

A Generalization Of The Bernoulli Numbers

Multiple Dirichlet Series, L-functions and Automorphic Forms gives the latest advances in the rapidly developing subject of *Multiple Dirichlet Series*, an area with origins in the theory of automorphic forms that exhibits surprising and deep connections to crystal graphs and mathematical physics. As such, it represents a new way in which areas including number theory, combinatorics, statistical mechanics, and quantum groups are seen to fit together. The volume also includes papers on automorphic forms and L-functions and related number-theoretic topics. This volume will be a valuable resource for graduate students and researchers in number theory, combinatorics, representation theory, mathematical physics, and special functions. Contributors: J. Beineke, B. Brubaker, D. Bump, G. Chinta, G. Cornelissen, C.A. Diaconu, S. Frechette, S. Friedberg, P. Garrett, D. Goldfeld, P.E. Gunnells, B. Heim, J. Hundley, D. Ivanov, Y. Komori, A.V. Kontorovich, O. Lorscheid, K. Matsumoto, P.J. McNamara, S.J. Patterson, M. Suzuki, H. Tsumura.

Enumerative Combinatorics presents elaborate and systematic coverage of the theory of enumeration. The first seven chapters provide the necessary background, including basic counting principles and techniques, elementary enumerative topics, and an extended presentation of generating functions and recurrence relations. The remaining seven chapters focus on more advanced topics, including, Stirling numbers, partitions of integers, partition polynomials, Eulerian numbers and Polya's counting theorem. Extensively classroom tested, this text was designed for introductory- and intermediate-level courses in enumerative combinatorics, but the far-reaching applications of the subject also make the book useful to those in operational research, the physical and social science, and anyone who uses combinatorial methods. Remarks, discussions, tables, and numerous examples support the text, and a wealth of exercises-with hints and answers provided in an appendix--further illustrate the subject's concepts, theorems, and applications.

Designed as a reference work and also as a graduate-level textbook, this volume presents an up-to-date and comprehensive account of the theories and applications of the various methods and techniques used in dealing with problems involving closed-form evaluations of (and representations of the Riemann Zeta function at positive integer arguments as) numerous families of series associated with the Riemann Zeta function, the Hurwitz Zeta function, and their extensions and generalizations such as Lerch's transcendent (or the Hurwitz-Lerch Zeta function). Audience: This book is intended for professional mathematicians and graduate students in mathematical sciences (both pure and applied).

Unique graduate-level monograph presents a heavily mathematical treatment with applications extending to many areas of physics and engineering. "A valuable compendium of results." — Bulletin of the American Mathematical Society, 1954 edition.

Combinatorial Methods in Discrete Distributions

Memoirs of the American Mathematical Society

Encyclopaedia of Mathematics

Recent Developments in Ordered Random Variables

A Generalization of the Bernoulli Numbers

In 1922, Harald Bohr and Johannes Møllerup established a remarkable characterization of the Euler gamma function using its log-convexity property. A decade later, Emil Artin investigated this result and used it to derive the basic properties of the gamma function using elementary methods of the calculus. Bohr-Møllerup's theorem was then adopted by Nicolas Bourbaki as the starting point for his exposition of the gamma function. This open access book develops a far-reaching generalization of Bohr-Møllerup's theorem to higher order convex functions, along lines initiated by Wolfgang Krull, Roger Webster, and some others but going considerably further than past work. In particular, this generalization shows using elementary techniques that a very rich spectrum of functions satisfy analogues of several classical properties of the gamma function, including Bohr-Møllerup's theorem itself, Euler's reflection formula, Gauss' multiplication theorem, Stirling's formula, and Weierstrass' canonical factorization. The scope of the theory developed in this work is illustrated through various examples, ranging from the gamma function itself and its variants and generalizations (q-gamma, polygamma, multiple gamma functions) to important special functions such as the Hurwitz zeta function and the generalized Stieltjes constants. This volume is also an opportunity to honor the 100th anniversary of Bohr-Møllerup's theorem and to spark the interest of a large number of researchers in this beautiful theory.

This Special Issue presents research papers on various topics within many different branches of mathematics, applied mathematics, and mathematical physics. Each paper presents mathematical theories, methods, and their application based on current and recently developed symmetric polynomials. Also, each one aims to provide the full understanding of current research problems, theories, and applications on the chosen topics and includes the most recent advances made in the area of symmetric functions and polynomials.

Commutation Relations, Normal Ordering, and Stirling Numbers provides an introduction to the combinatorial aspects of normal ordering in the Weyl algebra and some of its close relatives. The Weyl algebra is the algebra generated by two letters U and V subject to the commutation relation UV – VU = I. It is a classical result that normal ordering powers of VU involve the Stirling numbers. The book is a one-stop reference on the research activities and known results of normal ordering and Stirling numbers. It discusses the Stirling numbers, closely related generalizations, and their role as normal ordering coefficients in the Weyl algebra. The book also considers several relatives of this algebra, all of which are special cases of the algebra in which UV – qVU = hVs holds true. The authors describe combinatorial aspects of these algebras and the normal ordering process in them. In particular, they define associated generalized Stirling numbers as normal ordering coefficients in analogy to the classical Stirling numbers. In addition to the combinatorial aspects, the book presents the relation to operational calculus, describes the physical motivation for ordering words in the Weyl algebra arising from quantum theory, and covers some physical applications.

This book documents the history of pi from the dawn of mathematical time to the present. One of the beauties of the literature on pi is that it allows for the inclusion of very modern, yet accessible, mathematics. The articles on pi collected herein fall into various classes. First and foremost there is a selection from the mathematical and computational literature of four millennia. There is also a variety of historical studies on the cultural significance of the number. Additionally, there is a selection of pieces that are anecdotal, fanciful, or simply amusing. For this new edition, the authors have updated the original material while adding new material of historical and cultural interest. There is a substantial exposition of the recent history of the computation of digits of pi, a discussion of the normality of the distribution of the digits, and new translations of works by Viete and Huygen.

Handbook of Number Theory II

Number Theory in Progress

Fundamentals of Signal Processing in Generalized Metric Spaces

Proceedings of the Conference in Memory of Tsuneo Arakawa : Rikkyo University, Japan, 4-7 September 2004

Series Associated With the Zeta and Related Functions

This handbook focuses on some important topics from Number Theory and Discrete Mathematics. These include the sum of divisors function with the many old and new issues on Perfect numbers; Euler's totient and its many facets; the Möbius function along with its generalizations, extensions, and applications; the arithmetic functions related to the divisors or the digits of a number; the Stirling, Bell, Bernoulli, Euler and Eulerian numbers, with connections to various fields of pure or applied mathematics. Each chapter is a survey and can be viewed as an encyclopedia of the considered field, underlining the interconnections of Number Theory with Combinatorics, Numerical mathematics, Algebra, or Probability Theory. This reference work will be useful to specialists in number theory and discrete mathematics as well as mathematicians or scientists who need access to some of these results in other fields of research.

This book provides an introduction to elementary probability and to Bayesian statistics using de Finetti's subjectivist approach. One of the features of this approach is that it does not require the introduction of sample space – a non-intrinsic concept that makes the treatment of elementary probability unnecessarily complicate – but introduces as fundamental the concept of random numbers directly related to their interpretation in applications. Events become a particular case of random numbers and probability a particular case of expectation when it is applied to events. The subjective evaluation of expectation and of conditional expectation is based on an economic choice of an acceptable bet or penalty. The properties of expectation and conditional expectation are derived by applying a coherence criterion that the evaluation has to follow. The book is suitable for all introductory courses in probability and statistics for students in Mathematics, Informatics, Engineering, and Physics.

This text on a central area of number theory covers p-adic L-functions, class numbers, cyclotomic units, Fermat's Last Theorem, and Iwasawa's theory of Z_p-extensions. This edition contains a new chapter on the work of Thaine, Kolyvagin, and Rubin, including a proof of the Main Conjecture, as well as a chapter on other recent developments, such as primality testing via Jacobi sums and Sinnott's proof of the vanishing of Iwasawa's f-invariant.

Papers on Crypto-Automorphism of the Buchsteiner Loops, Generalizations of Poly-Bernoulli Numbers and Polynomials, Open Alliance in Graphs, Forcing Weak Edge Detour Number of a Graph, New Families of Mean Graphs, Euler-Savary Formula for the Lorentzian Planar Homothetic Motions, and other topics. Contributors: Hassan Jolany, M.R. Darafsheh, R. Eizadi Alikelaye, N. Jafari Rad, H. Rezazadeh, H. A. Malathi, H. C. Savithri, A. Nagarajan, S. Navaneetha Krishnan, R. Kala, and others.

Discrete Mechanics

Aspects of Ergodic, Qualitative and Statistical Theory of Motion

Mathematical Combinatorics, Vol. 2/2010

The Measurement of Uncertainty before 1900

The History of Statistics

The discrete vision of mechanics is based on the founding ideas of Galileo and the principles of relativity and equivalence, which postulate the equality between gravitational mass and inertial mass. To these principles are added the Hodge – Helmholtz decomposition, the principle of accumulation of constraints and the hypothesis of the duality of physical actions. These principles make it possible to establish the equation of motion based on the conservation of acceleration considered as an absolute quantity in a local frame of reference, in the form of a sum of the gradient of the scalar potential and the curl of the vector potential. These potentials, which represent the constraints of compression and rotation, are updated from the discrete operators. Discrete Mechanics: Concepts and Applications shows that this equation of discrete motion is representative of the compressible or incompressible flows of viscous or perfect fluids, the state of stress in an elastic solid or complex fluid and the propagation of nonlinear waves.

This book presents 57 peer-reviewed papers from the 12th Conference on Traffic and Granular Flow (TGF) held in Washington, DC, in July 2017. It offers a unique synthesis of the latest scientific findings made by researchers from different countries, institutions and disciplines. The research fields covered range from physics, computer science and engineering and they may be all grouped under the topic of "Traffic and Granular Flow". The main theme of the Conference was: "From Molecular Interactions to Internet of Things and Smart Cities: The Role of Technology in the Understanding and the Evolution of Particle Dynamics". This book is a revised and greatly expanded version of our book Elements of Number Theory published in 1972. As with the first book the primary audience we envisage consists of upper level undergraduate mathematics majors and graduate students. We have assumed some familiarity with the material in a standard undergraduate course in abstract algebra. A large portion of Chapters 1-11 can be read even without such background with the aid of a small amount of supplementary reading. The later chapters assume some knowledge of Galois theory, and in Chapters 16 and 18 an acquaintance with the theory of complex variables is necessary. Number theory is an ancient subject and its content is vast. Any introductory book must, of necessity, make a very limited selection from the fascinating array of possible topics. Our focus is on topics which point in the direction of algebraic number theory and arithmetic algebraic geometry. By a careful selection of subject matter we have found it possible to expose some rather advanced material without requiring very much in the way of technical background. Most of this material is classical in the sense that it was discovered during the nineteenth century and earlier, but it is also modern because it is intimately related to important research going on at the present time.

Wiley Series in Probability and Statistics A modern perspective on mixed models The availability of powerful computing methods in recent decades has thrust linear and nonlinear mixed models into the mainstream of statistical application. This volume offers a modern perspective on generalized, linear, and mixed models, presenting a unified and accessible treatment of the newest statistical methods for analyzing correlated, nonnormally distributed data. As a follow-up to Searle's classic, Linear Models, and Variance Components by Searle, Casella, and McCulloch, this new work progresses from the basic one-way classification to generalized linear mixed models. A variety of statistical methods are explained and illustrated, with an emphasis on maximum likelihood and restricted maximum likelihood. An invaluable resource for applied statisticians and industrial practitioners, as well as students interested in the latest results, Generalized, Linear, and Mixed Models features:
* A review of the basics of linear models and linear mixed models
* Descriptions of models for nonnormal data, including generalized linear and nonlinear models
* Analysis and illustration of techniques for a variety of real data sets
* Information on the accommodation of longitudinal data using these models
* Coverage of the prediction of realized values of random effects
* A discussion of the impact of computing issues on mixed models

Ferrohydrodynamics

international book series

The Kinematics of Vorticity

Arithmetic in Shangri-La : Proceedings of the 6th China-Japan Seminar, Shanghai, China, 15-17 August 2011

Advances in Queueing Theory, Methods, and Open Problems

Intended for beginners in ergodic theory, this introductory textbook addresses students as well as researchers in mathematical physics. The main novelty is the systematic treatment of characteristic problems in ergodic theory by a unified method in terms of convergent power series and renormalization group methods, in particular. Basic concepts of ergodicity, like Gibbs states, are developed and applied to, e.g., Asonov systems or KAM Theory. Many examples illustrate the ideas and, in addition, a substantial number of interesting topics are treated in the form of guided problems.

The progress of science and technology has placed Queueing Theory among the most popular disciplines in applied mathematics, operations research, and engineering. Although queueing has been on the scientific market since the beginning of this century, it is still rapidly expanding by capturing new areas in technology. Advances in Queueing provides a comprehensive overview of problems in this enormous area of science and focuses on the most significant methods recently developed. Written by a team of 24 eminent scientists, the book examines stochastic, analytic, and generic methods such as approximations, estimates and bounds, and simulation. The first chapter presents an overview of classical queueing methods from the birth of queues to the seventies. It also contains the most comprehensive bibliography of books on queueing and telecommunications to date. Each of the following chapters surveys recent methods applied to classes of queueing systems and networks followed by a discussion of open problems and future research directions. Advances in Queueing is a practical reference that allows the reader quick access to the latest methods.

Proceedings of the International Conference on Number Theory organized by the Stefan Banach International Mathematical Center in Honor of the 60th Birthday of Andrzej Schinzel, Zakopane, Poland, June 30-July 9, 1997.

A new breed of engineer is developing in our contemporary society. These engineers are concerned with communications and computers, economics and regulation. These new engineers apply themselves to data-to its pack aging, transmission, and protection. They are data engineers. Formal curricula do not yet exist for their dedicated development. Rather they learn most of their tools "on the job" and their roots are in computer engineering, communications engineering, and applied mathe matics. There is a need to draw relevant material together and present it so that those who wish to become data engineers can do so, for the betterment of themselves, their employer, their country, and, ultimately, the world-for we share the belief that the most effective tool for world peace and stability is neither politics nor armaments, but rather the open and timely exchange of information. This book has been written with that goal in mind. Today numerous signs encourage us to expect broader information exchange in the years to come. The movement toward a true Integrated Services Digital Network (ISDN) is perhaps the clearest of these. Also, the development offormal protocol layers reflects both a great deal of brilliance and compromise and also the desire for a common language among data engineers.

Performance Analysis of Queueing and Computer Networks

Multiple Dirichlet Series, L-functions and Automorphic Forms

Proceedings of a Workshop held in Heidelberg, West Germany, October 1-5, 1984

Data Transportation and Protection

Number Theory

This volume is based on the successful 6th ChinaOCoJapan Seminar on number theory that was held in Shanghai Jiao Tong University in August 2011. It is a compilation of survey papers as well as original works by distinguished researchers in their respective fields. The topics range from traditional analytic number theory OCo additive problems, divisor problems, Diophantine equations OCo to elliptic curves and automorphic L-functions. It contains new developments in number theory and the topics complement the existing two volumes from the previous seminars which can be found in the same book series.

Exploring the interrelations between generalized metric spaces, lattice-ordered groups, and order statistics, the book contains a new algebraic approach to Signal Processing Theory. It describes mathematical concepts and results important in the development, analysis, and optimization of signal processing algorithms intended for various applications. The book offers a solution of large-scale Signal Processing Theory problems of increasing both signal processing efficiency under prior uncertainty conditions and signal processing rate that is provided by multiplication-free signal processing algorithms based on lattice-ordered group operations. From simple basic relationships to computer simulation, the text covers a wide range of new mathematical techniques essential for understanding the proposed signal processing algorithms developed for solving the following problems: signal parameter and spectral estimation, signal filtering, detection, classification, and resolution; array signal processing; demultiplexing and demodulation in multi-channel communication systems and multi-station networks; wavelet analysis of 1D/ 2D signals. Along with discussing mathematical aspects, each chapter presents examples illustrating operation of signal processing algorithms developed for various applications. The book helps readers understand relations between known classic and obtained results as well as recent research trends in Signal Processing Theory and its applications, providing all necessary mathematical background concerning lattice-ordered groups to prepare readers for independent work in the marked directions including more advanced research and development.

This magnificent book is the first comprehensive history of statistics from its beginnings around 1700 to its emergence as a distinct and mature discipline around 1900. Stephen M. Stigler shows how statistics arose from the interplay of mathematical concepts and the needs of several applied sciences including astronomy, geodesy, experimental psychology, genetics, and sociology. He addresses many intriguing questions: How did scientists learn to combine measurements made under different conditions? And how were they led to use probability theory to measure the accuracy of the result? Why were statistical methods used successfully in astronomy long before they began to play a significant role in the social sciences? How could the introduction of least squares predate the discovery of regression by more than eighty years? On what grounds can the major works of men such as Bernoulli, De Moivre, Bayes, Quetelet, and Lexis be considered partial failures, while those of Laplace, Galton, Edgeworth, Pearson, and Yule are counted as successes? How did Galton's probability machine (the quincunx) provide him with the key to the major advance of the last half of the nineteenth century? Stigler's emphasis is upon how, when, and where the methods of probability theory were developed for measuring uncertainty in experimental and observational science, for reducing uncertainty, and as a conceptual framework for quantitative studies in the social sciences. He describes with care the scientific context in which the different methods evolved and identifies the problems (conceptual or mathematical) that retarded the growth of mathematical statistics and the conceptual developments that permitted major breakthroughs. Statisticians, historians of science, and social and behavioral scientists will gain from this book a deeper understanding of the use of statistical methods and a better grasp of the promise and limitations of such techniques. The product of ten years of research, The History of Statistics will appeal to all who are interested in the humanistic study of science.

A Generalization of the Bernoulli and Stirling Numbers ...A Generalization of the Bernoulli NumbersA Generalization of Bohr-Møllerup's Theorem for Higher Order Convex FunctionsSpringer Nature

Concepts and Applications

An Introduction to Probability with de Finetti's Approach and to Bayesian Statistics

Elements of Probability and Statistics

Algorithms and Applications

This volume contains a valuable collection of articles presented at a conference on Automorphic Forms and Zeta Functions in memory of Tsuneo Arakawa, an eminent researcher in modular forms in several variables and zeta functions. The book begins with a review of his works, followed by 16 articles by experts in the fields including H Aoki, R Berndt, K Hashimoto, S Hayashida, Y Hironaka, H Katsurada, W Kohnen, A Krieg, A Murase, H Narita, T Oda, B Roberts, R Schmidt, R Schulze-Pillot, N Skoruppa, T Sugano, and D Zagier. A variety of topics in the theory of modular forms and zeta functions are covered: Theta series and the basis problems, Jacobi forms, automorphic forms on Sp(1, q), double zeta functions, special values of zeta and L-functions, many of which are closely related to Arakawa's works. This collection of papers illustrates Arakawa's contributions and the current trends in modular forms in several variables and related zeta functions. Contents: Tsuneo Arakawa and His Works; Estimate of the Dimensions of Hilbert Modular Forms by Means of Differential Operator (H Aoki); Marsden-Weinstein Reduction, Orbits and Representations of the Jacobi Group (R Berndt); On Eisenstein Series of Degree Two for Squarefree Levels and the Genus Version of the Basis Problem I (S Bocherer); Double Zeta Values and Modular Forms (H Gangl et al.); Type Numbers and Linear Relations of Theta Series for Some General Orders of Quaternion Algebras (K Hashimoto); Skewholomorphic Jacobi Forms of Higher Degree (S Hayashida); A Hermitian Analog of the Schottky Form (M Hentschel & A Krieg); The Siegel Series and Spherical Functions on O(2n)/(O(n) x O(n)) (Y Hironaka & F Sati); Koecher-Maa Series for Real Analytic Siegel Eisenstein Series (T Ibukiyama & H Katsurada); A Short History on Investigation of the Special Values of Zeta and L-Functions of Totally Real Number Fields (T Ishii & T Oda); Genus Theta Series, Hecke Operators and the Basis Problem for Eisenstein Series (H Katsurada & R Schulze-Pillot); The Quadratic Mean of Automorphic L-Functions (W Kohnen et al.); Inner Product Formula for Kudla Lift (A Murase & T Sugano); On Certain Automorphic Forms of Sp(1,q) (Arakawa's Results and Recent Progress) (H Narita); On Modular Forms for the Paramodular Group (B Roberts & R Schmidt); SL(2,Z)-Invariant Spaces Spanned by Modular Units (N-P Skoruppa & W Eholzer). Readership: Researchers and graduate students in number theory or representation theory as well as in mathematical physics or combinatorics.

The Mathieu series is a functional series introduced by Émile Léonard Mathieu for the purposes of his research on the elasticity of solid bodies. Bounds for this series are needed for solving biharmonic equations in a rectangular domain. In addition to Tomovski and his coauthors, Pogany, Cerone, H. M. Srivastava, J. Choi, etc. are some of the known authors who published results concerning the Mathieu series, its generalizations and their alternating variants. Applications of these results are given in classical, harmonic and numerical analysis, analytical number theory, special functions, mathematical physics, probability, quantum field theory, quantum physics, etc. Integral representations, analytical inequalities, asymptotic expansions and behaviors of some classes of Mathieu series are presented in this book. A systematic study of probability density functions and probability distributions associated with the Mathieu series, its generalizations and Planck's distribution is also presented. The book is addressed at graduate and PhD students and researchers in mathematics and physics who are interested in special functions, inequalities and probability distributions.

A unique approach illustrating discrete distribution theory throughcombinatorial methods This book provides a unique approach by presenting combinatorialmethods in tandem with discrete distribution theory. This method,particular to discreteness, allows readers to gain a deeperunderstanding of theory by using applications to solve problems.The author makes extensive use of the reduction approach toconditional distributions of independent random occupancy numbers,and provides excellent studies of occupancy and

sequential occupancy distributions, convolutions of truncated discrete distributions, and compound and mixture distributions. Combinatorial Methods in Discrete Distributions begins with a brief presentation of set theory followed by basic counting principles. Fundamental principles of combinatorics, finite differences, and discrete probability are included to give readers the necessary foundation to the topics presented in the text. A thorough examination of the field is provided and features: Stirling numbers and generalized factorial coefficients Occupancy and sequential occupancy distributions n-fold convolutions of truncated distributions Compound and mixture distributions Thoroughly worked examples aid readers in understanding complex theory and discovering how theory can be applied to solve practical problems. An appendix with hints and answers to the exercises helps readers work through the more complex sections. Reference notes are provided at the end of each chapter, and an extensive bibliography offers readers a resource for additional information on specialized topics.

Performance Analysis of Queuing and Computer Networks develops simple models and analytical methods from first principles to evaluate performance metrics of various configurations of computer systems and networks. It presents many concepts and results of probability theory and stochastic processes. After an introduction to queues in computer networks, this self-contained book covers important random variables, such as Pareto and Poisson, that constitute models for arrival and service disciplines. It then deals with the equilibrium M/M/1 queue, which is the simplest queue that is amenable for analysis. Subsequent chapters explore applications of continuous time, state-dependent single Markovian queues, the M/G/1 system, and discrete time queues in computer networks. The author then proceeds to study networks of queues with exponential servers and Poisson external arrivals as well as the G/M/1 queue and Pareto interarrival times in a G/M/1 queue. The last two chapters analyze bursty, self-similar traffic, and fluid flow models and their effects on queues.

Pi: A Source Book

Generalized Bernoulli Numbers, Generalized Irregular Primes, and Class Number

Fundamentals

Mathematical Problems and Methods of Hydrodynamic Weather Forecasting

A Signal Theoretic Introduction to Random Processes

Comprehensive and thorough development of both probability and statistics for serious computer scientists; goal-oriented: "to present the mathematical analysis underlying probability results" Special emphases on simulation and discrete decision theory Mathematically-rich, but self-contained text, at a gentle pace Review of calculus and linear algebra in an appendix Mathematical interludes (in each chapter) which examine mathematical techniques in the context of probabilistic or statistical importance Numerous section exercises, summaries, historical notes, and Further Readings for reinforcement of content

A fresh introduction to random processes utilizing signal theory By incorporating a signal theory basis, A Signal Theoretic Introduction to Random Processes presents a unique introduction to random processes with an emphasis on the important random phenomena encountered in the electronic and communications engineering field. The strong mathematical and signal theory basis provides clarity and precision in the statement of results. The book also features: A coherent account of the mathematical fundamentals and signal theory that underpin the presented material Unique, in-depth coverage of material not typically found in introductory books Emphasis on modeling and notation that facilitates development of random process theory Coverage of the prototypical random phenomena encountered in electrical engineering Detailed proofs of results A related website with solutions to the problems found at the end of each chapter A Signal Theoretic Introduction to Random Processes is a useful textbook for upper-undergraduate and graduate-level courses in applied mathematics as well as electrical and communications engineering departments. The book is also an excellent reference for research engineers and scientists who need to characterize random phenomena in their research.

This is the first volume of a two volume set which presents the results of the 31st International Symposium on Shock Waves (ISSW31), held in Nagoya, Japan in 2017. It was organized with support from the International Shock Wave Institute (ISWI), Shock Wave Research Society of Japan, School of Engineering of Nagoya University, and other societies, organizations, governments and industry. The ISSW31 focused on the following areas: Blast waves, chemical reacting flows, chemical kinetics, detonation and combustion, ignition, facilities, diagnostics, flow visualization, spectroscopy, numerical methods, shock waves in rarefied flows, shock waves in dense gases, shock waves in liquids, shock waves in solids, impact and compaction, supersonic jet, multiphase flow, plasmas, magnetohydrodynamics, propulsion, shock waves in internal flows, pseudo-shock wave and shock train, nozzle flow, re-entry gasdynamics, shock waves in space, Richtmyer-Meshkov instability, shock/boundary layer interaction, shock/vortex interaction, shock wave reflection/interaction, shock wave interaction with dusty media, shock wave interaction with granular media, shock wave interaction with porous media, shock wave interaction with obstacles, supersonic and hypersonic flows, sonic boom, shock wave focusing, safety against shock loading, shock waves for material processing, shock-like phenomena, and shock wave education. These proceedings contain the papers presented at the symposium and serve as a reference for the participants of the ISSW 31 and individuals interested in these fields.

The ordered random variables play important roles in the theory and practice of statistics. They possess significant statistical properties. Over the last few decades, many articles on various topics of ordered statistical data have appeared. Our handbook comprises twenty one chapters discussing various topics on theory and applications. The editors of this book worked together several articles on order and record statistics, which covered the subjects of distributional properties, characterisations and statistical inferences. It was a special interest to co-ordinate and edit an interesting research problem based on material contributed by several prominent researchers from all over the world. This book presents new developments in the subject of ordered random variables. These aspects involve theory of ordered random variables, reliability theory, stochastic ordering, bounds, characterisations, and estimation and prediction techniques.

Enumerative Combinatorics

Fractals, Applied Synergetics and Structure Design

Generalized Linear Mixed Models

Quantum Probability and Applications II

Current Trends in Symmetric Polynomials with their Applications

The material provides an historical background to forecasting developments as well as introducing recent advances. The book will be of interest to both mathematicians and physicians, the topics covered include equations of dynamical meteorology, first integrals, non-linear stability, well-posedness of boundary problems, non-smooth solutions, parametric

Clear, comprehensive treatment of behavior and dynamics of magnetic fluids explores electromagnetism and fields, magnetocaloric energy conversion, more. For graduate students and researchers in physics, engineering, and math.

This ENCYCLOPAEDIA OF MATHEMATICS aims to be a reference work for all parts of mathematics. It is a translation with updates and editorial comments of the Soviet Mathematical Encyclopaedia published by 'Soviet Encyclopaedia Publishing House' in five volumes in 1977 - 1985. The annotated translation consists of ten volumes including a special index volume. There are three kinds of articles in this ENCYCLOPAEDIA. First of all there are survey-type articles dealing with the various main directions in mathematics (where a rather fine subdivision has been used). The main requirement for these articles has been that they should give a reasonably complete up-to-date account of the current state of affairs in these areas and that they should be maximally accessible. On the whole, these articles should be understandable to mathematics students in their first specialization years, to graduates from other mathematical areas and, depending on the specific subject, to specialists in other domains of science, engineers and teachers of mathematics. These articles treat their material at a fairly general level and aim to give an idea of the kind of problems, techniques and concepts involved in the area in question. They also contain background and motivation rather than precise statements of precise theorems with detailed definitions and technical details on how to carry out proofs and constructions.

Non-linear systems behaviours are discussed in this book from the point of new scientific approaches to the interdisciplinary nature of the fractal geometry and synergetics. Fractal analysis, synergetics methods and mathematical design are considered according to actual problems of condensed media physics, mechanics, material science and geology.

Commutation Relations, Normal Ordering, and Stirling Numbers

A Classical Introduction to Modern Number Theory

Generalized Mathieu Series

Automorphic Forms and Zeta Functions

A Generalization of Bohr-Mollerup's Theorem for Higher Order Convex Functions