Physics and Mathematical Physics, held in July, 1982,

was organized to bring together a broad spectrum of scientists from theoretical physics, mathematical physics, and various branches of pure and applied mathematics in order to promote interaction and an exchange of ideas and results in areas of common interest. This volume contains the papers submitted by speakers at the Seminar. The reader will find several groups of articles varying from the most abstract aspects of mathematics to a concrete phenomenological description of some models applicable to particle physics. The papers have been divided into four categories corresponding to the principal topics covered at the Seminar. This is only a rough division, and some papers overlap two or more of these categories.

Noncommutative Harmonic Analysis - Michael Eugene Taylor 1986

This book explores some basic roles of Lie groups in linear analysis, with particular emphasis on the generalizations of the Fourier transform and the study of partial differential equations. It began as lecture notes for a one-semester graduate course given by the author in noncommutative harmonic analysis. It is a valuable resource for both graduate students and faculty, and requires only a background with Fourier analysis and basic functional analysis, plus the first few chapters of a standard text on Lie groups. The basic method of noncommutative harmonic analysis, a generalization of Fourier analysis, is to synthesize operators on a space on which a Lie group has a unitary representation from operators on irreducible representation spaces.Though the general study is far from complete, this book covers a great deal of the progress that has been made on important classes of Lie groups. Unlike many other books on harmonic analysis, this book focuses on the relationship between harmonic analysis and partial differential equations. The author considers many classical PDEs, particularly boundary value problems for domains with simple shapes, that exhibit noncommutative groups of symmetries. Also, the book contains detailed work, which has not previously been published, on the harmonic analysis of the Heisenberg group and harmonic analysis on cones.

Contributions to the History of Indian Mathematics - Gerard G. Emch 2005-10-15

This volume consists of a collection of articles based on lectures given by scholars from India, Europe and USA at the sessions on 'History of Indian Mathematics' at the AMS-India mathematics conference in Bangalore during December 2003. These articles cover a wide spectrum of themes in Indian mathematics. They begin with the mathematics of the ancient period dealing with Vedic Prosody and Buddhist Logic, move on to the work of Brahmagupta, of Bhaskara, and that of the mathematicians of the Kerala school of the classical and medieval period, and end with the work of Ramanaujan, and Indian contributions to Quantum Statistics during the modern era. The volume should be of value to those interested in the history of mathematics.

A Course in Abstract Harmonic Analysis - Gerald B. Folland 2016-02-03

A Course in Abstract Harmonic Analysis is an introduction to that part of analysis on locally compact groups that can be done with minimal assumptions on the nature of the group. As a generalization of classical Fourier analysis, this abstract theory creates a foundation for a great deal of modern analysis, and it contains a number of elegant resul

Ergodic Theory and Semisimple Groups - R.J. Zimmer 2013-03-14

This book is based on a course given at the University of Chicago in 1980-81. As with the course, the main motivation of this work is to present an accessible treatment, assuming minimal background, of the profound work of G. A. Margulis concerning rigidity, arithmeticity, and structure of lattices in semi simple groups, and related work of the author on the actions of semisimple groups and their lattice subgroups. In doing so, we develop the necessary prerequisites from earlier work of Borel, Furstenberg, Kazhdan, Moore, and others. One of the difficulties involved in an exposition of this material is the continuous interplay between ideas from the theory of algebraic groups on the one hand and ergodic theory on the other. This, of course, is not so much a mathematical difficulty as a cultural one, as the number of persons comfortable in both areas has not traditionally been large. We hope this work will also serve as a contribution towards improving that situation. While there are a number of satisfactory introductory expositions of the ergodic theory of integer or real line actions, there is no such exposition of the type of ergodic theoretic results with which we shall be dealing (concerning actions of more general groups), and hence we have assumed absolutely no knowledge of ergodic theory (not even the definition of "ergodic") on the part of the reader. All results are developed in full detail.

Causality, Measurement Theory and the Differentiable Structure of Space-Time - R. N. Sen 2010-02-11

Introducing graduate students and researchers to mathematical physics, this book discusses two recent developments: the demonstration that causality can be defined on discrete space-times; and Sewell's measurement theory, in which the wave packet is reduced without recourse to the observer's conscious ego, nonlinearities or interaction with the rest of the universe. The definition of causality on a discrete space-time assumes that space-time is made up of geometrical points. Using Sewell's measurement theory, the author concludes that the notion of geometrical points is as meaningful in quantum mechanics as it is in classical mechanics, and that it is impossible to tell whether the differential calculus is a discovery or an invention. Providing a mathematical discourse on the relation between theoretical and experimental physics, the book gives detailed accounts of the mathematically difficult measurement theories of von Neumann and Sewell.

Group Matrices, Group Determinants and Representation Theory - Kenneth W. Johnson 2019-11-08

This book sets out an account of the tools which Frobenius used to discover representation theory for nonabelian groups and describes its modern applications. It provides a new viewpoint from which one can examine various aspects of representation theory and areas of application, such as probability theory and harmonic analysis. For example, the focal objects of this book, group matrices, can be thought of as a generalization of the circulant matrices which are behind many important algorithms in information science. The book is designed to appeal to several audiences, primarily mathematicians working either in group representation theory or in areas of mathematics where representation theory is involved. Parts of it may be used to introduce undergraduates to representation theory by studying the appealing pattern structure of group matrices. It is also intended to attract readers who are curious about ideas close to the heart of group representation theory, which do not usually appear in modern accounts, but which offer new perspectives.