gazelle

Mathematics

MATHEMATICS RESEARCH DEVELOPMENTS

Statistics
The Fundamentals
Volume 1

Kunihiro Suzuki

NOVA

Titles published by Nova Science

Contents

Advances in Mathematics Research Series
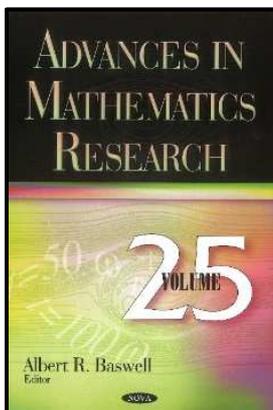
Advances in Mathematics Research
Volume 25
Edited by Albert R. Baswell

Advances in Mathematics Research. Volume 25 commences with an introduction to the solution attractor theory of local search systems. Here, a local search algorithm is treated as a discrete dynamical system and its search behavior is studied from the perspective of dynamical systems. Following this, this collection examines the three-year period of 1966 to 1968 when the invariant integral of fracture mechanics became popular, as well as 2015 to 2016 when the neoclassic cosmology based on the invariant integral came about.

The authors go on to argue how, in the history of philosophy, the meaning of the term "to be" has been disputed between two research programmes: The Platonic-Aristotelian and the Pythagorean- Parmenidean-Democritean programmes through Hobbes and Boole up to Peano. The history of science and philosophy goes hand in hand with the question of the nature of mathematical objects. By implication, this was known by the Pythagoreans, even though it was not expressed in the plane of a directly named problem. The authors propose that that strict Platonism in mathematics is not possible, though may be considered in many cases.

Also in this collection, perform building-scale analysis is performed, and the use of a convex map is considered. However, partitioning an architectural space is not easy due to its ambiguity. As such, an analysis method is proposed which may decompose the space with moderate granularity.

One study sets out to determine the feasibility of using a hidden Markov model to assess whether goats were in estrus. Mammalian behavior has typically been studied based on observations, but direct observation requires substantial time and effort if the number of mammals observed is high or the observations are obtained over a long period of time. Thus, a machine-learning method such as a hidden Markov model may be suitable.

A literature review of electric circuits and mathematical models of electric power transmission lines is provided, approaching a classification of the models regarding the nature of their parameters and frequency dependence. These models are important in predicting the voltage and current available, which aids in meeting safety and quality demands.

The authors conclude with a summary of some results concerning the problem of computing a proper rational parametrization Q from P. In particular, they present an algorithm that computes a parametrization Q of V such that $\deg(-Q) \leq \deg(-P)$. If $\deg(-Q) = 1$, then Q is proper and the reparametrization problem is solved.

HB 9781536146677 £238.99 February 2019 Nova Science Publishers 222 pages
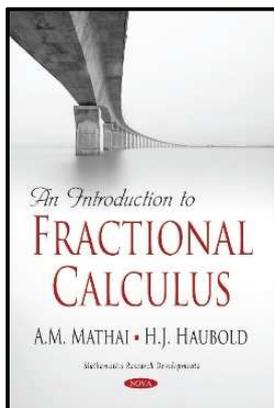
An Introduction to Fractional Calculus

A.M. Mathai, H.J. Haubold

This is a modified version of Module 10 of the Centre for Mathematical and Statistical Sciences (CMSS). CMSS modules are notes prepared on various topics with many examples from real-life situations and exercises so that the subject matter becomes interesting to students. These modules are used for undergraduate level courses and graduate level training in various topics at CMSS. Aside from Module 8, these modules were developed by Dr. A. M. Mathai, Director of CMSS and Emeritus Professor of Mathematics and Statistics, McGill University, Canada. Module 8 is based on the lecture notes of Professor W. J. Anderson of McGill University, developed for his undergraduate course (Mathematics 447).

Professor Dr. Hans J. Haubold has been a research collaborator of Dr. A.M. Mathai's since 1984, mainly in the areas of astrophysics, special functions and statistical distribution theory. He is also a lifetime member of CMSS and a Professor at CMSS. A large number of papers have been published jointly in these areas since 1984. The following monographs and books have been brought out in conjunction with this joint research: Modern Problems in Nuclear and Neutrino Astrophysics (A.M. Mathai and H.J. Haubold, 1988, Akademie-Verlag, Berlin); Special Functions for Applied Scientists (A.M.Mathai and H.J. Haubold, 2008, Springer, New York); and The H-Function: Theory and Applications (A.M.Mathai, R.K. Saxena and H.J. Haubold, 2010, Springer, New York). These CMSS modules are printed at CMSS Press and published by CMSS. Copies are made available to students free of charge, and to researchers and others at production cost. For the preparation of the initial drafts of all these modules, financial assistance was made available from the Department of Science and Technology, the Government of India (DST), New Delhi under project number SR/S4/MS:287/05. Hence, the authors would like to express their thanks and gratitude to DST, the Government of India, for its financial assistance.

PB 9781536146325 £84.99 December 2018 Nova Science Publishers 232 pages
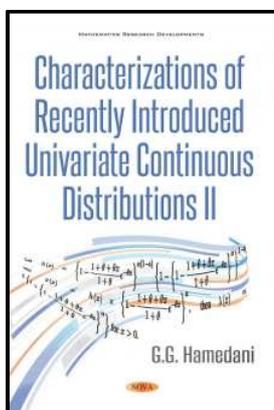
Characterizations of Recently Introduced Univariate Continuous Distributions II

G.G. Hamedani

This monograph is, as far as the author has gathered, the second of its kind (the first one was published by Nova in 2017 with coauthors Hamedani and Maadooliat) which presents various characterizations of a wide variety of continuous distributions. These two monographs could also be used as sources to prevent reinventing and duplicating the already exiting distributions. This current book consists of seven chapters. The first chapter lists cumulative and density functions of two hundred univariate distributions. Chapter two provides characterizations of these distributions: (i) based on the ration of two truncated moments; (ii) in terms of the hazard function; (iii) in terms of the reverse hazard function; (iv) based on the conditional expectation of certain functions of the random variable. Chapter three includes the characterizations of twenty distributions, including a published paper (Hamedani and Safavimanesh, 2017). Chapter four presents characterizations of thirty six distributions, and contains a published paper (Hamedani, 2017). Chapter five covers the characterizations of forty one distributions, as well as a published paper (Hamedani, 2018a). Chapter six presents characterizations of eighty distributions, and also contains a published paper (Hamedani, 2018b). Finally, chapter seven consists of seventy proposed distributions. The main reason to include previously published papers in Chapters 3-6 is to provide a rather complete source for the interested researchers who would want to avoid reinventing the existing distributions.

HB 9781536150957 £257.99 April 2019 Nova Science Publishers 442 pages

Connections between Mathematics, the Arts and Architecture

Nicoletta Sala, Gabriele Cappellato

The purpose of this book is to analyze the interdisciplinary aspects of mathematics and geometry in reference to nature, art, and architecture.

In Chapter 1, we introduce symmetry and its different meanings. Symmetry is a notion, which has been applied in the arts and architecture to find harmony and beauty. It joins aesthetics and practice, science and economy, mathematics and philosophy. In this chapter, we also analyze the influence of Vitruvius and the concept of old symmetry, received by the Renaissance. It is also interesting to note how in contemporary architecture there is often the presence of the "break" of symmetry (for example in the Frank O. Gehry's works).

Chapter 2 explains how proportions, and in particular, the golden section, has introduced aesthetic canons that have strongly influenced many artists like Polycletus, and architects, from Ictinus to Le Corbusier.

In Chapter 3, we discover how curves and spirals find their application in artistic works, for example in Mycenaean jewelry, and architectural works, from the Baroque of Francesco Borromini to the Land Art of Smithson.

Chapter 4 presents the importance and influence that Platonic solids and polyhedrons have had on philosophy and art through different historical periods and different cultures. For instance, we look at how Platonic solids are connected to the theory of Empedocles' elements and Hippocrates' theory of humors.

Chapter 5 describes surfaces, discovering how different cultures have used them in different manners, including Roman aqueducts, iron bridges, and finally arriving on modern structures that base their forms on hyperboloids and paraboloids.

In Chapter 6, we introduce fractal geometry, as a geometry that tries to explain nature's irregular shapes, trying to overcome the limitations imposed by "old" Euclidean geometry. We also analyze how fractal geometry has influenced architecture in this century.
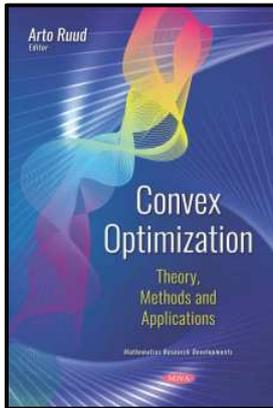
Convex Optimization
Theory, Methods and Applications
Edited by Arto Ruud

Over the past two decades, it has been recognized that advanced image processing techniques provide valuable information to physicians for the diagnosis, image guided therapy and surgery, and monitoring of human diseases. *Convex Optimization: Theory, Methods and Applications* introduces novel and sophisticated mathematical problems which encourage the development of advanced optimization and computing methods, especially convex optimization. The authors go on to study Steffensen-King-type methods of convergence to approximate a locally unique solution of a nonlinear equation and also in problems of convex optimization. Real-world applications are also provided.

The following study is focused on the design and testing of a Matlab code of the Frank-Wolfe algorithm. The Nesterov step is proposed in order to accelerate the algorithm, and the results of some numerical experiments of constraint optimization are also provided.

Lagrangian methods for numerical solutions to constrained convex programs are also explored. For enhanced algorithms, the traditional Lagrange multiplier update is modified to take a soft reflection across the zero boundary. This, coupled with a modified drift expression, is shown to yield improved performance.

Next, Newton's mesh independence principle was used to solve a certain class of optimal design problems from earlier studies. Motivated by optimization considerations, the authors show that under the same computational cost, a finer mesh independence principle can be given than before.

This compilation closes with a presentation on a local convergence analysis for eighth–order variants of Hansen–Patrick's family for approximating a locally unique solution of a nonlinear equation. The radius of convergence and computable error bounds on the distances involved are also provided.

PB 9781536146967 £90.99 April 2019 Nova Science Publishers 158 pages
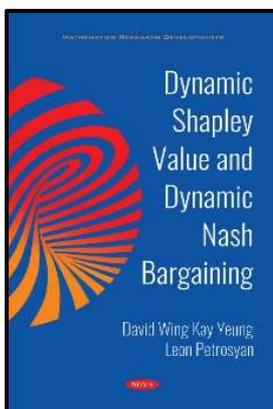
Dynamic Shapley Value and Dynamic Nash Bargaining
David Wing Kay Yeung, Leon Aganesovich Petrosyan

This book is an important and innovative addition to textbooks in game theory. It provides a detailed discourse on the extension of two of the world's most prominent cooperative game solutions – the seminal Shapley value in games with transferrable payoffs and the classic Nash bargaining scheme in games with non-transferrable payoffs – to a dynamic framework. The extension of these two classic cooperative solution concepts into a dynamic setting is not just of theoretical interest, but also allows many real-life cooperation situations – like global environmental management, nuclear disarmament, disease control, trade disputes and political unions – to be analyzed in an effective way.

This book provides: (i) A compendium of dynamic optimization techniques used in its analysis; (ii) a detailed disquisition on cooperative dynamic consistency; (iii) the extension of the Shapley Value to a dynamic framework; (iv) the establishment of a dynamic Nash bargaining paradigm; and (v) the incorporation of stochastic elements into the analyses. Interesting solvable examples are provided to illustrate the practicality and applicability of the dynamic Shapley value and dynamic Nash bargaining scheme in dynamic cooperation.

HB 9781536145496 £152.99 February 2019 Nova Science Publishers 82 pages
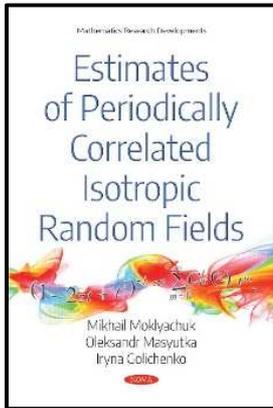
Estimates of Periodically Correlated Isotropic Random Fields

Mikhail Moklyachuk, Oleksandr Masyutka, Iryna Golichenko

We propose results of the investigation of the problem of the mean square optimal estimation of linear functionals which depend on the unknown values of periodically correlated isotropic random fields. Estimates are based on observations of the fields with a noise. Formulas for computing the value of the mean-square errors and the spectral characteristics of the optimal linear estimates of functionals are derived in the case of spectral certainty, where the spectral densities of the fields are exactly known. Formulas that determine the least favorable spectral densities and the minimax-robust spectral characteristics of the optimal estimates of functionals are proposed in the case of spectral uncertainty, where the spectral densities are not exactly known while some sets of admissible spectral densities are specified.

HB 9781536132441 £219.99 July 2018 Nova Science Publishers 316 pages
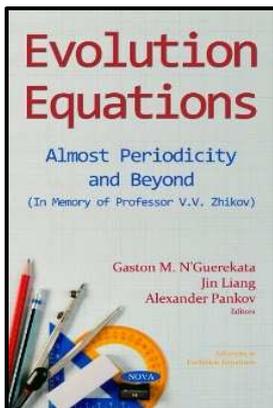
Evolution Equations
Almost Periodicity and Beyond (In Memory of Professor V.V. Zhikov)

Alexander Pankov Edited by Gaston Mandata N'Guerekata, Jin Liang

This volume of Advances in Evolution Equations is dedicated to the memory of Professor Vasilii Vasilievich Zhikov, an outstanding Russian mathematician. Zhikov's scientific interest ranged from almost periodic differential equations and topological dynamics to spectral theory of elliptic operators, qualitative theory of parabolic equations, calculus of variations, homogenization, and hydrodynamics, to name a few. Many of his results are now classical.

HB 9781536142587 £219.99 December 2018 Nova Science Publishers 254 pages
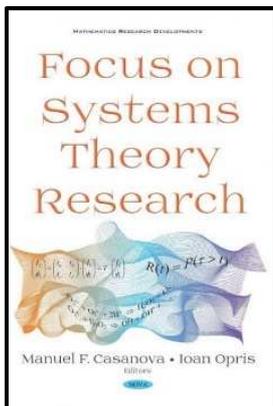
Focus on Systems Theory Research

Edited by Manuel F. Casanova, Ioan Opris

This book offers a multidisciplinary approach to systems theory, investigating its general principles, mathematical models, and applications in health sciences. It describes how leaders in the field have made a transition from equations and models to dilemmas faced in the real world. This book is meant to simplify our understanding of disparate hierarchical and complex open systems in the world by making us aware of patterns of action among its components. These interactions lead to cascading effects within the system which end up changing it as a whole.

This self-organization often leads to unpredictable results transforming the system, or integrating the same, into a still more complex system. These results, not necessarily the ones originally sought by their organizers, may offer the system the best opportunity for sustainable and adaptive growth. In the end, readers of this book will gain a basic understanding of systems theory, its application to natural and manmade processes, and how systems grow and equilibrate with their environment in order to continue functioning.

HB 9781536145618 £219.99 January 2019 Nova Science Publishers 385 pages
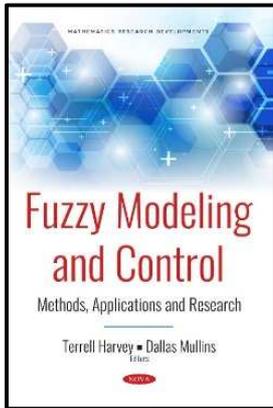
Fuzzy Modeling and Control
Methods, Applications and Research
Edited by Terrell Harvey, Dallas Mullins

Fuzzy Modeling and Control: Methods, Applications and Research opens by recommending a new fuzzy RANSAC algorithm based on the reinforcement learning concept to improve modeling performance under the outlier noise. The authors also propose a novel methodology for online modeling of multivariable Hammerstein evolving fuzzy models with minimum realization in state space from experimental data. Results characterized by strongly coupled nonlinearities demonstrate the computational efficiency of the proposed methodology. Later, two types of neural networks are applied to find the approximate solutions of the fully fuzzy nonlinear system, and a superior gradient descent algorithm is proposed in order to train the neural networks. Lastly, the authors propose a novel online evolving fuzzy Takagi-Sugeno state-space model identification approach for nonlinear multivariable systems. To circumvent "the curse of dimensionality", the algorithm uses tools for monitoring the quality of the existing clusters.

PB 9781536134148 £90.99 June 2018 Nova Science Publishers 74 pages
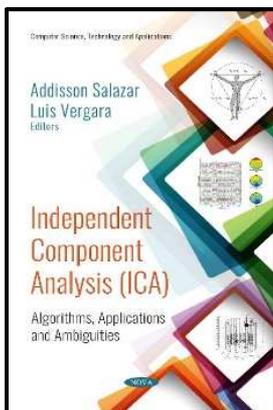
Independent Component Analysis (ICA)
Algorithms, Applications and Ambiguities
Edited by Addisson Salazar, Luis Vergara

Modern treatment of data requires powerful tools that allow the possible valuable contents of that data to be thoroughly understood and exploited. From the plethora of techniques proposed to achieve those objectives, the independent component analysis (ICA) has emerged as a flexible and efficient approach to model and characterize arbitrary data densities. Considering adequate data preprocessing, ICA can be implemented for any kind of data including imaging; biomedical signals; telecommunication data; and web data. In this framework, this book embraces a significant vision of ICA that presents innovative theoretical and practical approaches. ICA has been increasingly studied as a suitable method for many applications where available data describe complex geometries. Thus, this book aims to be an updated and advanced source of knowledge to solve real-world problems efficiently based on ICA. In contrast to classical time and frequency domain filtering, ICA has been proposed as a statistical filtering tool considering the observed data as mixtures of hidden non-Gaussian distributions called sources. Those sources extracted by ICA can be related with meaningful information about the origin of the data and for data detection/classification. Therefore, the successful of ICA has been widely demonstrated in challenging blind source separation (BSS), feature extraction, and pattern recognition tasks.

The suitability of ICA for a given problem of data analysis can be posed from different perspectives considering the physical interpretation of the phenomenon under analysis: (i) Estimation of the probability density of multivariate data without physical meaning; (ii) learning of some bases (usually called activation functions), which are more or less connected to the actual behaviors that are implicit in the physical phenomenon; and (iii) to identify where sources are originated and how they mix before arriving to the sensors to provide a physical explanation of the linear mixture model. In any case, even though the complexity of the problem constrains a physical interpretation, ICA can be used as a general-purpose data mining technique. The chapters that compose this book are written by premier researchers that present enlightening discussions, convincing demonstrations, and guidelines for future directions of research. The contents of this book span biomedical signal processing, dynamic modeling, next generation wireless communication, and sound and ultrasound signal processing. It also includes comprehensive works based on the related ICA techniques known as bounded component analysis (BCA) and non-negative matrix factorization (NMF).

HB 9781536139945 £247.99 November 2018 Nova Science Publishers 254 pages

Mathematical Recreations and Essays

W. W. Rouse

This book is divided into two parts and include questions which involve advanced mathematics. The first part consists of six chapters, in which are included various problems and amusements of the kind usually called mathematical recreations. The questions discussed in the first of these chapters are connected with arithmetic; those in the second with geometry; and those in the third relate to mechanics. The fourth chapter contains an account of some miscellaneous problems which involve both number and situation; the fifth chapter contains a concise account of magic squares; and the sixth and chapter deals with some unicursal problems. The second part consists of eight chapters, which are mostly historical. They deal respectively with the History of the Mathematical Tripos at Cambridge, three classical problems in geometry—namely, the duplication of the cube, the trisection of an angle, and the quadrature of the circle— Mersenne's Numbers , astrology, cryptography and ciphers, the hypotheses as to the nature of space and mass, and a means of measuring time.

HB 9781536148237 £219.99 January 2019 Nova Science Publishers 377 pages
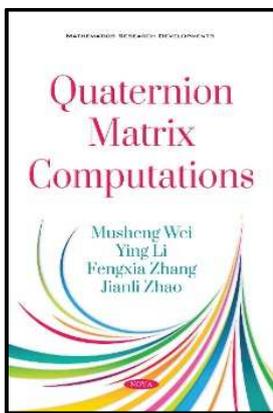
Quaternion Matrix Computations

Musheng Wei, Ying Li, Fengxia Zhang, Jianli Zhao

In this monograph, the authors describe state-of-the-art real structure-preserving algorithms for quaternion matrix computations, especially the LU, the Cholesky, the QR and the singular value decomposition of quaternion matrices, direct and iterative methods for solving quaternion linear systems, generalized least squares problems, and quaternion right eigenvalue problems. Formulas of the methods are derived, and numerical codes are provided which utilize advantages of real structure-preserving of quaternion matrices and high-level performance of vector pipelining arithmetic operations, using Matlab software. These algorithms are very efficient and stable. This monograph can be used as a reference book for scientists, engineers and researchers in color image processing, quaternionic quantum mechanics, information engineering, information security and scientific computing. It can also act as a textbook at the graduate level in related areas.

HB 9781536141214 £152.99 September 2018 Nova Science Publishers 220 pages
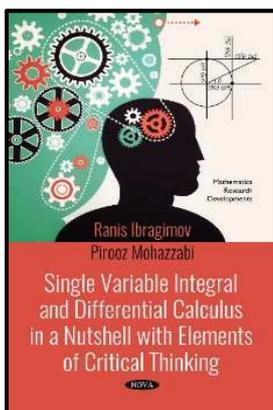
Single Variable Integral and Differential Calculus in a Nutshell with Elements of Critical Thinking

Ranis Ibragimov, Pirooz Mohazzabi

This book presents a variety of calculus problems concerning different levels of difficulty with technically correct solutions and methodological steps that look also correct, but that have obviously wrong results (like 0 = 1). Those errors are aimed to be resolved by applying critical thinking (i.e., reasonable, reflective, responsible, and skillful thinking). This book is structured in such a way that finding a problem for a given solution with the wrong answer requires a proper diagnosis by asking the right questions, which is one of the first steps to critical thinking. The objective of this book is to motivate students to identify various strategies and to develop criteria for choosing a suitable strategy to resolve obvious errors or illogical statements.

HB 9781536140477 £185.99 September 2018 Nova Science Publishers 267 pages
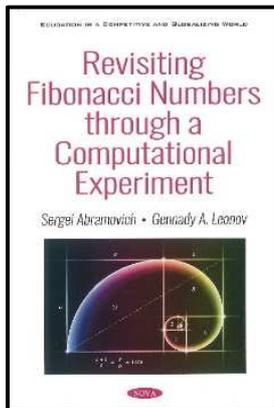
Revisiting Fibonacci Numbers through a Computational Experiment

Sergei Abramovich, Gennady A. Leonov

The material of this book stems from the idea of integrating a classic concept of Fibonacci numbers with commonly available digital tools including a computer spreadsheet, Maple, Wolfram Alpha, and the graphing calculator. This integration made it possible to introduce a number of new concepts such as: Generalized golden ratios in the form of cycles represented by the strings of real numbers; Fibonacci-like polynomials the roots of which define those cycles' dependence on a parameter; the directions of the cycles described in combinatorial terms of permutations with rises, as the parameter changes on the number line; Fibonacci sieves of order k; (r, k)-sections of Fibonacci numbers; and polynomial generalizations of Cassini's, Catalan's, and other identities for Fibonacci numbers.

The development of these concepts was motivated by considering the difference equation $f_{(n+1)}=af_n+bf_{(n-1)}, f_0=f_1=1$, and, by taking advantage of capabilities of the modern-day digital tools, exploring the behavior of the ratios $f_{(n+1)}/f_n$ as n increases. The initial use of a spreadsheet can demonstrate that, depending on the values of a and b, the ratios can either be attracted by a number (known as the Golden Ratio in the case a = b = 1) or by the strings of numbers (cycles) of different lengths. In general, difference equations, both linear and non-linear ones serve as mathematical models in radio engineering, communication, and computer architecture research. In mathematics education, commonly available digital tools enable the introduction of mathematical complexity of the behavior of these models to different groups of students through the modern-day combination of argument and computation.

The book promotes experimental mathematics techniques which, in the digital age, integrate intuition, insight, the development of mathematical models, conjecturing, and various ways of justification of conjectures. The notion of technology-immune/technology-enabled problem solving is introduced as an educational analogue of the notion of experimental mathematics. In the spirit of John Dewey, the book provides many collateral learning opportunities enabled by experimental mathematics techniques. Likewise, in the spirit of George Pólya, the book champions carrying out computer experimentation with mathematical concepts before offering their formal demonstration.

The book can be used in secondary mathematics teacher education programs, in undergraduate mathematics courses for students majoring in mathematics, computer science, electrical and mechanical engineering, as well as in other mathematical programs that study difference equations in the broad context of discrete mathematics.

PB 9781536149050 £185.99 March 2019 Nova Science Publishers 145 pages
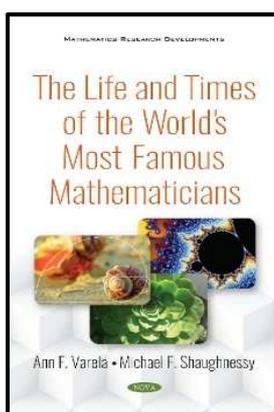
The Life and Times of the World's Most Famous Mathematicians

Michael F. Shaughnessy, Ann Varela

Arithmetic, math, algebra, geometry, trigonometry, calculus and statistics are all part of the modern world, yet so few of us know where these fields of study originated. In this book, the lives and discoveries of various mathematicians will be explored and examined, so as to provide some insight into various mathematical functions and operations.

HB 9781536139754 £185.99 July 2018 Nova Science Publishers 189 pages
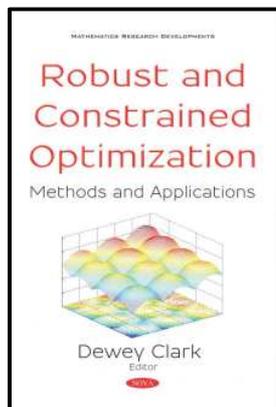
Robust and Constrained Optimization
Methods and Applications
Edited by Dewey Clark

In recent years, the volume of available data has grown exponentially and paved the way for new models in decision-making, particularly decision making under uncertainty. Thus, the opening chapter of Robust and Constrained Optimization: Methods and Applications introduces different robust models induced by three well-known data-driven uncertainty sets: distributional, clustering-oriented, and cutting hyperplanes uncertainty sets. Following this, the authors describe a model of an uncertain vector optimization problem and define robust solutions. Scalarization and vectorization techniques are proposed as efficient ways to compute robust solutions. In one study, a rain-fall optimization algorithm has been applied as a new naturally-inspired algorithm based on the behavior of raindrops. This algorithm has been developed with the goal of finding a simpler and more effective search algorithm to optimize multi-dimensional numerical test functions. The process considers the numerical differential of the cost function rather than the mathematical computation of the gradient. The authors examine the preconditioned iterative solution of a particular type of linear systems, mainly involving matrices of a two-by-two block form with square matrix blocks. Such systems arise in the finite element solution of optimal control problems for partial differential equations in various applications. Finally, it is shown how various metaheuristic algorithms (including memetic, interval, and random search optimization methods) can be applied to solve different types of optimal control problems (e.g., satellite stabilization, solar sail control, interception problems). Hybrid global optimization methods, which combine strategies from several different metaheuristic random search algorithms, are suggested in an attempt to improve accuracy of the obtained solution.

PB 9781536148350 £90.99 January 2019 Nova Science Publishers 178 pages
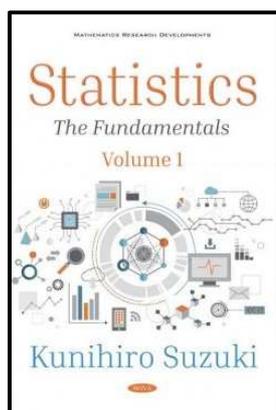
Statistics
Kunihiro Suzuki

We utilize statistics in our daily life: when we evaluate TV program ratings, predict voting results, prepare stocks, make sales predictions, and when we evaluate the effectiveness of medical treatments. We predict the results not on the basis of personal experience, but on the basis of data. However, the accuracy of the prediction depends on the data, the theory, and the depth of understanding of the model used. This book consists of three volumes: The first volume covers the fundamentals of statistics; The second volume discusses multiple variable analyses; and the third volume covers categorical and time dependent data analysis.

In this volume, consisting of the fundamentals of statistics, we study average, variance, and probability functions. Probability functions are characterized by their moments, and we also study various techniques to evaluate these moments. In this book, we cover fundamental models to advanced models without skipping their derivation processes. We can then clearly understand the assumptions and approximations used in each model, and hence, understand the limitations of the models. We also discuss almost all of the subjects in statistics, since they are all related to each other.

Although this book includes advanced models, readers who are not statisticians can easily understand the content, since we work our way up the derivations from the fundamental level to advanced levels without skipping any. We do hope that the readers will come away with an understanding of the meaning of the models in statistics, and the techniques used to reach the final results.

Volume 1 HB 9781536144628 £219.99 March 2019 Nova Science Publishers 410 pages
Volume 2 HB 9781536151220 £257.99 April 2019 Nova Science Publishers 146 pages
Volume 3 HB 9781536151244 £257.99 April 2019 Nova Science Publishers 155 pages
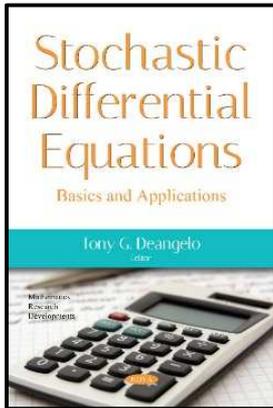
Stochastic Differential Equations
## Basics and Applications
Edited by Tony G. Deangelo

In this collection, the authors begin by introducing a methodology for examining continuous-time Ornstein-Uhlenbech family processes defined by stochastic differential equations (SDEs). Additionally, a study is presented introducing the mathematics of mixed effect parameters in univariate and bivariate SDEs and describing how such a model can be used to aid our understanding of growth processes using real world datasets.

Results and experience from applying the concepts and techniques in an extensive individual tree and stand growth modeling program in Lithuania are described as examples. Next, the authors present a review paper on J-calculus, as well as a contributed paper which displays some new results on the topic and deepens some special properties in relation with non-differentiability of functions.

Following this, this book develops the general framework to be used in our papers [2, 9, 8]. The starting point for the discussion will be the standard risk-sensitive structures, and how constructions of this kind can be given a rigorous treatment. The risk-sensitive optimal control is also investigated by using the extending part of this of problem of backward stochastic equation. In the closing article, the authors note that the square of an O-U process is the Cox-Ingersoll-Ross process used as a model for volatility in finance. The filtered form of the original hazard rate based on this new observation is also studied. If the difference between the original hazard rate and the filtered one is not significant, then the person is not affected by the new frailty.

PB 9781536138092 £78.99 September 2018 Nova Science Publishers 112 pages
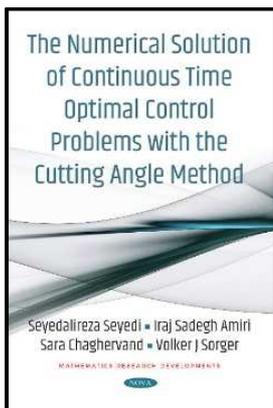
The Numerical Solution of Continuous Time Optimal Control Problems with the Cutting Angle Method
Seyedalireza Seyedi, Iraj Sadegh Amiri, Sara Chaghervand, Volker J Sorger

This book consists of two parts. The first part is on the development of the proposition that "if there exists a type of function, then there exists a functional with the same type" based on the proposition of the inheritance and generalizability properties of a function in a functional. This study presents the abstract convex, increasing positively homogeneous and convex-along-rays functionals via this proposition. The second part concerns the investigation of the use of a global search optimization algorithm called the Cutting Angle Method (CAM) on Optimal Control Problems (OCP). Many algorithms are available for solving OCP, but they are basically local search algorithms. To overcome the problem associated with local searches, most OCP are modeled as Linear Quadratic Regulator (LQR) problems in the hope that the solution found estimates of the true global solution to the original problem. However, in doing so, a lot of information carried by the original problem might be lost in its translation into LQR models.

CAM being a global search algorithm is expected to overcome this problem. It can be used alone or in combination with a local search to find the global solution. CAM has been successfully used on functions, however, OCP are functionals. To do this, a model has been introduced based on inheritance and generalizability properties to demonstrate that the optimization algorithms that are used for functions can also be extended for use in functionals. Based on these properties, the study discovered that with the Unit Vectors Combinations Technique (UVCT) proposed in this research, CAM could successfully work on functionals in general and OCP particularly. To help speed up the convergence of CAM, the literature proposed the use of local searches for the determination of the initial solution. In a case study done in the research, CAM was successfully combined with a local search known as the Dynamic Integrated System Optimization and Parameter Estimation (DISOPE) algorithm. Moreover, the initial solution given by the DISOPE algorithm has been verified as a global influence by CAM.

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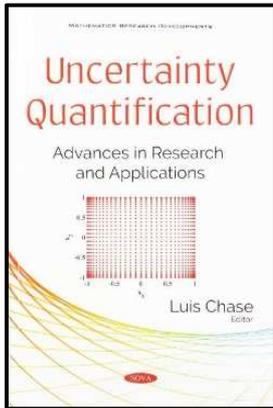
Uncertainty Quantification
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Edited by Luis Chase

In recent times, polynomial chaos expansion has emerged as a dominant technique to determine the response uncertainties of a system by propagating the uncertainties of the inputs. In this regard, the opening chapter of *Uncertainty Quantification: Advances in Research and Applications*, an intrusive approach called Galerkin Projection as well as non-intrusive approaches (such as pseudo-spectral projection and linear regression) are discussed. Next, the authors introduce a new methodology to determine the uncertainties of input parameters using CIRCÉ software to overcome the reliance on expert judgment. The goal is to determinate and evaluate the uncertainty bounds for physical models related to reflood model of MARS-KS code Vessel module (coupled with COBRA-TF) using both CIRCÉ and the experimental data of FEBA.

Lastly, uncertainties related to rheological model parameters of skeletal muscles are modeled and analyzed, and available data are acquired and fused for hyperelastic constitutive model parameters with Neo-Hookean and Mooney-Rivlin formulations.

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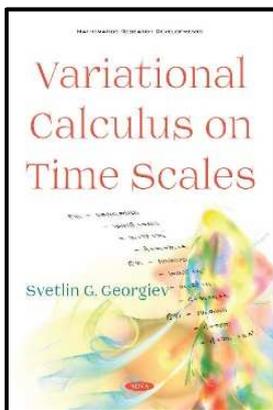
Variational Calculus on Time Scales
Svetlin Georgiev

This book encompasses recent developments of variational calculus for time scales. It is intended for use in the field of variational calculus and dynamic calculus for time scales. It is also suitable for graduate courses in the above fields. This book contains eight chapters, and these chapters are pedagogically organized. This book is specially designed for those who wish to understand variational calculus on time scales without having an extensive mathematical background.

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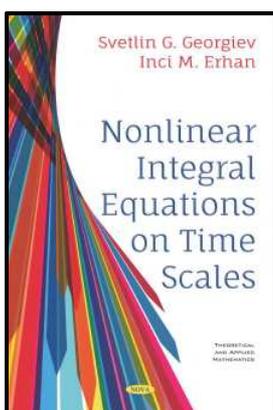
Nonlinear Integral Equations on Time Scales
Svetlin Georgiev, Inci M. Erhan

This book presents an introduction to the theory of nonlinear integral equations on time scales. Many population discrete models such as the logistic model, the Ricker model, the Beverton-Holt model, Leslie-Gower competition model and others can be investigated using nonlinear integral equations on the set of the natural numbers. This book contains different analytical and numerical methods for investigation of nonlinear integral equations on time scales. It is primarily intended for senior undergraduate students and beginning graduate students of engineering and science courses. Students in mathematical and physical sciences willfind many sections of direct relevance. This book contains nine chapters, and each chapter consists of numerous examples and exercises.

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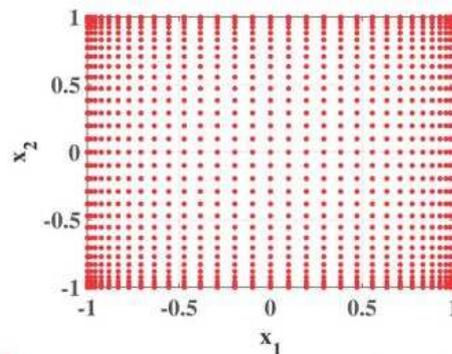
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