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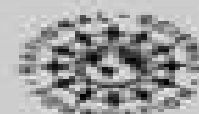
Number 98

Special Functions, KZ Type Equations, and Representation Theory

Alexander Varchenko



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Special Functions Kz Type Equations And Representation Theory

Ron Graham, Steve Butler



Special Functions Kz Type Equations And Representation Theory:

Special Functions, KZ Type Equations, and Representation Theory Aleksandr Nikolaevich Varchenko, **Special Functions, KZ Type Equations, and Representation Theory** Aleksandr Nikolaevich Varchenko, 2003 The last twenty years have seen an active interaction between mathematics and physics This book is devoted to one of the new areas which deals with mathematical structures related to conformal field theory and its sqs deformations In the book the author discusses the interplay between Knizhnik Zamolodchikov type equations the Bethe ansatz method representation theory and geometry of multi dimensional hypergeometric functions This book aims to provide an introduction to the area and expose different facets of the subject It contains constructions discussions of notions statements of main results and illustrative examples The exposition is restricted to the simplest case of the theory associated with the Lie algebra $\mathfrak{sl}(2)$ This book is intended for researchers and graduate students in mathematics and in mathematical physics in particular to those interested in applications of special functions

Special Functions Richard Beals, Roderick Wong, 2010-08-12 The subject of special functions is often presented as a collection of disparate results which are rarely organised in a coherent way This book answers the need for a different approach to the subject The authors main goals are to emphasise general unifying principles coherently and to provide clear motivation efficient proofs and original references for all of the principal results The book covers standard material but also much more including chapters on discrete orthogonal polynomials and elliptic functions The authors show how a very large part of the subject traces back to two equations the hypergeometric equation and the confluent hypergeometric equation and describe the various ways in which these equations are canonical and special Providing ready access to theory and formulas this book serves as an ideal graduate level textbook as well as a convenient reference

Special Functions and Orthogonal Polynomials Richard Beals, Roderick Wong, 2016-05-17 The subject of special functions is often presented as a collection of disparate results rarely organized in a coherent way This book emphasizes general principles that unify and demarcate the subjects of study The authors main goals are to provide clear motivation efficient proofs and original references for all of the principal results The book covers standard material but also much more It shows how much of the subject can be traced back to two equations the hypergeometric equation and confluent hypergeometric equation and it details the ways in which these equations are canonical and special There is extended coverage of orthogonal polynomials including connections to approximation theory continued fractions and the moment problem as well as an introduction to new asymptotic methods There are also chapters on Meijer G functions and elliptic functions The final chapter introduces Painlevé transcendents which have been termed the special functions of the twenty first century

Encyclopedia of Special Functions: The Askey-Bateman Project: Volume 2, Multivariable Special Functions Tom H. Koornwinder, Jasper V. Stokman, 2020-10-15 This is the second of three volumes that form the Encyclopedia of Special Functions an extensive update of the Bateman Manuscript Project Volume 2 covers multivariable special functions When the

Bateman project appeared study of these was in an early stage but revolutionary developments began to be made in the 1980s and have continued ever since World renowned experts survey these over the course of 12 chapters each containing an extensive bibliography The reader encounters different perspectives on a wide range of topics from Dunkl theory to Macdonald theory to the various deep generalizations of classical hypergeometric functions to the several variables case including the elliptic level Particular attention is paid to the close relation of the subject with Lie theory geometry mathematical physics and combinatorics

Low Dimensional Topology and Number Theory Masanori Morishita, Hiroaki Nakamura, Jun Ueki, 2025-03-02 This book is the result of research initiatives formed during the workshop Low Dimensional Topology and Number Theory XIII at Kyushu University in 2022 It is also dedicated to the memory of Professor Toshie Takata who has been a main figure of the session chairs for the series of annual workshops since 2009 The activity was aimed at understanding and deepening recent developments of lively and fruitful interactions between low dimensional topology and number theory over the past decades In this volume of proceedings the reader will find research papers as well as survey articles including open problems at the interface between classical and quantum topology and algebraic and analytic number theory written by leading experts and active researchers in the respective fields Topics include among others the strong slope conjecture Kashiwara Vergne Lie algebra braids and fibered double branched covers of 3 manifolds Temperley Lieb Jones category and conformal blocks WRT invariants and false theta functions the colored Jones polynomial of the figure eight knot potential functions and A polynomials l adic Galois polylogarithms Dijkgraaf Witten invariants in Bloch groups analogies between knots and primes in arithmetic topology normalized Jones polynomials for rational links Iwasawa main conjecture Weber's class number problem The book provides a valuable resource for researchers and graduate students interested in topics related to both low dimensional topology and number theory

Bridging Algebra, Geometry, and Topology Denis Ibadula, Willem Veys, 2014-10-20 Algebra geometry and topology cover a variety of different but intimately related research fields in modern mathematics This book focuses on specific aspects of this interaction The present volume contains refereed papers which were presented at the International Conference Experimental and Theoretical Methods in Algebra Geometry and Topology held in Eforie Nord near Constanta Romania during 20-25 June 2013 The conference was devoted to the 60th anniversary of the distinguished Romanian mathematicians Alexandru Dimca and tefan Papadima The selected papers consist of original research work and a survey paper They are intended for a large audience including researchers and graduate students interested in algebraic geometry combinatorics topology hyperplane arrangements and commutative algebra The papers are written by well known experts from different fields of mathematics affiliated to universities from all over the world they cover a broad range of topics and explore the research frontiers of a wide variety of contemporary problems of modern mathematics

Zeta and L -functions in Number Theory and Combinatorics Wen-Ching Winnie Li, 2019-03-01 Zeta and L functions play a central role in number theory They provide important information of arithmetic nature This book which grew

out of the author's teaching over several years explores the interaction between number theory and combinatorics using zeta and L functions as a central theme. It provides a systematic and comprehensive account of these functions in a combinatorial setting and establishes among other things the combinatorial counterparts of celebrated results in number theory such as the prime number theorem and the Chebotarev density theorem. The spectral theory for finite graphs and higher dimensional complexes is studied. Of special interest in theory and applications are the spectrally extremal objects called Ramanujan graphs and Ramanujan complexes which can be characterized by their associated zeta functions satisfying the Riemann Hypothesis. Explicit constructions of these extremal combinatorial objects using number theoretic and combinatorial means are presented. Research on zeta and L functions for complexes other than graphs emerged only in recent years. This is the first book for graduate students and researchers offering deep insight into this fascinating and fast developing area.

Hypergeometry, Integrability and Lie Theory Erik Koelink, Stefan Kolb, Nicolai Reshetikhin, Bart Vlaar, 2022-08-30 This volume contains the proceedings of the virtual conference on Hypergeometry Integrability and Lie Theory held from December 7-11 2020 which was dedicated to the 50th birthday of Jasper Stokman. The papers represent recent developments in the areas of representation theory quantum integrable systems and special functions of hypergeometric type. *Fitting Smooth Functions to Data* Charles Fefferman, Arie Israel, 2020-10-27 This book is an introductory text that charts the recent developments in the area of Whitney type extension problems and the mathematical aspects of interpolation of data. It provides a detailed tour of a new and active area of mathematical research. In each section the authors focus on a different key insight in the theory. The book motivates the more technical aspects of the theory through a set of illustrative examples. The results include the solution of Whitney's problem an efficient algorithm for a finite version and analogues for Hölder and Sobolev spaces in place of C_m . The target audience consists of graduate students and junior faculty in mathematics and computer science who are familiar with point set topology as well as measure and integration theory. The book is based on lectures presented at the CBMS regional workshop held at the University of Texas at Austin in the summer of 2019.

Lectures on Field Theory and Topology Daniel S. Freed, 2019-08-23 These lectures recount an application of stable homotopy theory to a concrete problem in low energy physics the classification of special phases of matter. While the joint work of the author and Michael Hopkins is a focal point a general geometric frame of reference on quantum field theory is emphasized. Early lectures describe the geometric axiom systems introduced by Graeme Segal and Michael Atiyah in the late 1980s as well as subsequent extensions. This material provides an entry point for mathematicians to delve into quantum field theory. Classification theorems in low dimensions are proved to illustrate the framework. The later lectures turn to more specialized topics in field theory including the relationship between invertible field theories and stable homotopy theory extended unitarity anomalies and relativistic free fermion systems. The accompanying mathematical explanations touch upon higher category theory duals to the sphere spectrum equivariant spectra differential cohomology and Dirac operators. The

outcome of computations made using the Adams spectral sequence is presented and compared to results in the condensed matter literature obtained by very different means The general perspectives and specific applications fuse into a compelling story at the interface of contemporary mathematics and theoretical physics

Analysis of Stochastic Partial Differential Equations Davar Khoshnevisan, 2014-06-11 The general area of stochastic PDEs is interesting to mathematicians because it contains an enormous number of challenging open problems There is also a great deal of interest in this topic because it has deep applications in disciplines that range from applied mathematics statistical mechanics and theoretical physics to theoretical neuroscience theory of complex chemical reactions including polymer science fluid dynamics and mathematical finance The stochastic PDEs that are studied in this book are similar to the familiar PDE for heat in a thin rod but with the additional restriction that the external forcing density is a two parameter stochastic process or what is more commonly the case the forcing is a random noise also known as a generalized random field At several points in the lectures there are examples that highlight the phenomenon that stochastic PDEs are not a subset of PDEs In fact the introduction of noise in some partial differential equations can bring about not a small perturbation but truly fundamental changes to the system that the underlying PDE is attempting to describe The topics covered include a brief introduction to the stochastic heat equation structure theory for the linear stochastic heat equation and an in depth look at intermittency properties of the solution to semilinear stochastic heat equations Specific topics include stochastic integrals la Norbert Wiener an infinite dimensional It type stochastic integral an example of a parabolic Anderson model and intermittency fronts There are many possible approaches to stochastic PDEs The selection of topics and techniques presented here are informed by the guiding example of the stochastic heat equation A co publication of the AMS and CBMS

Nonlinear Dispersive Equations Terence Tao, 2006 Starting only with a basic knowledge of graduate real analysis and Fourier analysis the text first presents basic nonlinear tools such as the bootstrap method and perturbation theory in the simpler context of nonlinear ODE then introduces the harmonic analysis and geometric tools used to control linear dispersive PDE These methods are then combined to study four model nonlinear dispersive equations Through extensive exercises diagrams and informal discussion the book gives a rigorous theoretical treatment of the material the real world intuition and heuristics that underlie the subject as well as mentioning connections with other areas of PDE harmonic analysis and dynamical systems

Asymptotics of Random Matrices and Related Models: The Uses of Dyson-Schwinger Equations Alice Guionnet, 2019-04-29 Probability theory is based on the notion of independence The celebrated law of large numbers and the central limit theorem describe the asymptotics of the sum of independent variables However there are many models of strongly correlated random variables for instance the eigenvalues of random matrices or the tiles in random tilings Classical tools of probability theory are useless to study such models These lecture notes describe a general strategy to study the fluctuations of strongly interacting random variables This strategy is based on the asymptotic analysis of Dyson-Schwinger or loop equations the author will show how

these equations are derived how to obtain the concentration of measure estimates required to study these equations asymptotically and how to deduce from this analysis the global fluctuations of the model The author will apply this strategy in different settings eigenvalues of random matrices matrix models with one or several cuts random tilings and several matrices models

Introduction to the Theory of Valuations Semyon Alesker, 2018-06-27 Theory of valuations on convex sets is a classical part of convex geometry which goes back at least to the positive solution of the third Hilbert problem by M Dehn in 1900 Since then the theory has undergone a multifaceted development The author discusses some of Hadwiger s results on valuations on convex compact sets that are continuous in the Hausdorff metric The book also discusses the Klain Schneider theorem as well as the proof of McMullen s conjecture which led subsequently to many further applications and advances in the theory The last section gives an overview of more recent developments in the theory of translation invariant continuous valuations some of which turn out to be useful in integral geometry This book grew out of lectures that were given in August 2015 at Kent State University in the framework of the NSF CBMS conference Introduction to the Theory of Valuations on Convex Sets Only a basic background in general convexity is assumed

Tensors: Asymptotic Geometry and Developments 2016-2018 J.M. Landsberg, 2019-07-05 Tensors are used throughout the sciences especially in solid state physics and quantum information theory This book brings a geometric perspective to the use of tensors in these areas It begins with an introduction to the geometry of tensors and provides geometric expositions of the basics of quantum information theory Strassen s laser method for matrix multiplication and moment maps in algebraic geometry It also details several exciting recent developments regarding tensors in general In particular it discusses and explains the following material previously only available in the original research papers 1 Shitov s 2017 refutation of longstanding conjectures of Strassen on rank additivity and Common on symmetric rank 2 The 2017 Christandl Vrana Zuiddam quantum spectral points that bring together quantum information theory the asymptotic geometry of tensors matrix multiplication complexity and moment polytopes in geometric invariant theory 3 the use of representation theory in quantum information theory including the solution of the quantum marginal problem 4 the use of tensor network states in solid state physics and 5 recent geometric paths towards upper bounds for the complexity of matrix multiplication Numerous open problems appropriate for graduate students and post docs are included throughout

Rudiments of Ramsey Theory Ron Graham, Steve Butler, 2015-10-01 In every sufficiently large structure which has been partitioned there will always be some well behaved structure in one of the parts This takes many forms For example colorings of the integers by finitely many colors must have long monochromatic arithmetic progressions van der Waerden s theorem and colorings of the edges of large graphs must have monochromatic subgraphs of a specified type Ramsey s theorem This book explores many of the basic results and variations of this theory Since the first edition of this book there have been many advances in this field In the second edition the authors update the exposition to reflect the current state of the art They also include many pointers to modern results A

co publication of the AMS and CBMS Applications of Polynomial Systems David A. Cox, 2020-03-02 Systems of polynomial equations can be used to model an astonishing variety of phenomena This book explores the geometry and algebra of such systems and includes numerous applications The book begins with elimination theory from Newton to the twenty first century and then discusses the interaction between algebraic geometry and numerical computations a subject now called numerical algebraic geometry The final three chapters discuss applications to geometric modeling rigidity theory and chemical reaction networks in detail Each chapter ends with a section written by a leading expert Examples in the book include oil wells HIV infection phylogenetic models four bar mechanisms border rank font design Stewart Gough platforms rigidity of edge graphs Gaussian graphical models geometric constraint systems and enzymatic cascades The reader will encounter geometric objects such as Bzier patches Cayley Menger varieties and toric varieties and algebraic objects such as resultants Rees algebras approximation complexes matroids and toric ideals Two important subthemes that appear in multiple chapters are toric varieties and algebraic statistics The book also discusses the history of elimination theory including its near elimination in the middle of the twentieth century The main goal is to inspire the reader to learn about the topics covered in the book With this in mind the book has an extensive bibliography containing over 350 books and papers *Arithmetic and Geometry Around Hypergeometric Functions* Rolf-Peter Holzapfel, Muhammed Uludag, M. Yoshida, 2007-06-28 This volume comprises lecture notes survey and research articles originating from the CIMPA Summer School Arithmetic and Geometry around Hypergeometric Functions held at Galatasaray University Istanbul June 13 25 2005 It covers a wide range of topics related to hypergeometric functions thus giving a broad perspective of the state of the art in the field **From the Basic Homotopy Lemma to the Classification of C^* -algebras** Huaxin Lin, 2017-08-11 This book examines some recent developments in the theory of algebras which are algebras of operators on Hilbert spaces An elementary introduction to the technical part of the theory is given via a basic homotopy lemma concerning a pair of almost commuting unitaries The book presents an outline of the background as well as some recent results of the classification of simple amenable algebras otherwise known as the Elliott program This includes some stable uniqueness theorems and a revisiting of Bott maps via stable homotopy Furthermore theory related rotation maps are introduced The book is based on lecture notes from the CBMS lecture sequence at the University of Wyoming in the summer of 2015

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