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KEY=INTRODUCTION - CALLAHAN TESSA

Introduction to Vertex Operator Superalgebras and Their Modules *Springer Science & Business Media* This book presents a systematic study on the structures of vertex operator superalgebras and their modules. Related theories of self-dual codes and lattices are included, as well as recent achievements on classifications of certain simple vertex operator superalgebras and their irreducible twisted modules, constructions of simple vertex operator superalgebras from graded associative algebras and their anti-involutions, self-dual codes and lattices. Audience: This book is of interest to researchers and graduate students in mathematics and mathematical physics. Elliptic Genera and Vertex Operator Super-Algebras *Springer* This monograph deals with two aspects of the theory of elliptic genus: its topological aspect involving elliptic functions, and its representation theoretic aspect involving vertex operator super-algebras. For the second aspect, elliptic genera are shown to have the structure of modules over certain vertex operator super-algebras. The vertex operators corresponding to parallel tensor fields on closed Riemannian Spin Kähler manifolds such as Riemannian tensors and Kähler forms are shown to give rise to Virasoro algebras and affine Lie algebras. This monograph is chiefly intended for topologists and it includes accounts on topics outside of topology such as vertex operator algebras. Moonshine, the Monster, and Related Topics Joint Research Conference on Moonshine, the Monster, and Related Topics, June 18-23, 1994, Mount Holyoke College, South Hadley, Massachusetts *American Mathematical Soc.* 'One of the great legacies of the classification of the finite simple groups is the existence of the Monster \mathcal{M} . Work of Borcherds and Frenkel-Lepowsky-Meurman led to the notion of a vertex (operator) algebra, which was seen to be the same as the chiral algebras used by physicists in conformal field theory \mathcal{V} . The connections with physics have proven to be invaluable, and it seems likely that another branch of mathematics whose origins are eerily similar to those of moonshine - that is, elliptic cohomology - will turn out to be very relevant too' - from the Preface. This volume contains the proceedings of a Joint Summer Research Conference held at Mount Holyoke College in June 1994. As perhaps the first conference proceedings devoted exclusively to the subject known as 'Moonshine', this work contains something for many mathematicians and physicists. It features: results concerning the monster simple group and other simple groups; connections with elliptic cohomology; connections with 2-dimensional conformal field theory; the role of operads; and, connections with modular functions. "Much of Moonshine, the Monster, and Related Topics" features new results not available anywhere else. Introduction to Vertex Operator Algebras and Their Representations *Springer Science & Business Media* The deep and relatively new field of vertex operator algebras is intimately related to a variety of areas in mathematics and physics: for example, the concepts of "monstrous moonshine," infinite-dimensional Lie theory, string theory, and conformal field theory. This book introduces the reader to the fundamental theory of vertex operator algebras and its basic techniques and examples. Beginning with a detailed presentation of the theoretical foundations and proceeding to a range of applications, the text includes a number of new, original results and also highlights and brings fresh perspective to important works of many researchers. After introducing the elementary "formal calculus" underlying the subject, the book provides an axiomatic development of vertex operator algebras and their modules, expanding on the early contributions of R. Borcherds, I. Frenkel, J. Lepowsky, A. Meurman, Y.-Z. Huang, C. Dong, Y. Zhu and others. The concept of a "representation" of a vertex (operator) algebra is treated in detail, following and extending the work of H. Li; this approach is used to construct important families of vertex (operator) algebras and their modules. Requiring only a familiarity with basic algebra, Introduction to Vertex Operator Algebras and Their Representations will be useful for graduate students and researchers in mathematics and physics. The book's presentation of the core topics will equip readers to embark on many active research directions related to vertex operator algebras, group theory, representation theory, and string theory. Kac-Moody Lie Algebras and Related Topics Ramanujan International Symposium on Kac-Moody Lie Algebras and Applications, January 28-31, 2002, Ramanujan Institute for Advanced Study in Mathematics, University of Madras, Chennai, India *American Mathematical Soc.* This volume is the proceedings of the Ramanujan International Symposium on Kac-Moody Lie algebras and their applications. The symposium provided researchers in mathematics and physics with the opportunity to discuss new developments in this rapidly-growing area of research. The book contains several excellent articles with new and significant results. It is suitable for graduate students and researchers working in Kac-Moody Lie algebras, their applications, and related areas of research. Moonshine - The First Quarter Century and Beyond Proceedings of a Workshop on the Moonshine Conjectures and Vertex Algebras *Cambridge University Press* "In 1979, John Conway and Simon Norton's famous paper, 'Monstrous Moonshine', outlined the remarkable connection between the monster group M and the theory of modular functions. The search for an explanation of this phenomenon involved the development and application of diverse areas of mathematics, including (generalized) Kac-Moody algebras, vertex (operator) algebras, automorphic forms and elliptic cohomology, together with string and conformal field theory from theoretical physics. This volume consists of seventeen papers based on talks presented at a workshop held to mark the anniversary of 'Monstrous Moonshine'. Containing a mixture of expository and current research material, they illustrate its extensive impact and reflect the broad range of research activity that has stemmed from the Moonshine conjectures. Potential directions for future development are also discussed"--Provided by publisher. Lie Algebras, Vertex Operator Algebras and Their Applications International Conference in Honor of James Lepowsky and Robert Wilson on Their Sixtieth Birthdays, May 17-21, 2005, North Carolina State University, Raleigh, North Carolina *American Mathematical Soc.* The articles in this book are based on talks given at the international conference "Lie algebras, vertex operator algebras and their applications", in honor of James Lepowsky and Robert Wilson on their sixtieth birthdays, held in May of 2005 at North Carolina State University. Some of the papers in this volume give inspiring expositions on the development and status of their respective research areas. Others outline and explore the challenges as well as the future directions of research for the twenty-first century. The focus of the papers in this volume is mainly on Lie algebras, quantum groups, vertex operator algebras and their applications to number theory, combinatorics and conformal field theory. This book is useful for graduate students and researchers in mathematics and mathematical physics who want to be introduced to different areas of current research or explore the frontiers of research in the areas mentioned above. Lie Theory and Its Applications in Physics IX International Workshop *Springer Science & Business Media* Traditionally, Lie Theory is a tool to build mathematical models for physical systems. Recently, the trend is towards geometrisation of the mathematical description of physical systems and objects. A geometric approach to a system yields in general some notion of symmetry which is very helpful in understanding its structure. Geometrisation and symmetries are meant in their broadest sense, i.e., classical geometry, differential geometry, groups and quantum groups, infinite-dimensional (super-)algebras, and their representations. Furthermore, we include the necessary tools from functional analysis and number theory. This is a large interdisciplinary and interrelated field. Samples of these new trends are presented in this volume, based on contributions from the Workshop "Lie Theory and Its Applications in Physics" held near Varna, Bulgaria, in June 2011. This book is suitable for an extensive audience of mathematicians, mathematical physicists, theoretical physicists, and researchers in the field of Lie Theory. Shape, Smoothness, and Invariant Stratification of an Attracting Set for Delayed Monotone Positive Feedback *American Mathematical Soc.* Vertex Operator Algebras and Related Areas An International Conference in Honor of Geoffrey Mason's 60th Birthday : July 7-11, 2008, Illinois State University, Normal, Illinois *American Mathematical Soc.* Vertex operator algebras were introduced to mathematics in the work of Richard Borcherds, Igor Frenkel, James Lepowsky and Arne Meurman as a mathematically rigorous formulation of chiral algebras of two-dimensional conformal field theory. The aim was to use vertex operator algebras to explain and prove the remarkable Monstrous Moonshine conjectures in group theory. The theory of vertex operator algebras has now grown into a major research area in mathematics. These proceedings contain expository lectures and research papers presented during the international conference on Vertex Operator Algebras and Related Areas, held at Illinois State University in Normal, IL, from July 7 to July 11, 2008. The main aspects of this conference were connections and interactions of vertex operator algebras with the following areas: conformal field theories, quantum field theories, Hopf algebra, infinite dimensional Lie algebras, and modular forms. This book will be useful for researchers as well as for graduate students in mathematics and physics. Its purpose is not only to give an up-to-date overview of the fields covered by the conference but also to stimulate new directions and discoveries by experts in the areas. Vertex Algebras and Geometry *American Mathematical Soc.* This book contains the proceedings of the AMS Special Session on Vertex Algebras and Geometry, held from October 8-9, 2016, and the mini-conference on Vertex Algebras, held from October 10-11, 2016, in Denver, Colorado. The papers cover vertex algebras in connection with geometry and tensor categories, with topics in vertex rings, chiral algebroids, the Higgs branch conjecture, and applicability and use of vertex tensor categories. Recent Developments in Infinite-dimensional Lie Algebras and Conformal Field Theory Proceedings of an International Conference on Infinite-dimensional Lie Theory and Conformal Field Theory, May 23-27, 2000, University of Virginia, Charlottesville, Virginia *American Mathematical Soc.* Because of its many applications to mathematics and mathematical physics, the representation theory of infinite-dimensional Lie and quantized enveloping algebras comprises an important area of current research. This volume includes articles from the proceedings of an international conference, "Infinite-Dimensional Lie Theory and Conformal Field Theory", held at the University of Virginia. Many of the contributors to the volume are prominent researchers in the field. This conference provided an opportunity for mathematicians and physicists to interact in an active research area of mutual interest. The talks focused on recent developments in the representation theory of affine, quantum affine, and extended affine Lie algebras and Lie superalgebras. They also highlighted applications to conformal field theory, integrable and disordered systems. Some of the articles are expository and accessible to a broad readership of mathematicians and physicists interested in this area; others are research articles that are appropriate for more advanced readers. Automorphic Forms and Lie

Superalgebras *Springer Science & Business Media* This book provides the reader with the tools to understand the ongoing classification and construction project of Lie superalgebras. It presents the material in as simple terms as possible. Coverage specifically details Borcherds-Kac-Moody superalgebras. The book examines the link between the above class of Lie superalgebras and automorphic form and explains their construction from lattice vertex algebras. It also includes all necessary background information. **Vertex Algebras for Beginners** *American Mathematical Soc.* This is a revised and expanded edition of Kac's original introduction to algebraic aspects of conformal field theory, which was published by the AMS in 1996. The volume serves as an introduction to algebraic aspects of conformal field theory, which in the past 15 years revealed a variety of unusual mathematical notions. Vertex algebra theory provides an effective tool to study them in a unified way. In the book, a mathematician encounters new algebraic structures that originated from Einstein's special relativity postulate and Heisenberg's uncertainty principle. A physicist will find familiar notions presented in a more rigorous and systematic way, possibly leading to a better understanding of foundations of quantum physics. This revised edition is based on courses given by the author at MIT and at Rome University in spring 1997. New material is added, including the foundations of a rapidly growing area of algebraic conformal theory. Also, in some places the exposition has been significantly simplified. **Vertex Algebras and Algebraic Curves: Second Edition** *American Mathematical Soc.* Vertex algebras are algebraic objects that encapsulate the concept of operator product expansion from two-dimensional conformal field theory. Vertex algebras are fast becoming ubiquitous in many areas of modern mathematics, with applications to representation theory, algebraic geometry, the theory of finite groups, modular functions, topology, integrable systems, and combinatorics. This book is an introduction to the theory of vertex algebras with a particular emphasis on the relationship with the geometry of algebraic curves. The notion of a vertex algebra is introduced in a coordinate-independent way, so that vertex operators become well defined on arbitrary smooth algebraic curves, possibly equipped with additional data, such as a vector bundle. Vertex algebras then appear as the algebraic objects encoding the geometric structure of various moduli spaces associated with algebraic curves. Therefore they may be used to give a geometric interpretation of various questions of representation theory. The book contains many original results, introduces important new concepts, and brings new insights into the theory of vertex algebras. The authors have made a great effort to make the book self-contained and accessible to readers of all backgrounds. Reviewers of the first edition anticipated that it would have a long-lasting influence on this exciting field of mathematics and would be very useful for graduate students and researchers interested in the subject. This second edition, substantially improved and expanded, includes several new topics, in particular an introduction to the Beilinson-Drinfeld theory of factorization algebras and the geometric Langlands correspondence. **Recent Developments in Quantum Affine Algebras and Related Topics Representations of Affine and Quantum Affine Algebras and Their Applications**, North Carolina State University, May 21-24, 1998 *American Mathematical Soc.* This volume reflects the proceedings of the International Conference on Representations of Affine and Quantum Affine Algebras and Their Applications held at North Carolina State University (Raleigh). In recent years, the theory of affine and quantum affine Lie algebras has become an important area of mathematical research with numerous applications in other areas of mathematics and physics. Three areas of recent progress are the focus of this volume: affine and quantum affine algebras and their generalizations, vertex operator algebras and their representations, and applications in combinatorics and statistical mechanics. Talks given by leading international experts at the conference offered both overviews on the subjects and current research results. The book nicely presents the interplay of these topics recently occupying 'center stage' in the theory of infinite dimensional Lie theory. **Annihilating Fields of Standard Modules of $\mathfrak{sl}(2, \mathbb{C})^{\sim}$ and Combinatorial Identities** *American Mathematical Soc.* In this volume, the authors show that a set of local admissible fields generates a vertex algebra. For an affine Lie algebra \mathfrak{g} , they construct the corresponding level k vertex operator algebra and show that level k highest weight \mathfrak{g} -modules are modules for this vertex operator algebra. They determine the set of annihilating fields of level k standard modules and study the corresponding loop \mathfrak{g} -module--the set of relations that defines standard modules. In the case when \mathfrak{g} is of type $A^{(1)}_1$, they construct bases of standard modules parameterized by colored partitions, and as a consequence, obtain a series of Rogers-Ramanujan type combinatorial identities. **The Moduli Space of $N=1$ Superspheres with Tubes and the Sewing Operation** *American Mathematical Soc.* Within the framework of complex supergeometry and motivated by two-dimensional genus-zero holomorphic $N = 1$ superconformal field theory, we define the moduli space of $N=1$ genus-zero super-Riemann surfaces with oriented and ordered half-infinite tubes, modulo superconformal equivalence. We define a sewing operation on this moduli space which gives rise to the sewing equation and normalization and boundary conditions. To solve this equation, we develop a formal theory of infinitesimal $N = 1$ superconformal transformations based on a representation of the $N=1$ Neveu-Schwarz algebra in terms of superderivations. We solve a formal version of the sewing equation by proving an identity for certain exponentials of superderivations involving infinitely many formal variables. We use these formal results to give a reformulation of the moduli space, a more detailed description of the sewing operation, and an explicit formula for obtaining a canonical supersphere with tubes from the sewing together of two canonical superspheres with tubes. We give some specific examples of sewings, two of which give geometric analogues of associativity for an $N=1$ Neveu-Schwarz vertex operator superalgebra. We study a certain linear functional in the supermeromorphic tangent space at the identity of the moduli space of superspheres with $1 + 1$ tubes (one outgoing tube and one incoming tube) which is associated to the $N=1$ Neveu-Schwarz element in an $N=1$ Neveu-Schwarz vertex operator superalgebra. We prove the analyticity and convergence of the infinite series arising from the sewing operation. Finally, we define a bracket on the supermeromorphic tangent space at the identity of the moduli space of superspheres with $1+1$ tubes and show that this gives a representation of the $N=1$ Neveu-Schwarz algebra with central charge zero. **Algebraic Groups and Their Generalizations: Quantum and infinite dimensional methods** *American Mathematical Soc.* Proceedings of a research institute held at Pennsylvania State University, July 1991, focusing on quantum and infinite-dimensional methods of algebraic groups. Topics include perverse sheaves, finite Chevalley groups, the general theory of algebraic groups, representations, invariant theory, general Moonshine beyond the Monster **The Bridge Connecting Algebra, Modular Forms and Physics** *Cambridge University Press* This book was originally published in 2006. Moonshine forms a way of explaining the mysterious connection between the monster finite group and modular functions from classical number theory. The theory has evolved to describe the relationship between finite groups, modular forms and vertex operator algebras. Moonshine Beyond the Monster describes the general theory of Moonshine and its underlying concepts, emphasising the interconnections between mathematics and mathematical physics. Written in a clear and pedagogical style, this book is ideal for graduate students and researchers working in areas such as conformal field theory, string theory, algebra, number theory, geometry and functional analysis. Containing over a hundred exercises, it is also a suitable textbook for graduate courses on Moonshine and as supplementary reading for courses on conformal field theory and string theory. **Vertex Operator Algebras in Mathematics and Physics** *American Mathematical Soc.* Vertex operator algebras are a class of algebras underlying a number of recent constructions, results, and themes in mathematics. These algebras can be understood as "string-theoretic analogues" of Lie algebras and of commutative associative algebras. They play fundamental roles in some of the most active research areas in mathematics and physics. Much recent progress in both physics and mathematics has benefited from cross-pollination between the physical and mathematical points of view. This book presents the proceedings from the workshop, "Vertex Operator Algebras in Mathematics and Physics", held at The Fields Institute. It consists of papers based on many of the talks given at the conference by leading experts in the algebraic, geometric, and physical aspects of vertex operator algebra theory. The book is suitable for graduate students and research mathematicians interested in the major themes and important developments on the frontier of research in vertex operator algebra theory and its applications in mathematics and physics. **Spinor Construction of Vertex Operator Algebras, Triality, and $E_8(1)$** *American Mathematical Soc.* The theory of vertex operator algebras is a remarkably rich new mathematical field which captures the algebraic content of conformal field theory in physics. Ideas leading up to this theory appeared in physics as part of statistical mechanics and string theory. In mathematics, the axiomatic definitions crystallized in the work of Borcherds and in **Vertex Operator Algebras and the Monster**, by Frenkel, Lepowsky, and Meurman. The structure of monodromies of intertwining operators for modules of vertex operator algebras yields braid group representations and leads to natural generalizations of vertex operator algebras, such as superalgebras and para-algebras. Many examples of vertex operator algebras and their generalizations are related to constructions in classical representation theory and shed new light on the classical theory. This book accomplishes several goals. The authors provide an explicit spinor construction, using only Clifford algebras, of a vertex operator superalgebra structure on the direct sum of the basic and vector modules for the affine Kac-Moody algebra $D^{(1)}_n$. They also review and extend Chevalley's spinor construction of the 24-dimensional commutative nonassociative algebraic structure and triality on the direct sum of the three 8-dimensional D_4 -modules. Vertex operator para-algebras, introduced and developed independently in this book and by Dong and Lepowsky, are related to one-dimensional representations of the braid group. The authors also provide a unified approach to the Chevalley, Griess, and E_8 algebras and explain some of their similarities. A third goal is to provide a purely spinor construction of the exceptional affine Lie algebra $E^{(1)}_8$, a natural continuation of previous work on spinor and oscillator constructions of the classical affine Lie algebras. These constructions should easily extend to include the rest of the exceptional affine Lie algebras. The final objective is to develop an inductive technique of construction which could be applied to the Monster vertex operator algebra. Directed at mathematicians and physicists, this book should be accessible to graduate students with some background in finite-dimensional Lie algebras and their representations. Although some experience with affine Kac-Moody algebras would be useful, a summary of the relevant parts of that theory is included. This book shows how the concepts and techniques of Lie theory can be generalized to yield the algebraic structures associated with conformal field theory. The careful reader will also gain a detailed knowledge of how the spinor construction of classical triality lifts to the affine algebras and plays an important role in a spinor construction of vertex operator algebras, modules, and intertwining operators with nontrivial monodromies. **"Moonshine" of Finite Groups** *European Mathematical Society* This is an almost verbatim reproduction of the author's lecture notes written in 1983-84 at Ohio State University, Columbus. A substantial update is given in the bibliography. Over the last 20 plus years there has been energetic activity in the field of finite simple group theory related to the monster simple group. Most notably, influential works have been produced in the theory of vertex operator algebras from research that was stimulated by the moonshine of the finite groups. Still, we can ask the same questions now that we did 30-40 years ago: What is the monster simple group? Is it really related to the theory of the universe as it was vaguely so envisioned? What lies behind the moonshine phenomena of the monster group? It may appear that we have only scratched the surface. These notes are primarily reproduced for the benefit of readers who wish to start learning about modular functions used in moonshine. **Mathematical Aspects of Conformal and Topological Field Theories and Quantum Groups** *American Mathematical Soc.* This book contains papers presented by speakers at the AMS-IMS-SIAM Joint Summer Research Conference on Conformal Field Theory, Topological Field Theory and Quantum Groups, held at Mount Holyoke College in June 1992. One group of papers deals with one aspect of conformal field theory, namely, vertex operator algebras or superalgebras and their representations. Another group deals with various aspects of quantum groups. Other topics covered include the theory of knots in three-manifolds, symplectic geometry, and tensor products. This book provides an excellent view of some of the latest developments in this growing field of research. **Lie Algebras and Related Topics Proceedings of a Research Conference Held May 22-June 1, 1988, with Support from the National Science Foundation** *American Mathematical Soc.* The 1984 classification of the finite-dimensional restricted simple Lie algebras over an algebraically closed field of characteristic $p > 7$ provided the impetus for a Special Year of Lie Algebras, held at the University of Wisconsin, Madison, during 1987-88. Work done during the Special Year and afterward put researchers much closer toward a solution of the long-standing problem of determining the finite-dimensional simple Lie algebras over an algebraically closed field of characteristic $p > 7$. This volume contains the proceedings of a conference on Lie algebras and

related topics, held in May 1988 to mark the end of the Special Year. The conference featured lectures on Lie algebras of prime characteristic, algebraic groups, combinatorics and representation theory, and Kac-Moody and Virasoro algebras. Many facets of recent research on Lie theory are reflected in the papers presented here, testifying to the richness and diversity of this topic. Infinite-dimensional Aspects of Representation Theory and Applications International Conference on Infinite-Dimensional Aspects of Representation Theory and Applications, May 18-22, 2004, University of Virginia, Charlottesville, Virginia *American Mathematical Soc.* The University of Virginia (Charlottesville) hosted an international conference on Infinite-dimensional Aspects of Representation Theory and Applications. This volume contains papers resulting from the mini-courses and talks given at the meeting. Beyond the techniques and ideas related to representation theory, the book demonstrates connections to number theory, algebraic geometry, and mathematical physics. The specific topics covered include Hecke algebras, quantum groups, infinite-dimensional Lie algebras, quivers, modular representations, and Gromov-Witten invariants. The book is suitable for graduate students and researchers interested in representation theory.

Representation Theory of the Virasoro Algebra *Springer Science & Business Media* The Virasoro algebra is an infinite dimensional Lie algebra that plays an increasingly important role in mathematics and theoretical physics. This book describes some fundamental facts about the representation theory of the Virasoro algebra in a self-contained manner. Topics include the structure of Verma modules and Fock modules, the classification of (unitarizable) Harish-Chandra modules, tilting equivalence, and the rational vertex operator algebras associated to the so-called minimal series representations. Covering a wide range of material, this book has three appendices which provide background information required for some of the chapters. The authors organize fundamental results in a unified way and refine existing proofs. For instance in chapter three, a generalization of Jantzen filtration is reformulated in an algebraic manner, and geometric interpretation is provided. Statements, widely believed to be true, are collated, and results which are known but not verified are proven, such as the corrected structure theorem of Fock modules in chapter eight. This book will be of interest to a wide range of mathematicians and physicists from the level of graduate students to researchers. In Search of the Riemann Zeros Strings, Fractal Membranes and Noncommutative Spacetimes *American Mathematical Soc.* Formulated in 1859, the Riemann Hypothesis is the most celebrated and multifaceted open problem in mathematics. In essence, it states that the primes are distributed as harmoniously as possible—or, equivalently, that the Riemann zeros are located on a single vertical line, called the critical line. In this book, the author proposes a new approach to understand and possibly solve the Riemann Hypothesis. His reformulation builds upon earlier (joint) work on complex fractal dimensions and the vibrations of fractal strings, combined with string theory and noncommutative geometry. Accordingly, it relies on the new notion of a fractal membrane or quantized fractal string, along with the modular flow on the associated moduli space of fractal membranes. Conjecturally, under the action of the modular flow, the spacetime geometries become increasingly symmetric and crystal-like, hence, arithmetic. Correspondingly, the zeros of the associated zeta functions eventually condense onto the critical line, towards which they are attracted, thereby explaining why the Riemann Hypothesis must be true. Written with a diverse audience in mind, this unique book is suitable for graduate students, experts and nonexperts alike, with an interest in number theory, analysis, dynamical systems, arithmetic, fractal or noncommutative geometry, and mathematical or theoretical physics. Recent Developments in Lie Algebras, Groups, and Representation Theory 2009-2011 Southeastern Lie Theory Workshop Series : Combinatorial Lie Theory and Applications, October 9-11, 2009, North Carolina State University : Homological Methods in Representation Theory, May 22-24, 2010, University of Georgia : Finite and Algebraic Groups, June 1-4, 2011, University of Virginia *American Mathematical Soc.* This book contains the proceedings of the 2009-2011 Southeastern Lie Theory Workshop Series, held October 9-11, 2009 at North Carolina State University, May 22-24, 2010, at the University of Georgia, and June 1-4, 2011 at the University of Virginia. Some of the articles, written by experts in the field, survey recent developments while others include new results in Lie algebras, quantum groups, finite groups, and algebraic groups. The Orbit Method in Geometry and Physics In Honor of A. A. Kirillov *Springer Science & Business Media* The orbit method influenced the development of several areas of mathematics in the second half of the 20th century and remains a useful and powerful tool in such areas as Lie theory, representation theory, integrable systems, complex geometry, and mathematical physics. Among the distinguished names associated with the orbit method is that of A.A. Kirillov, whose pioneering paper on nilpotent orbits (1962), places him as the founder of orbit theory. The original research papers in this volume are written by prominent mathematicians and reflect recent achievements in orbit theory and other closely related areas such as harmonic analysis, classical representation theory, Lie superalgebras, Poisson geometry, and quantization. Contributors: A. Alekseev, J. Alev, V. Baranovskiy, R. Brylinski, J. Dixmier, S. Evens, D.R. Farkas, V. Ginzburg, V. Gorbounov, P. Grozman, E. Gutkin, A. Joseph, D. Kazhdan, A.A. Kirillov, B. Kostant, D. Leites, F. Malikov, A. Melnikov, P.W. Michor, Y.A. Neretin, A. Okounkov, G. Olshanski, F. Petrov, A. Polishchuk, W. Rossmann, A. Sergeev, V. Schechtman, I. Shchepochkina. The work will be an invaluable reference for researchers in the above mentioned fields, as well as a useful text for graduate seminars and courses. AdS/CFT, (Super-)Virasoro, Affine (Super-)Algebras *Walter de Gruyter GmbH & Co KG* The De Gruyter Studies in Mathematical Physics are devoted to the publication of monographs and high-level texts in mathematical physics. They cover topics and methods in fields of current interest, with an emphasis on didactical presentation. The series will enable readers to understand, apply and develop further, with sufficient rigor, mathematical methods to given problems in physics. For this reason, works with a few authors are preferred over edited volumes. The works in this series are aimed at advanced students and researchers in mathematical and theoretical physics. They can also serve as secondary reading for lectures and seminars at advanced levels. Proceedings of the Japan Academy Mathematical sciences Groups, Difference Sets, and the Monster Proceedings of a Special Research Quarter at The Ohio State University, Spring 1993 *Walter de Gruyter* This series is devoted to the publication of monographs, lecture resp. seminar notes, and other materials arising from programs of the OSU Mathemaical Research Institute. This includes proceedings of conferences or workshops held at the Institute, and other mathematical writings. Complex Analysis and Related Topics *Springer Science & Business Media* This volume is a collection of up-to-date research and expository papers on different aspects of complex analysis, including relations to operator theory and hypercomplex analysis. The articles cover many important and essential subjects, such as the Schrödinger equation, subelliptic operators, Lie algebras and superalgebras, Toeplitz and Hankel operators, reproducing kernels and Qp spaces, among others. Most of the papers were presented at the International Symposium on Complex Analysis and Related Topics held in Cuernavaca (Morelos), Mexico, in November 1996, which was attended by approximately 50 experts in the field. The book can be used as a reference work on recent research in the subjects covered. It is one of the few books stressing the relation between operator theory and complex and hypercomplex analyses. The book is addressed to researchers and postgraduate students in the fields named here and in related ones. Infinite-dimensional Lie Algebras *American Mathematical Soc.* This volume begins with an introduction to the structure of finite-dimensional simple Lie algebras, including the representation of $\widehat{\mathfrak{sl}}(2, \mathbb{C})$, root systems, the Cartan matrix, and a Dynkin diagram of a finite-dimensional simple Lie algebra. Continuing on, the main subjects of the book are the structure (real and imaginary root systems) of and the character formula for Kac-Moody superalgebras, which is explained in a very general setting. Only elementary linear algebra and group theory are assumed. Also covered is modular property and asymptotic behavior of integrable characters of affine Lie algebras. The exposition is self-contained and includes examples. The book can be used in a graduate-level course on the topic. Encyclopaedia of Mathematics, Supplement III *Springer Science & Business Media* This is the third supplementary volume to Kluwer's highly acclaimed twelve-volume Encyclopaedia of Mathematics. This additional volume contains nearly 500 new entries written by experts and covers developments and topics not included in the previous volumes. These entries are arranged alphabetically throughout and a detailed index is included. This supplementary volume enhances the existing twelve volumes, and together, these thirteen volumes represent the most authoritative, comprehensive and up-to-date Encyclopaedia of Mathematics available. The Monster and Lie Algebras Proceedings of a Special Research Quarter at the Ohio State University, May 1996 *Walter de Gruyter* This series is devoted to the publication of monographs, lecture resp. seminar notes, and other materials arising from programs of the OSU Mathemaical Research Institute. This includes proceedings of conferences or workshops held at the Institute, and other mathematical writings. Quantization and Non-holomorphic Modular Forms *Springer Science & Business Media* This is a new approach to the theory of non-holomorphic modular forms, based on ideas from quantization theory or pseudodifferential analysis. Extending the Rankin-Selberg method so as to apply it to the calculation of the Roelcke-Selberg decomposition of the product of two Eisenstein series, one lets Maass cusp-forms appear as residues of simple, Eisenstein-like, series. Other results, based on quantization theory, include a reinterpretation of the Lax-Phillips scattering theory for the automorphic wave equation, in terms of distributions on R^2 automorphic with respect to the linear action of $SL(2, \mathbb{Z})$. The Princeton Companion to Mathematics *Princeton University Press* A comprehensive guide to mathematics with over 200 entries divided thematically. The Gelfand Mathematical Seminars, 1990-1992 1990-1992 *Springer Science & Business Media* This Seminar began in Moscow in November 1943 and has continued without interruption up to the present. We are happy that with this volume, Birkhäuser has begun to publish papers of talks from the Seminar. It was, unfortunately, difficult to organize their publication before 1990. Since 1990, most of the talks have taken place at Rutgers University in New Brunswick, New Jersey. Parallel seminars were also held in Moscow, and during July, 1992, at IRES in Bures-sur-Yvette, France. Speakers were invited to submit papers in their own style, and to elaborate on what they discussed in the Seminar. We hope that readers will find the diversity of styles appealing, and recognize that to some extent this reflects the diversity of styles in a mathematical society. The principal aim was to have interesting talks, even if the topic was not especially popular at the time. The papers listed in the Table of Contents reflect some of the rich variety of ideas presented in the Seminar. Not all the speakers submitted papers. Among the interesting talks that influenced the seminar in an important way, let us mention, for example, that of R. Langlands on percolation theory and those of J. Conway and J. McKay on sporadic groups. In addition, there were many extemporaneous talks as well as short discussions.