

Projective Representations Of Finite Groups

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Module Characters and Projective Representations of Finite Groups - E. Nauwelaerts 1988

Representation Theory of Finite Group Extensions - Tullio Ceccherini-Silberstein 2022-11-29

This monograph adopts an operational and functional analytic approach to the following problem: given a short exact sequence (group extension) $1 \rightarrow N \rightarrow G \rightarrow H \rightarrow 1$ 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.

A Course in Finite Group Representation Theory - Peter Webb 2016-08-19

This graduate-level text provides a thorough grounding in the representation theory of finite groups over fields and rings. The book provides a balanced and comprehensive account of the subject, detailing the methods needed to analyze representations that arise in many areas of mathematics. Key topics include the construction and use of character tables, the role of induction and restriction, projective and simple modules

for group algebras, indecomposable representations, Brauer characters, and block theory. This classroom-tested text provides motivation through a large number of worked examples, with exercises at the end of each chapter that test the reader's knowledge, provide further examples and practice, and include results not proven in the text. Prerequisites include a graduate course in abstract algebra, and familiarity with the properties of groups, rings, field extensions, and linear algebra.

Character Theory of Finite Groups - I. Martin Isaacs 2006-11-21

Character theory is a powerful tool for understanding finite groups. In particular, the theory has been a key ingredient in the classification of finite simple groups. Characters are also of interest in their own right, and their properties are closely related to properties of the structure of the underlying group. The book begins by developing the module theory of complex group algebras. After the module-theoretic foundations are laid in the first chapter, the focus is primarily on characters. This enhances the accessibility of the material for students, which was a major consideration in the writing. Also with students in mind, a large number of problems are included, many of them quite challenging. In addition to the development of the basic theory (using a cleaner notation than previously), a number of more specialized topics are covered with accessible presentations. These include projective representations, the basics of the Schur index, irreducible character degrees and group structure, complex linear groups, exceptional characters, and a fairly extensive introduction to blocks and Brauer characters. This is a corrected reprint of the original 1976 version, later reprinted by Dover. Since 1976 it has become the standard reference for character theory, appearing in the bibliography of almost every research paper in the subject. It is largely self-contained, requiring of the reader only the most basic facts of linear algebra, group theory, Galois theory and ring and module theory.

Modular Representation Theory of Finite Groups - Michael J. Collins 2001-01-01

This book is an outgrowth of a Research Symposium on the Modular Representation Theory of Finite Groups, held at the University of Virginia in May 1998. The main themes of this symposium were representations of

groups of Lie type in nondefining (or cross) characteristic, and recent developments in block theory. Series of lectures were given by M. Geck, A. Kleshchev and R. Rouquier, and their brief was to present material at the leading edge of research but accessible to graduate students working in the field. The first three articles are substantial expansions of their lectures, and each provides a complete account of a significant area of the subject together with an extensive bibliography. The remaining articles are based on some of the other lectures given at the symposium; some again are full surveys of the topic covered while others are short, but complete, research articles. The opportunity has been taken to produce a book of enduring value so that this is not a conference proceedings in the conventional sense. Material has been updated so that this book, through its own content and in its extensive bibliographies, will serve as an invaluable resource for all those working in the area, whether established researchers or graduate students who wish to gain a general knowledge of the subject starting from a single source.

Applications of Finite Groups - J. S. Lomont 2014-05-12

Applications of Finite Groups focuses on the applications of finite groups to problems of physics, including representation theory, crystals, wave equations, and nuclear and molecular structures. The book first elaborates on matrices, groups, and representations. Topics include abstract properties, applications, matrix groups, key theorem of representation theory, properties of character tables, simply reducible groups, tensors and invariants, and representations generated by functions. The text then examines applications and subgroups and representations, as well as subduced and induced representations, fermion annihilation and creation operators, crystallographic point groups, proportionality tensors in crystals, and nonrelativistic wave equations. The publication takes a look at space group representations and energy bands, symmetric groups, and applications. Topics include molecular and nuclear structures, multiplet splitting in crystalline electric fields, construction of irreducible representations of the symmetric groups, and reality of representations. The manuscript is a dependable source of data for physicists and researchers interested in the applications of finite groups.

Representations of Groups - Klaus Lux 2010-07-01

The representation theory of finite groups has seen rapid growth in recent years with the development of efficient algorithms and computer algebra systems. This is the first book to provide an introduction to the ordinary and modular representation theory of finite groups with special emphasis on the computational aspects of the subject. Evolving from courses taught at Aachen University, this well-paced text is ideal for graduate-level study. The authors provide over 200 exercises, both theoretical and computational, and include worked examples using the computer algebra system GAP. These make the abstract theory tangible and

engage students in real hands-on work. GAP is freely available from www.gap-system.org and readers can download source code and solutions to selected exercises from the book's web page.

Lifting Problems for Projective Representations of Finite Groups Over Number Fields - Hans Opolka 2020

The purpose of this note is to investigate lifting problems for cocycle classes of projective representations of finite groups over a field k of characteristic 0 and to provide more detailed information in this respect if k is a number field. Some examples are discussed.

Linear and Projective Representations of Symmetric Groups - Alexander Kleshchev 2005-06-30

The representation theory of symmetric groups is one of the most beautiful, popular and important parts of algebra, with many deep relations to other areas of mathematics such as combinatorics, Lie theory and algebraic geometry. Kleshchev describes a new approach to the subject, based on the recent work of Lascoux, Leclerc, Thibon, Ariki, Grojnowski and Brundan, as well as his own. Much of this work has previously appeared only in the research literature. However to make it accessible to graduate students, the theory is developed from scratch, the only prerequisite being a standard course in abstract algebra. For the sake of transparency, Kleshchev concentrates on symmetric and spin-symmetric groups, though methods he develops are quite general and apply to a number of related objects. In sum, this unique book will be welcomed by graduate students and researchers as a modern account of the subject.

Projective Representations of Finite Groups - Gregory Karpilovsky

Projective Representations of Finite Groups - How Ngee Ng 1974

Projective Representations [i.e. Representations] of Finite Groups - Yuval Ginosar 1996

Group Representations - 1994-02-18

This third volume can be roughly divided into two parts. The first part is devoted to the investigation of various properties of projective characters. Special attention is drawn to spin representations and their character tables and to various correspondences for projective characters. Among other topics, projective Schur index and projective representations of abelian groups are covered. The last topic is investigated by introducing a symplectic geometry on finite abelian groups. The second part is devoted to Clifford theory for graded algebras and its application to the corresponding theory for group algebras. The volume ends with a detailed investigation of the Schur index for ordinary representations. A prominent role is played in the discussion by Brauer groups together with cyclotomic algebras and cyclic algebras.

Representation Theory of Finite Groups and Associative Algebras - Charles W. Curtis 1966

Modular Representation Theory - D. Benson 2008-07-22

This reprint of a 1983 Yale graduate course makes results in modular representation theory accessible to an audience ranging from second-year graduate students to established mathematicians. Following a review of background material, the lectures examine three closely connected topics in modular representation theory of finite groups: representations rings; almost split sequences and the Auslander-Reiten quiver; and complexity and cohomology varieties, which has become a major theme in representation theory.

Some Topics in the Theory of Projective Representations of Finite Groups - Frank Hampton Curphey OATES 1978

The Brauer Splitting Theorem and Projective Representations of Finite Groups Over Rings - E. Nauwelaerts 1986

Irreducible Projective Representations of Finite Groups - 2000

Representations of Finite Groups - Hirosi Nagao 2014-05-10

Representations of Finite Groups provides an account of the fundamentals of ordinary and modular representations. This book discusses the fundamental theory of complex representations of finite groups. Organized into five chapters, this book begins with an overview of the basic facts about rings and modules. This text then provides the theory of algebras, including theories of simple algebras, Frobenius algebras, crossed products, and Schur indices with representation-theoretic versions of them. Other chapters include a survey of the fundamental theory of modular representations, with emphasis on Brauer characters. This book discusses as well the module-theoretic representation theory due to Green and includes some topics such as Burry-Carlson's theorem and Scott modules. The final chapter deals with the fundamental results of Brauer on blocks and Fong's theory of covering, and includes some approaches to them. This book is a valuable resource for readers who are interested in the various approaches to the study of the representations of groups.

Modular Branching Rules for Projective Representations of Symmetric Groups and Lowering Operators for the Supergroup $Q(n)$ - Aleksandr Sergeevich Kleshchëv 2012

There are two approaches to projective representation theory of symmetric and alternating groups, which are

powerful enough to work for modular representations. One is based on Sergeev duality, which connects projective representation theory of the symmetric group and representation theory of the algebraic supergroup $Q(n)$ via appropriate Schur (super)algebras and Schur functors. The second approach follows the work of Grojnowski for classical affine and cyclotomic Hecke algebras and connects projective representation theory of symmetric groups in characteristic p to the crystal graph of the basic module of the twisted affine Kac-Moody algebra of type $A_{p-1}^{(2)}$. The goal of this work is to connect the two approaches mentioned above and to obtain new branching results for projective representations of symmetric groups.

The Projective Representations of the Finite Imprimitive Unitary Reflection Groups - Muhammad Saeed-ul-Islam 1980

Degree Patterns of Projective Representations of Finite Groups - Donal Healy (Ph.D.) 2006

On the Reduction of Induced Representations of Finite Groups - Patricia Anne Tucker 1961

Modular Representation Theory of Finite Groups - Peter Schneider 2012-11-27

Representation theory studies maps from groups into the general linear group of a finite-dimensional vector space. For finite groups the theory comes in two distinct flavours. In the 'semisimple case' (for example over the field of complex numbers) one can use character theory to completely understand the representations. This by far is not sufficient when the characteristic of the field divides the order of the group. Modular Representation Theory of finite Groups comprises this second situation. Many additional tools are needed for this case. To mention some, there is the systematic use of Grothendieck groups leading to the Cartan matrix and the decomposition matrix of the group as well as Green's direct analysis of indecomposable representations. There is also the strategy of writing the category of all representations as the direct product of certain subcategories, the so-called 'blocks' of the group. Brauer's work then establishes correspondences between the blocks of the original group and blocks of certain subgroups the philosophy being that one is thereby reduced to a simpler situation. In particular, one can measure how nonsemisimple a category a block is by the size and structure of its so-called 'defect group'. All these concepts are made explicit for the example of the special linear group of two-by-two matrices over a finite prime field. Although the presentation is strongly biased towards the module theoretic point of view an attempt is made to strike a certain balance by also showing the reader the group theoretic approach. In particular, in the case of defect groups a detailed proof of the equivalence of the two approaches is given. This book aims to familiarize students at the masters

level with the basic results, tools, and techniques of a beautiful and important algebraic theory. Some basic algebra together with the semisimple case are assumed to be known, although all facts to be used are restated (without proofs) in the text. Otherwise the book is entirely self-contained.

Characters of Finite Groups. Part 1 - IA. G. Berkovich E. M. Zhmud' 1997-12-02

This book discusses character theory and its applications to finite groups. The work places the subject within the reach of people with a relatively modest mathematical background. The necessary background exceeds the standard algebra course with respect only to finite groups. Starting with basic notions and theorems in character theory, the authors present a variety of results on the properties of complex-valued characters and applications to finite groups. The main themes are degrees and kernels of irreducible characters, the class number and the number of nonlinear irreducible characters, values of irreducible characters, characterizations and generalizations of Frobenius groups, and generalizations and applications of monomial groups. The presentation is detailed, and many proofs of known results are new. Most of the results in the book are presented in monograph form for the first time. Numerous exercises offer additional information on the topics and help readers to understand the main concepts and results.

Linear and Projective Representations of Symmetric Groups - Alexander Kleshchev 2005-06-30

Kleshchev describes a new approach to the subject of the representation theory of symmetric groups.

A Journey Through Representation Theory - Caroline Gruson 2018-10-23

This text covers a variety of topics in representation theory and is intended for graduate students and more advanced researchers who are interested in the field. The book begins with classical representation theory of finite groups over complex numbers and ends with results on representation theory of quivers. The text includes in particular infinite-dimensional unitary representations for abelian groups, Heisenberg groups and $SL(2)$, and representation theory of finite-dimensional algebras. The last chapter is devoted to some applications of quivers, including Harish-Chandra modules for $SL(2)$. Ample examples are provided and some are revisited with a different approach when new methods are introduced, leading to deeper results. Exercises are spread throughout each chapter. Prerequisites include an advanced course in linear algebra that covers Jordan normal forms and tensor products as well as basic results on groups and rings.

Some Contributions to the Theory of Projective Representations of Finite Groups - David Edward Seedhouse 1988

Group Representation Theory - Meinolf Geck 2007-05-07

After the pioneering work of Brauer in the middle of the 20th century in the area of the representation theory

of groups, many entirely new developments have taken place and the field has grown into a very large field of study. This progress, and the remaining open problems (e.g., the conjectures of Alperin, Dade, Broué, James, etc.) have ensured that group representation theory remains a lively area of research. In this book, the leading researchers in the field contribute a chapter in their field of specialty, namely: Broué (Finite reductive groups and *spetses*); Carlson (Cohomology and representations of finite groups); Geck (Representations of Hecke algebras); Seitz (Topics in algebraic groups); Kessar and Linckelmann (Fusion systems and blocks); Serre (On finite subgroups of Lie groups); Thévenaz (The classification of endo-permutation modules); and Webb (Representations and cohomology of categories).

Extensions and Projective Representations of Finite Groups - S. Tom Dixon 1967

The Degrees of Irreducible Projective Representations of Finite Groups - R. J. Higgs 1985

Group Theory and Physics - S. Sternberg 1995-09-07

This textbook, based on courses taught at Harvard University, is an introduction to group theory and its application to physics. The physical applications are considered as the mathematical theory is developed so that the presentation is unusually cohesive and well-motivated. Many modern topics are dealt with, and there is much discussion of the group $SU(n)$ and its representations. This is of great significance in elementary particle physics. Applications to solid state physics are also considered. This stimulating account will prove to be an essential resource for senior undergraduate students and their teachers.

An Approach to Divisibility Theorems for Irreducible Projective Representations of Finite Groups - Neil Magnuson Bogue 1979

Linear Representations of Finite Groups - Jean-Pierre Serre 1996-11-01

This book consists of three parts, rather different in level and purpose. The first part was originally written for quantum chemists. It describes the correspondence, due to Frobenius, between linear representations and characters. The second part is a course given in 1966 to second-year students of l'Ecole Normale. It completes in a certain sense the first part. The third part is an introduction to Brauer Theory.

Group Representation for Quantum Theory - Masahito Hayashi 2016-11-18

This book explains the group representation theory for quantum theory in the language of quantum theory. As is well known, group representation theory is very strong tool for quantum theory, in particular, angular momentum, hydrogen-type Hamiltonian, spin-orbit interaction, quark model, quantum optics, and quantum

information processing including quantum error correction. To describe a big picture of application of representation theory to quantum theory, the book needs to contain the following six topics, permutation group, $SU(2)$ and $SU(d)$, Heisenberg representation, squeezing operation, Discrete Heisenberg representation, and the relation with Fourier transform from a unified viewpoint by including projective representation.

Unfortunately, although there are so many good mathematical books for a part of six topics, no book contains all of these topics because they are too segmentalized. Further, some of them are written in an abstract way in mathematical style and, often, the materials are too segmented. At least, the notation is not familiar to people working with quantum theory. Others are good elementary books, but do not deal with topics related to quantum theory. In particular, such elementary books do not cover projective representation, which is more important in quantum theory. On the other hand, there are several books for physicists. However, these books are too simple and lack the detailed discussion. Hence, they are not useful for advanced study even in physics. To resolve this issue, this book starts with the basic mathematics for quantum theory. Then, it introduces the basics of group representation and discusses the case of the finite groups, the symmetric group, e.g. Next, this book discusses Lie group and Lie algebra. This part starts with the basics knowledge, and proceeds to the special groups, e.g., $SU(2)$, $SU(1,1)$, and $SU(d)$. After the special groups, it explains concrete applications to physical systems, e.g., angular momentum, hydrogen-type Hamiltonian, spin-orbit interaction, and quark model. Then, it proceeds to the general theory for Lie group and Lie algebra. Using this knowledge, this book explains the Bosonic system, which has the symmetries of Heisenberg group and the squeezing symmetry by $SL(2,R)$ and $Sp(2n,R)$. Finally, as the discrete version, this book treats the discrete Heisenberg representation which is related to quantum error correction. To enhance readers' understanding, this book contains 54 figures, 23 tables, and 111 exercises with solutions.

The Degree of Irreducible Projective Representations of Finite Groups - Russell John HIGGS 1985

Projective Representations of Finite Groups - Gregory Karpilovsky 1985

This book presents a systematic account of this topic, from the classical foundations established by Schur 80 years ago to current advances and developments in the field. This work focuses on general methods and builds theory solidly on the study of modules over twisted group algebras, and provides a wide range of skill-sharpening mathematical techniques applicable to this subject. Offers an understanding of projective representations of finite groups for algebraists, number theorists, mathematical researchers studying modern algebra, and theoretical physicists.

Real Projective Representations of Some Finite Groups - Christopher Magson 1988

Projective Representations of the Symmetric Groups - Professor P N Hoffman 1992

The study of the symmetric groups forms one of the basic building blocks of modern group theory. This book presents information currently known on the projective representations of the symmetric and alternating groups. Special emphasis is placed on the theory of Q-functions and skew Q-functions.

Introduction to Representation Theory - Pavel I. Etingof 2011

Very roughly speaking, representation theory studies symmetry in linear spaces. It is a beautiful mathematical subject which has many applications, ranging from number theory and combinatorics to geometry, probability theory, quantum mechanics, and quantum field theory. The goal of this book is to give a "holistic" introduction to representation theory, presenting it as a unified subject which studies representations of associative algebras and treating the representation theories of groups, Lie algebras, and quivers as special cases. Using this approach, the book covers a number of standard topics in the representation theories of these structures. Theoretical material in the book is supplemented by many problems and exercises which touch upon a lot of additional topics; the more difficult exercises are provided with hints. The book is designed as a textbook for advanced undergraduate and beginning graduate students. It should be accessible to students with a strong background in linear algebra and a basic knowledge of abstract algebra.