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KEY=MICHITAKE - MELINA JENNINGS

THEORY OF HYPERGEOMETRIC FUNCTIONS

Springer Science & Business Media This book presents a geometric theory of complex analytic integrals representing hypergeometric functions of several variables. Starting from an integrand which is a product of powers of polynomials, integrals are explained, in an open affine space, as a pair of twisted de Rham cohomology and its dual over the coefficients of local system. It is shown that hypergeometric integrals generally satisfy a holonomic system of linear differential equations with respect to the coefficients of polynomials and also satisfy a holonomic system of linear difference equations with respect to the exponents. These are deduced from Grothendieck-Deligne’s rational de Rham cohomology on the one hand, and by multidimensional extension of Birkhoff’s classical theory on analytic difference equations on the other.

HESSIAN POLYHEDRA, INVARIANT THEORY AND APPELL HYPERGEOMETRIC FUNCTIONS

World Scientific Our book gives the complex counterpart of Klein's classic book on the icosahedron. We show that the following four apparently disjoint theories: the symmetries of the Hessian polyhedra (geometry), the resolution of some system of algebraic equations (algebra), the system of partial differential equations of Appell hypergeometric functions (analysis) and the modular equation of Picard modular functions (arithmetic) are in fact dominated by the structure of a single object, the Hessian group □′216. It provides another beautiful example on the fundamental unity of mathematics.

PERSPECTIVES IN LIE THEORY

Springer Lie theory is a mathematical framework for encoding the concept of symmetries of a problem, and was the central theme of an INdAM intensive research period at the Centro de Giorgi in Pisa, Italy, in the academic year 2014-2015. This book gathers the key outcomes of this period, addressing topics such as: structure and representation theory of vertex algebras, Lie algebras and superalgebras, as well as hyperplane arrangements with different approaches, ranging from geometry and topology to combinatorics.

ASPECTS OF SCATTERING AMPLITUDES AND MODULI SPACE LOCALIZATION

Springer Nature This thesis proposes a new perspective on scattering amplitudes in quantum field theories. Their standard formulation in terms of sums over Feynman diagrams is replaced by a computation of geometric invariants, called intersection numbers, on moduli spaces of Riemann surfaces. It therefore gives a physical interpretation of intersection

numbers, which have been extensively studied in the mathematics literature in the context of generalized hypergeometric functions. This book explores physical consequences of this formulation, such as recursion relations, connections to geometry and string theory, as well as a phenomenon called moduli space localization. After reviewing necessary mathematical background, including topology of moduli spaces of Riemann spheres with punctures and its fundamental group, the definition and properties of intersection numbers are presented. A comprehensive list of applications and relations to other objects is given, including those to scattering amplitudes in open- and closed-string theories. The highlights of the thesis are the results regarding localization properties of intersection numbers in two opposite limits: in the low- and the high-energy expansion. In order to facilitate efficient computations of intersection numbers the author introduces recursion relations that exploit fibration properties of the moduli space. These are formulated in terms of so-called braid matrices that encode the information of how points braid around each other on the corresponding Riemann surface. Numerous application of this approach are presented for computation of scattering amplitudes in various gauge and gravity theories. This book comes with an extensive appendix that gives a pedagogical introduction to the topic of homologies with coefficients in a local system.

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.

ELLIPTIC QUANTUM GROUPS

REPRESENTATIONS AND RELATED GEOMETRY

Springer Nature This is the first book on elliptic quantum groups, i.e., quantum groups associated to elliptic solutions of the Yang-Baxter equation. Based on research by the author and his collaborators, the book presents a comprehensive survey on the subject including a brief history of formulations and applications, a detailed formulation of the elliptic quantum group in the Drinfeld realization, explicit construction of both finite and infinite-dimensional representations, and a construction of the vertex operators as intertwining operators of these representations. The vertex operators are important objects in representation theory of quantum groups. In this book, they are used to derive the elliptic q-KZ equations and their elliptic hypergeometric integral solutions. In particular, the so-called elliptic weight functions appear in such solutions. The author’s recent study showed that these elliptic weight functions are identified with Okounkov’s elliptic stable envelopes for certain equivariant elliptic cohomology and play an important role to construct geometric representations of elliptic quantum groups. Okounkov’s geometric approach to quantum integrable systems is a rapidly growing topic in mathematical physics related to the Bethe ansatz, the Alday-Gaiotto-Tachikawa correspondence between 4D SUSY gauge theories and the CFT’s, and the Nekrasov-Shatashvili correspondences between quantum integrable systems and quantum cohomology. To invite the reader to such topics is one of the aims of this book.

APPROXIMATION THEORY AND HARMONIC ANALYSIS ON SPHERES AND BALLS

Springer Science & Business Media This monograph records progress in approximation theory and harmonic analysis on balls and spheres, and presents contemporary material that will be useful to analysts in this area. While the first part of the book contains mainstream material on the subject, the second and the third parts deal with more specialized topics, such as analysis in weight spaces with reflection invariant weight functions, and analysis on balls and simplexes. The last part of the book features several applications, including cubature formulas, distribution of points on the sphere, and the reconstruction algorithm in computerized tomography. This book is directed at researchers and advanced graduate students in analysis. Mathematicians who are familiar with Fourier analysis and harmonic analysis will understand many of the concepts that appear in this manuscript: spherical harmonics, the Hardy-Littlewood maximal function, the Marcinkiewicz multiplier theorem, the Riesz transform, and doubling weights are all familiar tools to researchers in this area.

2017 MATRIX ANNALS

Springer MATRIX is Australia’s international and residential mathematical research institute. It facilitates new collaborations and mathematical advances through intensive residential research programs, each 1-4 weeks in duration. This book is a scientific record of the eight programs held at MATRIX in its second year, 2017: - Hypergeometric Motives and Calabi–Yau Differential Equations - Computational Inverse Problems - Integrability in Low-Dimensional Quantum Systems - Elliptic Partial Differential Equations of Second Order: Celebrating 40 Years of Gilbarg and Trudinger’s Book - Combinatorics, Statistical Mechanics, and Conformal Field Theory - Mathematics of Risk - Tutte Centenary Retreat - Geometric R-Matrices: from Geometry to Probability The articles are grouped into peer-reviewed contributions and other contributions. The peer-reviewed articles present original results or reviews on a topic related to the MATRIX program; the remaining contributions are predominantly lecture notes or short articles based on talks or activities at MATRIX.

HYPERGEOMETRY, INTEGRABILITY AND LIE THEORY

American Mathematical Soc. 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.

HYPERGEOMETRIC ORTHOGONAL POLYNOMIALS AND THEIR Q-ANALOGUES

Springer Science & Business Media The present book is about the Askey scheme and the q-Askey scheme, which are graphically displayed right before chapter 9 and chapter 14, respectively. The fa- lies of orthogonal polynomials in these two schemes generalize the classical orth- onal polynomials (Jacobi, Laguerre and Hermite polynomials) and they have pr- erties similar to them. In fact, they have properties so similar that I am inclined (f- lowing Andrews & Askey [34]) to call all families in the (q-)Askey scheme classical orthogonal polynomials, and to call the Jacobi, Laguerre and Hermite polynomials very classical orthogonal polynomials. These very classical orthogonal polynomials are good friends of mine since - most the beginning of my mathematical career. When I was a fresh PhD student at the Mathematical Centre (now CWI) in Amsterdam, Dick Askey spent a sabbatical there during the academic year 1969–1970. He lectured to us in a very stimulating wayabouthypergeometricfunctionsandclassicalorthogonalpolynomials. Evenb- ter, he gave us problems to solve which might be worth a PhD. He also pointed out to us that there was more than just Jacobi, Laguerre and Hermite polynomials, for instance Hahn polynomials, and that it was one of the merits of the Higher Transc- dental Functions (Bateman project) that it included some newer stuff like the Hahn polynomials (see [198, §10. 23]).

NOVEL ELECTRONIC STRUCTURE THEORY: GENERAL INNOVATIONS AND STRONGLY CORRELATED SYSTEMS

Academic Press Novel Electronic Structure Theory: General Innovations and Strongly Correlated Systems, Volume 76, the latest release in the Advances in Quantum Chemistry series presents work and reviews of current work in quantum chemistry (molecules), but also includes scattering from atoms and solid state work of interest in physics. Topics covered in this release include the Present Status of Selected Configuration Interaction with Truncation Energy Error, Recent Developments in Asymptotic Expansions from Numerical Analysis and Approximation Theory, The kinetic energy Pauli enhancement factor and its role in determining the shell structure of atoms and molecules, Numerical Hartree-Fock and Many-Body Calculations for Diatomic Molecules, and more. Provides reports on current work in molecular and atomic quantum mechanics Contains work reported by many of the best scientists in the field Presents the latest release in the Advances in Quantum Chemistry series

HYPERGEOMETRIC SUMMATION

AN ALGORITHMIC APPROACH TO SUMMATION AND SPECIAL FUNCTION IDENTITIES

Springer Modern algorithmic techniques for summation, most of which were introduced in the 1990s, are developed here and carefully implemented in the computer algebra system MapleTM. The algorithms of Fasenmyer, Gosper, Zeilberger, Petkovšek and van Hoeij for hypergeometric summation and recurrence equations, efficient multivariate summation as well as q-analogues of the above algorithms are covered. Similar algorithms concerning differential equations are considered. An equivalent theory of hyperexponential integration due to Almkvist and Zeilberger completes the book. The combination of these results gives orthogonal polynomials and (hypergeometric and q-hypergeometric) special functions a solid algorithmic foundation. Hence, many examples from this very active field are given. The materials covered are suitable for an introductory course on algorithmic summation and will appeal to students and researchers alike.

BASIC THEORY

Walter de Gruyter GmbH & Co KG This multi-volume handbook is the most up-to-date and comprehensive reference work in the field of fractional calculus and its numerous applications. This first volume collects authoritative chapters covering the mathematical theory of fractional calculus, including fractional-order operators, integral transforms and equations, special functions, calculus of variations, and probabilistic and other aspects.

COMPUTER ALGEBRA IN QUANTUM FIELD THEORY

INTEGRATION, SUMMATION AND SPECIAL FUNCTIONS

Springer Science & Business Media The book focuses on advanced computer algebra methods and special functions that have striking applications in the context of quantum field theory. It presents the state of the art and new methods for (infinite) multiple sums, multiple integrals, in particular Feynman integrals, difference and differential equations in the format of survey articles. The presented techniques emerge from interdisciplinary fields: mathematics, computer science and theoretical physics; the articles are written by mathematicians and physicists with the goal that both groups can learn from the other field, including most recent developments. Besides that, the collection of articles also serves as an up-to-date handbook of available algorithms/software that are commonly used or might be useful in the fields of mathematics, physics or other sciences.

METAHEURISTIC AND EVOLUTIONARY COMPUTATION: ALGORITHMS AND APPLICATIONS

Springer Nature This book addresses the principles and applications of metaheuristic approaches in engineering and related fields. The first part covers metaheuristics tools and techniques such as ant colony optimization and Tabu search, and their applications to several classes of optimization problems. In turn, the book's second part focuses on a wide variety of metaheuristics applications in engineering and/or the applied sciences, e.g. in smart grids and renewable energy. In addition, the simulation codes for the problems discussed are included in an appendix for ready reference. Intended for researchers aspiring to learn and apply metaheuristic techniques, and gathering contributions by prominent experts in the field, the book offers readers an essential introduction to metaheuristics, its theoretical aspects and applications.

ANTI-DIFFERENTIATION AND THE CALCULATION OF FEYNMAN AMPLITUDES

Springer Nature This volume comprises review papers presented at the Conference on Antidifferentiation and the Calculation of Feynman Amplitudes, held in Zeuthen, Germany, in October 2020, and a few additional invited reviews. The book aims at comprehensive surveys and new innovative results of the analytic integration methods of Feynman integrals in quantum field theory. These methods are closely related to the field of special functions and their function spaces, the theory of differential equations and summation theory. Almost all of these algorithms have a strong basis in computer algebra. The solution of the corresponding problems are connected to the analytic management of large data in the range of Giga- to Terabytes. The methods are widely applicable to quite a series of other branches of mathematics and theoretical physics.

POSITIVITY AND NONCOMMUTATIVE ANALYSIS

FESTSCHRIFT IN HONOUR OF BEN DE PAGTER ON THE OCCASION OF HIS 65TH BIRTHDAY

Springer Capturing the state of the art of the interplay between positivity, noncommutative analysis, and related areas including partial differential equations, harmonic analysis, and operator theory, this volume was initiated on the occasion of the Delft conference in honour of Ben de Pagter's 65th birthday. It will be of interest to researchers in positivity, noncommutative analysis, and related fields. Contributions by Shavkat Ayupov, Amine Ben Amor, Karim Boulabiar, Qingying Bu, Gerard Buskes, Martijn Caspers, Jurie Conradie, Garth Dales, Marcel de Jeu, Peter Dodds, Theresa Dodds, Julio Flores, Jochen Glück, Jacobus Grobler, Wolter Groenevelt, Markus Haase, Klaas Pieter Hart, Francisco Hernández, Jamel Jaber, Rien Kaashoek, Turabay Kalandarov, Anke Kalauch, Arkady Kitover, Erik Koelink, Karimbergen Kudaybergenov, Louis Labuschagne, Yongjin Li, Nick Lindemulder, Emiel Lorist, Qi Lü, Miek Messerschmidt, Susumu Okada, Mehmet Orhon, Denis Potapov, Werner Ricker, Stephan Roberts, Pablo Román, Anton Schep, Claud Steyn, Fedor Sukochev, James Sweeney, Guido Sweers, Pedro Tradacete, Jan Harm van der Walt, Onno van Gaans, Jan van Neerven, Arnoud van Rooij, Freek van Schagen, Dominic Vella, Mark Veraar, Anthony Wickstead, Marten Wortel, Ivan Yaroslavtsev, and Dmitriy Zanin.

USE OF MATHEMATICAL LITERATURE

INFORMATION SOURCES FOR RESEARCH AND DEVELOPMENT

Butterworth-Heinemann Use of Mathematical Literature discusses the bibliographic concerns of mathematical literature. The book is comprised of 14 chapters that cover characteristics of mathematical literature and provide reviews of some of the major literature in various mathematical fields. The text first discusses the role of the literature in mathematics, and then proceeds to tackling major organizations, journals, and reference materials. Next, the book provides critical accounts of the major literature in various mathematical fields, such as combinatorics, topology, and mathematical programming. The book will be of great use to students, practitioners, and researchers of mathematics. Other profession handling math literature, such as teachers, librarians, and translators will also find this book invaluable.

SECOND ORDER DIFFERENTIAL EQUATIONS

SPECIAL FUNCTIONS AND THEIR CLASSIFICATION

Springer Science & Business Media Second Order Differential Equations presents a classical piece of theory concerning hypergeometric special functions as solutions of second-order linear differential equations. The theory is presented in an entirely self-contained way, starting with an introduction of the solution of the second-order differential equations and then focusingon the systematic treatment and classification of these solutions. Each chapter contains a set of problems which help reinforce the theory. Some of the preliminaries are covered in appendices at the end of the book, one of which provides an introduction to Poincaré-Perron theory, and the appendix also contains a new way of analyzing the asymptomatic behavior of solutions of differential equations. This textbook is appropriate for advanced undergraduate and graduate students in Mathematics, Physics, and Engineering interested in Ordinary and Partial Differntial Equations. A solutions manual is available online.

RECENT TRENDS IN COMBINATORICS

Springer This volume presents some of the research topics discussed at the 2014-2015 Annual Thematic Program Discrete Structures: Analysis and Applications at the Institute for Mathematics and its Applications during Fall 2014, when combinatorics was the focus. Leading experts have written surveys of research problems, making state of the art results more conveniently and widely available. The three-part structure of the volume reflects the three workshops held during Fall 2014. In the first part, topics on extremal and probabilistic combinatorics are presented; part two focuses on additive and analytic combinatorics; and part three presents topics in geometric and enumerative combinatorics. This book will be of use to those who research combinatorics directly or apply combinatorial methods to other fields.

GRÖBNER DEFORMATIONS OF HYPERGEOMETRIC DIFFERENTIAL EQUATIONS

Springer Science & Business Media The theory of Gröbner bases is a main tool for dealing with rings of differential operators. This book reexamines the concept of Gröbner bases from the point of view of geometric deformations. The algorithmic methods introduced in this book are particularly useful for studying the systems of multidimensional hypergeometric PDE's introduced by Gelfand, Kapranov, and Zelevinsky. A number of original research results are contained in the book, and many open problems are raised for future research in this rapidly growing area of computational mathematics.

ENCYCLOPEDIA OF SPECIAL FUNCTIONS: THE ASKEY-BATEMAN PROJECT: VOLUME 2, MULTIVARIABLE SPECIAL FUNCTIONS

Cambridge University Press 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.

MITTAG-LEFFLER FUNCTIONS, RELATED TOPICS AND APPLICATIONS

Springer As a result of researchers' and scientists' increasing interest in pure as well as applied mathematics in non-conventional models, particularly those using fractional calculus, Mittag-Leffler functions have recently caught the interest of the scientific community. Focusing on the theory of the Mittag-Leffler functions, the present volume offers a self-contained, comprehensive treatment, ranging from rather elementary matters to the latest research results. In addition to the theory the authors devote some sections of the work to the applications, treating various situations and processes in viscoelasticity, physics, hydrodynamics, diffusion and wave phenomena, as well as stochastics. In particular the Mittag-Leffler functions allow us to describe phenomena in processes that progress or decay too slowly to be represented by classical functions like the exponential function and its successors. The book is intended for a broad audience, comprising graduate students, university instructors and scientists in the field of pure and applied mathematics, as well as researchers in applied sciences like mathematical physics, theoretical chemistry, bio-mathematics, theory of control and several other related areas.

ALGORITHMIC COMBINATORICS: ENUMERATIVE COMBINATORICS, SPECIAL FUNCTIONS AND COMPUTER ALGEBRA

IN HONOUR OF PETER PAULE ON HIS 60TH BIRTHDAY

Springer Nature The book is centered around the research areas of combinatorics, special functions, and computer algebra. What these research fields share is that many of their outstanding results do not only have applications in Mathematics, but also other disciplines, such as computer science, physics, chemistry, etc. A particular charm of these areas is how they interact and influence one another. For instance, combinatorial or special functions' techniques have motivated the development of new symbolic algorithms. In particular, first proofs of challenging problems in combinatorics and special functions were derived by making essential use of computer algebra. This book addresses these interdisciplinary aspects. Algorithmic aspects are emphasized and the corresponding software packages for concrete problem solving are introduced. Readers will range from graduate students, researchers to practitioners who are interested in solving concrete problems within mathematics and other research disciplines.

THETA CONSTANTS, RIEMANN SURFACES, AND THE MODULAR GROUP

AN INTRODUCTION WITH APPLICATIONS TO UNIFORMIZATION THEOREMS, PARTITION IDENTITIES, AND COMBINATORIAL NUMBER THEORY

American Mathematical Soc. There are incredibly rich connections between classical analysis and number theory. For instance, analytic number theory contains many examples of asymptotic expressions derived from estimates for analytic functions, such as in the proof of the Prime Number Theorem. In combinatorial number theory, exact formulas for number-theoretic quantities are derived from relations between analytic functions. Elliptic functions, especially theta functions, are an important class of such functions in this context, which had been made clear already in Jacobi's Fundamenta nova. Theta functions are also classically connected with Riemann surfaces and with the modular group $\Gamma = \mathrm{PSL}(2,\mathbb{Z})$, which provide another path for insights into number theory. Farkas and Kra, well-known masters of the theory of Riemann surfaces and the analysis of theta functions, uncover here interesting combinatorial identities by means of the function theory on Riemann surfaces related to the principal congruence subgroups $\Gamma(k)$. For instance, the authors use this approach to derive congruences discovered by Ramanujan for the partition function, with the main ingredient being the construction of the same function in more than one way. The authors also obtain a variant on Jacobi's famous result on the number of ways that an integer can be represented as a sum of four squares, replacing the squares by triangular numbers and, in the process, obtaining a cleaner result. The recent trend of applying the ideas and methods of algebraic geometry to the study of theta functions and number theory has resulted in great advances in the area. However, the authors choose to stay with the classical point of view. As a result, their statements and proofs are very concrete. In this book the mathematician familiar with the algebraic geometry approach to theta functions and number theory will find many interesting ideas as well as detailed explanations and derivations of new and old results. Highlights of the book include systematic studies of theta constant identities, uniformizations of surfaces represented by subgroups of the modular group, partition identities, and Fourier coefficients of automorphic functions. Prerequisites are a solid understanding of complex analysis, some familiarity with Riemann surfaces, Fuchsian groups, and elliptic functions, and an interest in number theory. The book contains summaries of some of the required material, particularly for theta functions and theta constants. Readers will find here a careful exposition of a classical point of view of analysis and number theory. Presented are numerous examples plus suggestions for research-level problems. The text is suitable for a graduate course or for independent reading.

A CONCRETE APPROACH TO CLASSICAL ANALYSIS

Springer Science & Business Media Mathematical analysis offers a solid basis for many achievements in applied mathematics and discrete mathematics. This new textbook is focused on differential and integral calculus, and includes a wealth of useful and relevant examples, exercises, and results enlightening the reader to the power of mathematical tools. The intended audience consists of advanced undergraduates studying mathematics or computer science. The author provides excursions from the standard topics to modern and exciting topics, to illustrate the fact that even first or second year students can understand certain research problems. The text has been divided into ten chapters and covers topics on sets and numbers, linear spaces and metric spaces, sequences and series of numbers and of functions, limits and continuity, differential and integral calculus of functions of one or several variables, constants (mainly pi) and algorithms for finding them, the W - Z method of summation, estimates of algorithms and of certain combinatorial problems. Many challenging exercises accompany the text. Most of them have been used to prepare for different mathematical competitions during the past few years. In this respect, the author has maintained a healthy balance of theory and exercises.

NIST HANDBOOK OF MATHEMATICAL FUNCTIONS

Cambridge University Press The new standard reference on mathematical functions, replacing the classic but outdated handbook from Abramowitz and Stegun. Includes PDF version.

INTRODUCTION TO COMPLEX ANALYSIS

American Mathematical Soc. In this text, the reader will learn that all the basic functions that arise in calculus—such as powers and fractional powers, exponentials and logs, trigonometric functions and their inverses, as well as many new functions that the reader will meet—are naturally defined for complex arguments. Furthermore, this expanded setting leads to a much richer understanding of such functions than one could glean by merely considering them in the real domain. For example, understanding the exponential function in the complex domain via its differential equation provides a clean path to Euler's formula and hence to a self-contained treatment of the trigonometric functions. Complex analysis, developed in partnership with Fourier analysis, differential equations, and geometrical techniques, leads to the development of a cornucopia of functions of use in number theory, wave motion, conformal mapping, and other mathematical phenomena, which the reader can learn about from material presented here. This book could serve for either a one-semester course or a two-semester course in complex analysis for beginning graduate students or for well-prepared undergraduates whose background includes multivariable calculus, linear algebra, and advanced calculus.

ORTHOGONAL POLYNOMIALS

2ND AIMS-VOLKSWAGEN STIFTUNG WORKSHOP, DOUALA, CAMEROON, 5-12 OCTOBER, 2018

Springer Nature This book presents contributions of international and local experts from the African Institute for Mathematical Sciences (AIMS-Cameroon) and also from other local universities in the domain of orthogonal polynomials and applications. The topics addressed range from univariate to multivariate orthogonal polynomials, from multiple orthogonal polynomials and random matrices to orthogonal polynomials and Painlevé equations. The contributions are based on lectures given at the AIMS-Volkswagen Stiftung Workshop on Introduction of Orthogonal Polynomials and Applications held on October 5–12, 2018 in Douala, Cameroon. This workshop, funded within the framework of the Volkswagen Foundation Initiative "Symposia and Summer Schools", was aimed globally at promoting capacity building in terms of research and training in orthogonal polynomials and applications, discussions and development of new ideas as well as development and enhancement of networking including south-south cooperation.

NUMERICAL ALGORITHMS FOR NUMBER THEORY: USING PARI/GP

American Mathematical Soc. This book presents multiprecision algorithms used in number theory and elsewhere, such as extrapolation, numerical integration, numerical summation (including multiple zeta values and the Riemann-Siegel formula), evaluation and speed of convergence of continued fractions, Euler products and Euler sums, inverse Mellin transforms, and complex L L-functions. For each task, many algorithms are presented, such as Gaussian and doubly-exponential integration, Euler-MacLaurin, Abel-Plana, Lagrange, and Monien summation. Each algorithm is given in detail, together with a complete implementation in the free Pari/GP system. These implementations serve both to make even more precise the inner workings of the algorithms, and to gently introduce advanced features of the Pari/GP language. This book will be appreciated by anyone interested in number

theory, specifically in practical implementations, computer experiments and numerical algorithms that can be scaled to produce thousands of digits of accuracy.

INTEGRAL TRANSFORMS AND OPERATIONAL CALCULUS

MDPI Researches and investigations involving the theory and applications of integral transforms and operational calculus are remarkably wide-spread in many diverse areas of the mathematical, physical, chemical, engineering and statistical sciences. This Special Issue contains a total of 36 carefully-selected and peer-reviewed articles which are authored by established researchers from many countries. Included in this Special Issue are review, expository and original research articles dealing with the recent advances on the topics of integral transforms and operational calculus as well as their multidisciplinary applications

WAVELET ANALYSIS ON THE SPHERE

SPHEROIDAL WAVELETS

Walter de Gruyter GmbH & Co KG The goal of this monograph is to develop the theory of wavelet harmonic analysis on the sphere. By starting with orthogonal polynomials and functional Hilbert spaces on the sphere, the foundations are laid for the study of spherical harmonics such as zonal functions. The book also discusses the construction of wavelet bases using special functions, especially Bessel, Hermite, Tchebychev, and Gegenbauer polynomials.

ANALYSIS ON H-HARMONICS AND DUNKL TRANSFORMS

Birkhäuser This book provides an introduction to h-harmonics and Dunkl transforms. These are extensions of the ordinary spherical harmonics and Fourier transforms, in which the usual Lebesgue measure is replaced by a reflection-invariant weighted measure. The authors' focus is on the analysis side of both h-harmonics and Dunkl transforms. Graduate students and researchers working in approximation theory, harmonic analysis, and functional analysis will benefit from this book.

ARITHMETIC AND GEOMETRY AROUND HYPERGEOMETRIC FUNCTIONS

LECTURE NOTES OF A CIMPA SUMMER SCHOOL HELD AT GALATASARAY UNIVERSITY, ISTANBUL, 2005

Springer Science & Business Media 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.

GEORGE E. ANDREWS 80 YEARS OF COMBINATORY ANALYSIS

Springer Nature This book presents a printed testimony for the fact that George Andrews, one of the world's leading experts in partitions and q-series for the last several decades, has passed the milestone age of 80. To honor George Andrews on this occasion, the conference "Combinatory Analysis 2018" was organized at the Pennsylvania State University from June 21 to 24, 2018. This volume comprises the original articles from the Special Issue "Combinatory Analysis 2018 – In Honor of George Andrews' 80th Birthday" resulting from the conference and published in Annals of Combinatorics. In addition to the 37 articles of the Andrews 80 Special Issue, the book includes two new papers. These research contributions explore new grounds and present new achievements, research trends, and problems in the area. The volume is complemented by three special personal contributions: "The Worlds of George Andrews, a daughter's take" by Amy Alznauer, "My association and collaboration with George Andrews" by Krishna Alladi, and "Ramanujan, his Lost Notebook, its importance" by Bruce Berndt. Another aspect which gives this Andrews volume a truly unique character is the "Photos" collection. In addition to pictures taken at "Combinatory Analysis 2018", the editors selected a variety of photos, many of them not available elsewhere: "Andrews in Austria", "Andrews in China", "Andrews in Florida", "Andrews in Illinois", and "Andrews in India". This volume will be of interest to researchers, PhD students, and interested practitioners working in the area of Combinatory Analysis, q-Series, and related fields.

COMPLEX DIFFERENTIAL AND DIFFERENCE EQUATIONS

PROCEEDINGS OF THE SCHOOL AND CONFERENCE HELD AT BĘDLEWO, POLAND, SEPTEMBER 2-15, 2018

Walter de Gruyter GmbH & Co KG With a balanced combination of longer survey articles and shorter, peer-reviewed research-level presentations on the topic of differential and difference equations on the complex domain, this edited volume presents an up-to-date overview of areas such as WKB analysis, summability, resurgence, formal solutions, integrability, and several algebraic aspects of differential and difference equations.

NEW TRENDS IN DIFFERENTIAL AND DIFFERENCE EQUATIONS AND APPLICATIONS

MDPI This Special Issue aims to be a compilation of new results in the areas of differential and difference Equations, covering boundary value problems, systems of differential and difference equations, as well as analytical and numerical methods. The objective is to provide an overview of techniques used in these different areas and to emphasize their applicability to real-life phenomena, by the inclusion of examples. These examples not only clarify the theoretical results presented, but also provide insight on how to apply, for future works, the techniques used.

AN INTRODUCTION TO BASIC FOURIER SERIES

Springer Science & Business Media It was with the publication of Norbert Wiener's book ''The Fourier In tegral and Certain of Its Applications" [165] in 1933 by Cambridge Univer sity Press that the mathematical community came to realize that there is an alternative approach to the study of c1assical Fourier Analysis, namely, through the theory of c1assical orthogonal polynomials. Little would he know at that time that this little idea of his would help usher in a new and exiting branch of c1assical analysis called q-Fourier Analysis. Attempts at finding q-analogs of Fourier and other related transforms were made by other authors, but it took the mathematical insight and instincts of none other then Richard Askey, the grand master of Special Functions and Orthogonal Polynomials, to see the natural connection between orthogonal polynomials and a systematic theory of q-Fourier Analysis. The paper that he wrote in 1993 with N. M. Atakishiyev and S. K Suslov, entitled "An Analog of the Fourier Transform for a q-Harmonic Oscillator" [13], was probably the first significant publication in this area. The Poisson k~rnel for the contin uous q-Hermite polynomials plays a role of the q-exponential function for the analog of the Fourier integral under considerationj see also [14] for an extension of the q-Fourier transform to the general case of Askey-Wilson polynomials. (Another important ingredient of the q-Fourier Analysis, that deserves thorough investigation, is the theory of q-Fourier series.

ALGEBRAIC GROUPS AND DIFFERENTIAL GALOIS THEORY

American Mathematical Soc. Differential Galois theory has seen intense research activity during the last decades in several directions: elaboration of more general theories, computational aspects, model theoretic approaches, applications to classical and quantum mechanics as well as to other mathematical areas such as number theory. This book intends to introduce the reader to this subject by presenting Picard-Vessiot theory, i.e. Galois theory of linear differential equations, in a self-contained way. The needed prerequisites from algebraic geometry and algebraic groups are contained in the first two parts of the book. The third part includes Picard-Vessiot extensions, the fundamental theorem of Picard-Vessiot theory, solvability by quadratures, Fuchsian equations, monodromy group and Kovacic's algorithm. Over one hundred exercises will help to assimilate the concepts and to introduce the reader to some topics beyond the scope of this book. This book is suitable for a graduate course in differential Galois theory. The last chapter contains several suggestions for further reading encouraging the reader to enter more deeply into different topics of differential Galois theory or related fields.

SPECIAL FUNCTIONS

Cambridge University Press An overview of special functions, focusing on the hypergeometric functions and the associated hypergeometric series.