Hypergeometric Summation An Algorithmic Approach To Summation And Special Function Identities Universitext

This volume presents the proceedings of the Joint Summer Research Conference on q-series, combinatorics, and computer algebra held at Mount Holyoke College (South Hadley, MA). All of the papers were contributed by participants and offer original research on topics of current interest. Articles in the book reflect the diversity of areas that overlap with q-series, as well as the usefulness of q-series across the mathematical sciences. The conference was held in honor of Richard Askey on the occasion of his 65th birthday and the proceedings contain an article about Askey's contributions to special functions.

This book discusses the latest advances in algorithms for symbolic summation, factorization, symbolic-numeric linear algebra and linear functional equations. It presents a collection of papers on original research topics from the Waterloo Workshop on Computer Algebra (WWCA-2016), a satellite workshop of the International Symposium on Symbolic and Algebraic Computation (ISSAC'2016), which was held at Wilfrid Laurier University (Waterloo, Ontario, Canada) on July 23–24, 2016. This workshop and the resulting book celebrate the 70th birthday of Sergei Abramov (Dorodnicyn Computing Centre of the Russian Academy of Sciences, Moscow), whose highly regarded and inspirational contributions to symbolic methods have become a crucial benchmark of computer algebra and have been broadly adopted by many Computer Algebra systems.

This issue is a continuation of the previous successful Special Issue "Mathematical Analysis and Applications" . Investigations involving the theory and applications of mathematical analytical tools and techniques are remarkably widespread in many diverse areas of the mathematical, physical, chemical, engineering and statistical sciences. In this Special Issue, we invite and welcome review, expository and original research articles dealing with the recent advances in mathematical analysis and its multidisciplinary applications.

Este libro es un manual especializado sobre la modelización matemática de la evolución de los activos y productos financieros, su valoración y la gestión del riesgo asociado a los mismos. Además de abordar la componente teórica de los conceptos anteriores, en el libro se proponen soluciones numéricas a los problemas más comunes a los que se enfrentan las instituciones financieras en su día a día. Los distintos capítulos del libro vienen acompañados de ejercicios y los códigos en Python y Matlab para generar la mayoría de resultados que se muestran en las tablas y en las figuras. En la página web (https://quantfinancebook.com/) y en el canal de YouTube Computations in Finance (https://youtube.com/ComputationsInFinance), se proporcionan otros recursos tales como ejercicios resueltos y cursos online basados en los contenidos del libro. El libro comienza con un repaso de conceptos estadísticos básicos y con la introducción al modelado de activos financieros, continuando con un incremento gradual de la complejidad de los modelos presentados, hasta llegar a los modelos más avanzados que se utilizan actualmente en la industria bancaria. Por ello, este manual es perfecto para introducirse en el mundo de las finanzas cuantitativas, como libro de referencia para cursos universitarios de grado y máster dedicados a esta temática o como texto de consulta para profesionales quants.

This Handbook gives a comprehensive snapshot of a field at the intersection of mathematics and computer science with applications in physics, engineering and education. Reviews 67 software systems and offers 100 pages on applications in physics, mathematics, computer science, engineering chemistry and education.

An Introduction to Hypergeometric, Supertigonometric, and Superhyperbolic Functions gives a basic introduction to the newly established hypergeometric, supertrigonometric, and superhyperbolic functions from the special functions viewpoint. The special functions, such as the Euler Gamma function, the Euler Beta function, the Clausen hypergeometric series, and the Gauss hypergeometric have been successfully applied to describe the real-world phenomena that involve complex behaviors arising in mathematics, physics, chemistry, and engineering. Presents a collection of the most up-to-date research, providing a complete overview of Multi-Objective Combinatorial Optimization problems and applications Includes a logical investigation of a family of the hypergeometric series Provides an historical overview for a family of the special polynomials Proposes a family of the hypergeometric supertrigonometric functions Covers a family of the hypergeometric superhyperbolic functions

Noncommutative algebras, rings and other noncommutative objects, along with their more classical commutative counterparts, have become a key part of modern mathematics, physics and many other fields. The q-deformed Heisenberg algebras defined by deformed Heisenberg canonical commutation relations of quantum mechanics play a distinguished role as important objects in pure mathematics and in many applications in physics. The structure of commuting elements in an algebra is of fundamental importance for its structure and representation theory as well as for its applications. The main objects studied in this monograph are q-deformed Heisenberg algebras — more specifically, commuting elements in q-deformed Heisenberg algebras. In this book the structure of commuting elements in q-deformed Heisenberg algebras is studied in a systematic way. Many new results are presented with complete proofs. Several appendices with some general theory used in other parts of the book include material on the Diamond lemma for ring theory, a theory of degree functions in arbitrary associative algebras, and some basic facts about q-combinatorial functions over an arbitrary field. The bibliography contains, in addition to references on q-deformed Heisenberg algebras, some selected references on related subjects and on existing and potential applications. The book is self-contained, as far as proofs and the background material are concerned. In addition to research and reference purposes, it can be used in a special course or a series of lectures on the subject or as complementary material to a general course on algebra. Specialists as well as doctoral and advanced undergraduate students in mathematics and physics will find this book useful in their research and study. Contents:Immediate Consequences of the Commutation RelationsBases and Normal Form in H(q) and H(q,J)Degree in and

Gradation of H(q,J)Centralisers of Elements in H(q,J)Centralisers of Elements in H(q)Algebraic Dependence of Commuting Elements in H(q) and H(q,J)Representations of H(q,J) by q-Difference OperatorsThe Diamond LemmaDegree Functions and Gradationsq-Special Combinatorics Readership: Researchers, graduate students and undergraduates in algebra and physics. Keywords:q-Deformed Heisenberg Algebras;Normal Form;Gradation;Commuting Elements;q-Difference Operators;Centraliser;Diamond Lemma;Graded Algebras;q-CombinatoricsReviews:"The exposition is very detailed and the book may serve both as a text for researchers interested in the theory of quantum deformations and as an introductory text for beginners."Mathematical Reviews "The book has an extended list of references (410 items). The exposition is self-contained and may be very useful both to specialists and doctoral or advanced undergraduate students."Romanian Journal of Pure and Applied Mathematics "… this is a very elementary and full of detail book, which some beginners in the theory of quantum deformations can find interesting and useful to dip into for calculations or to learn about the Diamond Lemma, gradation or q-calculus."Mathematics Abstracts

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'.

Significant revision of classic reference in special functions.

This book describes the key theoretical techniques for semiconductor research to quantitatively calculate and simulate the properties. It presents particular techniques to study novel semiconductor materials, such as 2D heterostructures, quantum wires, quantum dots and nitrogen containing III-V alloys. The book is aimed primarily at newcomers working in the field of semiconductor physics to give guidance in theory and experiment. The theoretical techniques for electronic and optoelectronic devices are explained in detail.

Algebra, as we know it today, consists of many different ideas, concepts and results. A reasonable estimate of the number of these different items would be somewhere between 50,000 and 200,000. Many of these have been named and many more could (and perhaps should) have a name or a convenient designation. Even the nonspecialist is likely to encounter most of these, either somewhere in the literature, disguised as a definition or a theorem or to hear about them and feel the need for more information. If this happens, one should be able to find enough information in this Handbook to judge if it is worthwhile to pursue the quest. In addition to the primary information given in the Handbook, there are references to relevant articles, books or lecture notes to help the reader. An excellent index has been included which is extensive and not limited to definitions, theorems etc. The Handbook of Algebra will publish articles as they are received and thus the reader will find in this third volume articles from twelve different sections. The advantages of this scheme are two-fold: accepted articles will be published quickly and the outline of the Handbook can be allowed to evolve as the various volumes are published. A particularly important function of the Handbook is to provide professional mathematicians working in an area other than their own with sufficient information on the topic in question if and when it is needed. - Thorough and practical source of information - Provides in-depth coverage of new topics in algebra - Includes references to relevant articles, books and lecture notes

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.

This book is a printed edition of the Special Issue "Mathematical Analysis and Applications" that was published in Axioms

Besides the investigation of general chains the book contains chapters which are concerned with eigenvalue techniques, conductance, stopping times, the strong Markov property, couplings, strong uniform times, Markov chains on arbitrary finite groups (including a crash-course in harmonic analysis), random generation and counting, Markov random fields, Gibbs fields, the Metropolis sampler, and simulated annealing. With 170 exercises.

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.

In this paper, the author presents a new method for finding identities for hypergeoemtric series, such as the (Gauss) hypergeometric series, the generalized hypergeometric series and the Appell-Lauricella hypergeometric series. Furthermore, using this method, the author gets identities for the hypergeometric series and shows that values of at some points can be expressed in terms of gamma functions, together with certain elementary functions. The author tabulates the values of that can be obtained with this method and finds that this set includes almost all previously known values and many previously unknown values.

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. (308 Pages). This book is written to provide an easy to follow study on the subject of Special Functions and Orthogonal Polynomials. It is written in such a way that it can be used as a self study text. Basic knowledge of calculus and differential equations is needed. The book is intended to help students in engineering, physics and applied sciences understand various aspects of Special Functions and Orthogonal Polynomials that very often occur in engineering, physics, mathematics and applied sciences. The book is organized in chapters that are in a sense self contained. Chapter 1 deals with series solutions of Differential Equations. Gamma and Beta functions are studied in Chapter 2 together with other functions that are defined by integrals. Legendre Polynomials and Functions are studied in Chapter 3. Chapters 4 and 5 deal with Hermite, Laguerre and other Orthogonal Polynomials. A detailed treatise of Bessel Function in given in Chapter 6.

"This book collects in one volume the author's considerable results in the area of the summation of series and their representation in closed form, and details the techniques by which they have been obtained... the calculations are given in plenty of detail, and closely related work which has appeared in a variety of places is conveniently collected together." --The Australian Mathematical Society Gazette 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.

This book brings together two streams of computer algebra: symbolic summation and integration on the one hand, and fast algorithmics on the other hand. In symbolic integration and summation, not too many algorithms with analyzed run times are known, and until now the mathematically oriented world of integration and summation and the computer science world of algorithm analysis have not had much to say to each other. The progress presented in this work towards overcoming this situation is threefold: - a clear framework for algorithm analysis with the appropriate parameters is provided, - modular algorithmic techniques are introduced in this area, and - almost optimal algorithms are presented for the basic problems.

These proceedings reflect the special session on Experimental Mathematics held January 5, 2009, at the Joint Mathematics Meetings in Washington, DC as well as some papers specially solicited for this volume. Experimental Mathematics is a recently structured field of Mathematics that uses the computer and advanced computing technology as a tool to perform experiments. These include the analysis of examples, testing of new ideas, and the search of patterns to suggest results and to complement existing analytical rigor. The development of a broad spectrum of mathematical software products, such as Mathematica® and Maple™ has allowed mathematicians of diverse backgrounds and interests to use the computer as an essential tool as part of their daily work environment. This volume reflects a wide range of topics related to the young field of Experimental Mathematics. The use of computation varies from aiming to exclude human input in the solution of a problem to traditional mathematical questions for which computation is a prominent tool.

Comprehensive account of theory and applications of Gröbner bases, co-edited by the subject's inventor.

This book is of interest to mathematicians and computer scientists working in finite mathematics and combinatorics. It presents a breakthrough method for analyzing complex summations. Beautifully written, the book contains practical applications as well as conceptual developments that will have applications in other areas of mathematics. From the table of contents: * Proof Machines * Tightening the Target * The Hypergeometric Database * The Five Basic Algorithms: Sister Celine's Method, Gosper&'s Algorithm, Zeilberger's Algorithm, The WZ Phenomenon, Algorithm Hyper * Epilogue: An Operator Algebra Viewpoint * The WWW Sites and the Software (Maple and Mathematica) Each chapter contains an introduction to the subject and ends with a set of exercises.

Gives concrete examples of how to justify the validity of every single digit of a numerical answer.

This book discusses the interplay of stochastics (applied probability theory) and numerical analysis in the field of quantitative finance. The stochastic models, numerical valuation techniques, computational aspects, financial products, and risk management applications presented will enable readers to progress in the challenging field of computational finance.When the behavior of financial market participants changes, the corresponding stochastic mathematical models describing the prices may also change. Financial regulation may play a role in such changes too. The book thus presents several models for stock prices, interest rates as well as foreign-exchange rates, with increasing complexity across the chapters. As is said in the industry, 'do not fall in love with your favorite model.' The book covers equity models before moving to short-rate and other interest rate models. We cast these models for interest rate into the Heath-Jarrow-Morton framework, show relations between the different models, and explain a few interest rate products and their pricing.The chapters are accompanied by exercises. Students can access solutions to selected exercises, while complete solutions are made available to

instructors. The MATLAB and Python computer codes used for most tables and figures in the book are made available for both print and e-book users. This book will be useful for people working in the financial industry, for those aiming to work there one day, and for anyone interested in quantitative finance. The topics that are discussed are relevant for MSc and PhD students, academic researchers, and for quants in the financial industry.

"This reference is a comprehensive collection of recent case studies, theories, research on digital rights management, and its place in the world today"--

Annotation The advent of mathematical software has been one of the most important events in mathematics. Mathematical software systems are used to construct examples, to prove theorems, and to find new mathematical phenomena. On the other hand, mathematical research often motivates developments of new algorithms and new systems. Mathematical software systems rely on the cooperation of mathematicians, designers of algorithms, and mathematical programmers. This book is aimed at software developers in mathematics and programming mathematicians, but it also provides opportunities to discuss the topics with mathematicians.

These are the proceedings of the conference "Symbolic Computation, Number Theory, Special Functions, Physics and Combinatorics" held at the Department of Mathematics, University of Florida, Gainesville, from November 11 to 13, 1999. The main emphasis of the conference was Com puter Algebra (i. e. symbolic computation) and how it related to the fields of Number Theory, Special Functions, Physics and Combinatorics. A subject that is common to all of these fields is q-series. We brought together those who do symbolic computation with q-series and those who need q-series in cluding workers in Physics and Combinatorics. The goal of the conference was to inform mathematicians and physicists who use q-series of the latest developments in the field of q-series and especially how symbolic computa tion has aided these developments. Over 60 people were invited to participate in the conference. We ended up having 45 participants at the conference, including six one hour plenary speakers and 28 half hour speakers. There were talks in all the areas we were hoping for. There were three software demonstrations.

A collection of surveys and research papers on mathematical software and algorithms. The common thread is that the field of mathematical applications lies on the border between algebra and geometry. Topics include polyhedral geometry, elimination theory, algebraic surfaces, Gröbner bases, triangulations of point sets and the mutual relationship. This diversity is accompanied by the abundance of available software systems which often handle only special mathematical aspects. This is why the volume also focuses on solutions to the integration of mathematical software systems. This includes low-level and XML based high-level communication channels as well as general frameworks for modular systems.

Upon publication, the first edition of the CRC Concise Encyclopedia of Mathematics received overwhelming accolades for its unparalleled scope, readability, and utility. It soon took its place among the top selling books in the history of Chapman & Hall/CRC, and its popularity continues unabated. Yet also unabated has been the d