Linear Algebra Unipg

It is now a century ago that one of the icons of modern physics published some of the most influential scientific papers of all times. With his work on relativity and quantum theory, Albert Einstein has altered the field of physics forever. It should not come as a surprise that looking back at Einstein's work, one needs to rethink the whole scope of physics, before and after his time. This books aims to provide a perspective on the history of modern physics, spanning from the late 19th century up to today. It is not an encyclopaedic work, but it presents the groundbreaking and sometimes provocative main contributions by Einstein as marking the line between 'old' and 'new' physics, and expands on some of the developments and open issues to which they gave rise. This presentation is not meant as a mere celebration of Einstein's work, but as a critical appraisal which provides accurate historical and conceptual information. The contributing authors all have a reputation for working on themes related to Einstein's work and its consequences. Therefore, the collection of papers gives a good representation of what happened in the 100 years after Einstein's landmark Annalen der Physik articles. All people interested in the field of physics, history of science and epistemology could benefit from this book. An effort has been made to make the book attractive not only to scientists, but also to people with a more basic knowledge of mathematics and physics.

This volume contains both invited lectures and contributed talks presented at the meeting on Total Positivity and its Applications held at the guest house of the University of Zaragoza in Jaca, Spain, during the week of September 26-30, 1994. There were present at the meeting almost fifty researchers from fourteen countries. Their interest in thesubject of Total Positivity made for a stimulating and fruitful exchange of scientific information. Interest to participate in the meeting exceeded our expectations. Regrettably, budgetary constraints forced us to restriet the number of attendees. Professor S. Karlin, of Stanford University, who planned to attend the meeting had to cancel his participation at the last moment. Nonetheless, his almost universal spiritual presence energized and inspired all of us in Jaca. More than anyone, he influenced the content, style and quality of the presentations given at the meeting. Every article in these Proceedings (except some by Karlin hirnself) references his influential treatise Total Positivity, Volume I, Stanford University Press, 1968. Since its appearance, this book has intrigued and inspired the minds of many researchers (one of us, in his formative years, read the galley proofs and the other of us first doubted its value but then later became its totally committed disciple). All of us present at the meeting encourage Professor Karlin to return to the task of completing the anxiously awaited Volume 11 of Total Positivity.

This book gathers selected contributions presented at the INdAM Meeting Structured Matrices in Numerical Linear Algebra: Analysis, Algorithms and Applications, held in Cortona, Italy on September 4-8, 2017. Highlights cutting-edge research on Structured Matrix Analysis, it covers theoretical issues, computational aspects, and applications alike. The contributions, written by authors from the foremost international groups in the community, trace the main research lines and treat the main problems of current interest in this field. The book offers a valuable resource for all scholars who are interested in this topic, including researchers, PhD students and post-docs.

Praise for the Second Edition: "The authors present an intuitive and easy-to-read book. ... accompanied by many examples, proposed exercises, good references, and comprehensive appendices that initiate the reader unfamiliar with MATLAB." —Adolfo Alvarez Pinto, International Statistical Review "Practitioners of EDA who use MATLAB will want a copy of this book. ... The authors have done a great service by bringing together so many EDA routines, but their main accomplishment in this dynamic text is providing the understanding and tools to do EDA. —David A Huckaby, MAA Reviews Exploratory Data Analysis (EDA) is an important part of the data analysis process. The methods presented in this text are ones that should be in the toolkit of every data scientist. As computational sophistication has increased and data sets have grown in size and complexity, EDA has become an even more important process for visualizing and summarizing data before making assumptions to generate hypotheses and models. Exploratory Data Analysis with MATLAB, Third Edition presents EDA methods from a computational perspective and uses numerous examples and applications to show how the methods are used in practice. The authors use MATLAB code, pseudo-code, and algorithm descriptions to illustrate the concepts. The MATLAB code for examples, data sets, and the EDA Toolbox are available for download on the book's website. New to the Third Edition Random projections and estimating local intrinsic dimensionality Deep learning autoencoders and stochastic neighbor embedding Minimum spanning tree and additional cluster validity indices Kernel density estimation Plots for visualizing data distributions, such as beanplots and violin plots A chapter on visualizing categorical data

Mathematicians from various countries assemble computational techniques that have developed and described over the past two decades to analyze matrices with structure, which are encountered in a wide variety of problems in pure and applied mathematics and in engineering. The 16 studies are on asymptotical spectral properties; algorithm design and analysis; issues specifically relating to structures, algebras, and polynomials; and image processing and differential equations. c. Book News Inc.

Computational Science - ICCS 2003International Conference, Melbourne, Australia and St. Petersburg, Russia, June 2-4, 2003. ProceedingsSpringer Science & Business Media Eigenvalue computations are ubiquitous in science and engineering. John Francis's implicitly shifted QR algorithm has been the method of choice for small to medium sized eigenvalue problems since its invention in 1959. This book presents a new view of this classical algorithm. While Francis's original procedure chases bulges, the new version chases core transformations, which allows the development of fast algorithms for eigenvalue problems with a variety of special structures. This also leads to a fast and backward stable algorithm for computing the roots of a polynomial by solving the companion matrix eigenvalue problem. The authors received a SIAM Outstanding Paper prize for this

work. This book will be of interest to researchers in numerical linear algebra and their students.

... "What do you call work?" "Why ain't that work?" Tom resumed his whitewashing, and answered carelessly: "Well. II1a), he it is, and maybe it aill't. All I know, is, it suits Tom Sawvc/:" "Oil CO/lll!, IIOW, Will do not mean to let 011 that you like it?" The brush continued to move. "Likc it? Well, I do not see wlzy I oughtn't to like it. Does a hoy get a chance to whitewash a fence every day?" That put the thing ill a Ilew light. Ben stopped nibhling the apple ... (From Mark Twain's Adventures of Tom Sawyer, Chapter II.) Mathematics can put quantitative phenomena in a new light; in turn applications may provide a vivid support for mathematical concepts. This volume illustrates some aspects of the mathematical treatment of phase transitions, namely, the classical Stefan problem and its generalizations. The in tended reader is a researcher in application-oriented mathematics. An effort has been made to make a part of the book accessible to beginners, as well as physicists and engineers with a mathematical background. Some room has also been devoted to illustrate analytical tools. This volume deals with research I initiated when I was affiliated with the Istituto di Analisi Numerica del C.N.R. in Pavia, and then continued at the Dipartimento di Matematica dell'Universita di Trento. It was typeset by the author in plain TEX.

Most coding theory experts date the origin of the subject with the 1948 publication of A Mathematical Theory of Communication by Claude Shannon. Since then, coding theory has grown into a discipline with many practical applications (antennas, networks, memories), requiring various mathematical techniques, from commutative algebra, to semi-definite programming, to algebraic geometry. Most topics covered in the Concise Encyclopedia of Coding Theory are presented in short sections at an introductory level and progress from basic to advanced level, with definitions, examples, and many references. The book is divided into three parts: Part I fundamentals: cyclic codes, skew cyclic codes, quasi-cyclic codes, self-dual codes, codes and designs, codes over rings, convolutional codes, performance bounds Part II families: AG codes, group algebra codes, few-weight codes, Boolean function codes, codes over graphs Part III applications: alternative metrics, algorithmic techniques, interpolation decoding, pseudo-random sequences, lattices, quantum coding, space-time codes, network coding, distributed storage, secret-sharing, and code-based-cryptography. Features Suitable for students and researchers in a wide range of mathematical disciplines Contains many examples and references Most topics take the reader to the frontiers of research

The five-volume set LNCS 6782 - 6786 constitutes the refereed proceedings of the International Conference on Computational Science and Its Applications, ICCSA 2011, held in Santander, Spain, in June 2011. The five volumes contain papers presenting a wealth of original research results in the field of computational science, from foundational issues in computer science and mathematics to advanced applications in virtually all sciences making use of computational techniques. The topics of the fully refereed papers are structured according to the five major conference themes: geographical analysis, urban modeling, spatial statistics; cities, technologies and planning; computational geometry and applications; computer aided modeling, simulation, and analysis; and mobile communications.

This book has two main purposes. On the one hand, it provides a concise and systematic development of the theory of lower previsions, based on the concept of acceptability, in spirit of the work of Williams and Walley. On the other hand, it also extends this theory to deal with unbounded quantities, which abound in practical applications. Following Williams, we start out with sets of acceptable gambles. From those, we derive rationality criteria---avoiding sure loss and coherence---and inference methods---natural extension---for (unconditional) lower previsions. We then proceed to study various aspects of the resulting theory, including the concept of expectation (linear previsions), limits, vacuous models, classical propositional logic, lower oscillations, and monotone convergence. We discuss n-monotonicity for lower previsions, and relate lower previsions with Choquet integration, belief functions, random sets, possibility measures, various integrals, symmetry, and representation theorems based on the Bishop-De Leeuw theorem. Next, we extend the framework of sets of acceptable gambles to consider also unbounded quantities. As before, we again derive rationality criteria and inference methods for lower previsions, this time also allowing for conditioning. We apply this theory to construct extensions of lower previsions from bounded random quantities to a larger set of random quantities, based on ideas borrowed from the theory of Dunford integration. A first step is to extend a lower prevision to random quantities that are bounded on the complement of a null set (essentially bounded random quantities). This extension is achieved by a natural extension procedure that can be motivated by a rationality axiom stating that adding null random quantities does not affect acceptability. In a further step, we approximate unbounded random quantities by a sequences of bounded ones, and, in essence, we identify those for which the induced lower prevision limit does not depend on the details of the approximation. We call those random quantities 'previsible'. We study previsibility by cut sequences, and arrive at a simple sufficient condition. For the 2-monotone case, we establish a Choquet integral representation for the extension. For the general case, we prove that the extension can always be written as an envelope of Dunford integrals. We end with some examples of the theory.

Richard Feynman's never previously published doctoral thesis formed the heart of much of his brilliant and profound work in theoretical physics. Entitled ?The Principle of Least Action in Quantum Mechanics," its original motive was to quantize the classical action-at-a-distance electrodynamics. Because that theory adopted an overall space?time viewpoint, the classical Hamiltonian approach used in the conventional formulations of quantum theory could not be used, so Feynman turned to the Lagrangian function and the principle of least action as his points of departure.The result was the path integral approach, which satisfied ? and transcended ? its original motivation, and has enjoyed great success in renormalized quantum field theory, including the derivation of the ubiquitous Feynman diagrams for elementary particles. Path integrals have many other applications, including atomic, molecular, and nuclear scattering, statistical mechanics, quantum liquids and solids, Brownian motion, and noise theory. It also sheds new light on fundamental issues like the interpretation of quantum theory because of its new overall space?time viewpoint.The present volume includes Feynman's Princeton thesis, the related review article ?Space?Time Approach to Non-Relativistic Quantum Mechanics? [Reviews of Modern Physics 20 (1948), 367?387], Paul Dirac's seminal paper ?The Lagrangian in Quantum Mechanics'' [Physikalische Zeitschrift der Sowjetunion, Band 3, Heft 1 (1933)], and an introduction by Laurie M Brown.

This authoritative book presents recent research results on nonlinear problems with lack of compactness. The topics covered include several nonlinear problems in the Euclidean setting as well as variational problems on manifolds. The combination of deep techniques in nonlinear analysis with applications to a variety of problems make this work an essential source of information for researchers and graduate students working in analysis and PDE's.

This treatment of the basic theory of algebraic Riccati equations describes the classical as well as the more advanced algorithms for their solution in a manner that is accessible to both practitioners and scholars. It is the first book in which nonsymmetric algebraic Riccati equations are treated in a clear and systematic way. Some proofs of theoretical results have been simplified and a unified notation has been adopted. Readers will find a unified discussion of doubling algorithms, which are effective in solving algebraic Riccati equations as well as a detailed description of all classical and advanced algorithms for solving algebraic Riccati equations and their MATLAB codes. This will help the reader gain an understanding of the computational issues and provide ready-to-use implementation of the different solution techniques.

The four-volume set LNCS 2657, LNCS 2658, LNCS 2659, and LNCS 2660 constitutes the refereed proceedings of the Third International Conference on Computational Science, ICCS 2003, held concurrently in Melbourne, Australia and in St. Petersburg, Russia in June 2003. The four volumes present more than 460 reviewed contributed and invited papers and span the whole range of computational science, from foundational issues in computer science and algorithmic mathematics to advanced applications in virtually all application fields making use of computational techniques. These proceedings give

a unique account of recent results in the field.

This state-of-the-art survey offers a renewed and refreshing focus on the progress in evolutionary computation, in neural networks, and in fuzzy systems. The book presents the expertise and experiences of leading researchers spanning a diverse spectrum of computational intelligence in these areas. The result is a balanced contribution to the research area of computational intelligence that should serve the community not only as a survey and a reference, but also as an inspiration for the future advancement of the state of the art of the field. The 13 selected chapters originate from lectures and presentations given at the IEEE World Congress on Computational Intelligence, WCCI 2012, held in Brisbane, Australia, in June 2012.

Non-Additive Measure and Integral is the first systematic approach to the subject. Much of the additive theory (convergence theorems, Lebesgue spaces, representation theorems) is generalized, at least for submodular measures which are characterized by having a subadditive integral. The theory is of interest for applications to economic decision theory (decisions under risk and uncertainty), to statistics (including belief functions, fuzzy measures) to cooperative game theory, artificial intelligence, insurance, etc. Non-Additive Measure and Integral collects the results of scattered and often isolated approaches to non-additive measures and their integrals which originate in pure mathematics, potential theory, statistics, game theory, economic decision theory and other fields of application. It unifies, simplifies and generalizes known results and supplements the theory with new results, thus providing a sound basis for applications and further research in this growing field of increasing interest. It also contains fundamental results of sigma-additive and finitely additive measure and integration theory and sheds new light on additive theory. Non-Additive Measure and Integral employs distribution functions and quantile functions as basis tools, thus remaining close to the familiar language of probability theory. In addition to serving as an important reference, the book can be used as a mathematics textbook for graduate courses or seminars, containing many exercises to support or supplement the text.

The four-volume set LNCS 3480-3483 constitutes the refereed proceedings of the International Conference on Computational Science and Its Applications, ICCSA 2005, held in Singapore in May 2005. The four volumes present a total of 540 papers selected from around 2700 submissions. The papers span the whole range of computational science, comprising advanced applications in virtually all sciences making use of computational techniques as well as foundations, techniques, and methodologies from computer science and mathematics, such as high performance computing and communication, networking, optimization, information systems and technologies, scientific visualization, graphics, image processing, data analysis, simulation and modelling, software systems, algorithms, security, multimedia etc.

This book is a tribute to Lotfi A. Zadeh, the father of fuzzy logic, on the occasion of his 90th Birthday. The book gathers original scientific contributions written by top scientists and presenting the latest theories, applications and new trends in the fascinating and challenging field of soft computing.

This book constitutes the proceedings of the 5th International Conference on Geometric Science of Information, GSI 2021, held in Paris, France, in July 2021. The 98 papers presented in this volume were carefully reviewed and selected from 125 submissions. They cover all the main topics and highlights in the domain of geometric science of information, including information geometry manifolds of structured data/information and their advanced applications. The papers are organized in the following topics: Probability and statistics on Riemannian Manifolds; sub-Riemannian geometry and neuromathematics; shapes spaces; geometry of quantum states; geometric and structure preserving discretizations; information geometry in physics; Lie group machine learning; geometric and symplectic methods for hydrodynamical models; harmonic analysis on Lie groups; statistical manifold and Hessian information geometry; geometric mechanics; deformed entropy, cross-entropy, and relative entropy; transformation information geometry; statistics, information and topology; geometric deep learning; topological and geometrical structures in neurosciences; computational information geometry; manifold and optimization; divergence statistics; optimal transport and learning; and geometric structures in thermodynamics and statistical physics.

This book constitutes the refereed proceedings of the 9th International Conference on Developments in Language Theory, DLT 2005, held in Palermo, Italy in July 2005. The 29 revised full papers presented together with 5 invited papers were carefully reviewed and selected from 73 submissions. All important issues in language theory are addressed including grammars, acceptors, and transducers for strings frees, graphs, and arrays; efficient text algorithms; algebraic theories for automata and languages; variable-length codes; symbolic dynamics; decision problems; relations to complexity theory and logic; picture description and analysis; cryptography; concurrency; DNA computing; and quantum computing.

This volume presents a systematic and unified treatment of Leray-Schauder continuation theorems in nonlinear analysis. In particular, fixed point theory is established for many classes of maps, such as contractive, non-expansive, accretive, and compact maps, to name but a few. This book also presents coincidence and multiplicity results. Many appli

The aim of this monograph is to give a thorough and self-contained account of functions of (generalized) bounded variation, the methods connected with their study, their relations to other important function classes, and their applications to various problems arising in Fourier analysis and nonlinear analysis. In the first part the basic facts about spaces of functions of bounded variation and related spaces are collected, the main ideas which are useful in studying their properties are presented, and a comparison of their importance and suitability for applications is provided, with a particular emphasis on illustrative examples and counterexamples. The second part is concerned with (sometimes quite surprising) properties of nonlinear composition and superposition operators in such spaces. Moreover, relations with Riemann-Stieltjes integrals, convergence tests for Fourier series, and applications to nonlinear integral equations are discussed. The only prerequisite for understanding this book is a modest background in real analysis, functional analysis, and operator theory. It is addressed to non-specialists who want to get an idea of the development of the theory and its applications in the last decades, as well as a glimpse of the diversity of the directions in which current research is moving. Since the authors try to take into account recent results and state several open problems, this book might also be a fruitful source of inspiration for further research.

In celebration of Haim Brezis's 60th birthday, a conference was held at the Ecole Polytechnique in Paris, with a program testifying to Brezis's wide-ranging influence on nonlinear analysis and partial differential equations. The articles in this volume are primarily from that conference. They present a rare view of the state of the art of many aspects of nonlinear PDEs, as well as describe new directions that are being opened up in this field. The articles, written by mathematicians at the center of current developments, provide somewhat more personal views of the important developments and challenges.

The second edition of An Introduction to Differentiable Manifolds and Riemannian Geometry, Revised has sold over 6,000 copies since publication in 1986 and this revision will make it even more useful. This is the only book available that is approachable by "beginners" in this subject. It has become an essential introduction to the subject for mathematics students, engineers, physicists, and economists who need to learn how to apply these vital methods. It is also the only book that thoroughly reviews certain areas of advanced calculus that are necessary to understand the subject. Line and surface integrals Divergence and curl of vector fields

The growing capabilities in generating and collecting data has risen an urgent need of new techniques and tools in order to analyze, classify and summarize statistical information, as well as to discover and characterize trends, and to automatically bag anomalies. This volume provides the latest advances in data analysis methods for multidimensional data which can present a complex structure: The book offers

a selection of papers presented at the first Joint Meeting of the Société Francophone de Classification and the Classification and Data Analysis Group of the Italian Statistical Society. Special attention is paid to new methodological contributions from both the theoretical and the applicative point of views, in the fields of Clustering, Classification, Time Series Analysis, Multidimensional Data Analysis, Knowledge Discovery from Large Datasets, Spatial Statistics.

This three volume set (CCIS 1237-1239) constitutes the proceedings of the 18th International Conference on Information Processing and Management of Uncertainty in Knowledge-Based Systems, IPMU 2020, in June 2020. The conference was scheduled to take place in Lisbon, Portugal, at University of Lisbon, but due to COVID-19 pandemic it was held virtually. The 173 papers were carefully reviewed and selected from 213 submissions. The papers are organized in topical sections: homage to Enrique Ruspini; invited talks; foundations and mathematics; decision making, preferences and votes; optimization and uncertainty; games; real world applications; knowledge processing and creation; machine learning I; machine learning II; XAI; image processing; temporal data processing; text analysis and processing; fuzzy interval analysis; theoretical and applied aspects of imprecise probabilities; similarities in artificial intelligence; belief function theory and its applications; aggregation: theory and practice; aggregation: pre-aggregation functions and other generalizations of monotonicity; aggregation: aggregation of different data structures; fuzzy methods in data mining and knowledge discovery; computational intelligence for logistics and transportation problems; fuzzy implication functions; soft methods in statistics and data analysis; image understanding and explainable AI; fuzzy and generalized quantifier theory; mathematical methods towards dealing with uncertainty in applied sciences; statistical image processing and analysis, with applications in neuroimaging; interval uncertainty; discrete models and computational intelligence; current techniques to model, process and describe time series; mathematical fuzzy logic and graded reasoning models; formal concept analysis, rough sets, general operators and related topics; computational intelligence methods in information modelling, representation and processing.

In Noether's original presentation of her celebrated theorem of 1918, allowances were made for the dependence of the coefficient functions of the differential operator which generated the infinitesimal transformation of the Action Integral upon the derivatives of the dependent variable(s), the so-called generalized, or dynamical, symmetries. A similar allowance is to be found in the variables of the boundary function, often termed a gauge function by those who have not read the original paper. This generality was lost after texts such as those of Courant and Hilbert or Lovelock and Rund confined attention to only point transformations. In recent decades, this diminution of the power of Noether's Theorem has been partly countered, in particular, in the review of Sarlet and Cantrijn. In this Special Issue, we emphasize the generality of Noether's Theorem in its original form and explore the applicability of even more general coefficient functions by allowing for nonlocal terms. We also look at the application of these more general symmetries to problems in which parameters or parametric functions have a more general dependence upon the independent variables.

This volume provides recent research results in data analysis, classification and multivariate statistics and highlights perspectives for new scientific developments within these areas. Particular attention is devoted to methodological issues in clustering, statistical modeling and data mining. The volume also contains significant contributions to a wide range of applications such as finance, marketing, and social sciences. The papers in this volume were first presented at the 7th Conference of the Classification and Data Analysis Group (ClaDAG) of the Italian Statistical Society, held at the University of Catania, Italy.

This book is the first of two volumes which contain the proceedings of the Workshop on Nonlinear Partial Differential Equations, held from May 28-June 1, 2012, at the University of Perugia in honor of Patrizia Pucci's 60th birthday. The workshop brought t

Algorithmic discrete mathematics plays a key role in the development of information and communication technologies, and methods that arise in computer science, mathematics and operations research – in particular in algorithms, computational complexity, distributed computing and optimization – are vital to modern services such as mobile telephony, online banking and VoIP. This book examines communication networking from a mathematical viewpoint. The contributing authors took part in the European COST action 293 – a four-year program of multidisciplinary research on this subject. In this book they offer introductory overviews and state-of-the-art assessments of current and future research in the fields of broadband, optical, wireless and ad hoc networks. Particular topics of interest are design, optimization, robustness and energy consumption. The book will be of interest to graduate students, researchers and practitioners in the areas of networking, theoretical computer science, operations research, distributed computing and mathematics.

These four volumes (CCIS 297, 298, 299, 300) constitute the proceedings of the 14th International Conference on Information Processing and Management of Uncertainty in Knowledge-Based Systems, IPMU 2012, held in Catania, Italy, in July 2012. The 258 revised full papers presented together with six invited talks were carefully reviewed and selected from numerous submissions. The papers are organized in topical sections on fuzzy machine learning and on-line modeling; computing with words and decision making; soft computing in computer vision; rough sets and complex data analysis: theory and applications; intelligent databases and information system; information fusion systems; philosophical and methodological aspects of soft computing; basic issues in rough sets; 40th anniversary of the measures of fuziness; SPS11 uncertainty in profiling systems and applications; handling uncertainty with copulas; formal methods to deal with uncertainty of many-valued events; linguistic summarization and description of data; fuzzy implications: theory and applications; sensing and data mining for teaching and learning; theory and applications of intuitionistic fuzzy sets; approximate aspects of data mining and database analytics; fuzzy numbers and their applications; information processing and management of uncertainty in knowledge-based systems; aggregation functions; imprecise probabilities; probabilistic graphical models with imprecision: theory and applications; belief function theory: basics and/or applications; fuzzy uncertainty in economics and business; new trends in De Finetti's approach; fuzzy measures and integrals; multi criteria decision making; uncertainty in privacy and security; uncertainty in the spirit of Pietro Benvenuti; coopetition; game theory; probabilistic approach.

Focusing on stochastic porous media equations, this book places an emphasis on existence theorems, asymptotic behavior and ergodic properties of the associated transition semigroup. Stochastic perturbations of the porous media equation have reviously been considered by physicists, but rigorous mathematical existence results have only recently been found. The porous media equation models a number of different physical phenomena, including the flow of an ideal gas and the diffusion of a compressible fluid through porous media, and also thermal propagation in plasma and plasma radiation. Another important application is to a model of the standard self-organized criticality process, called the "sand-pile model" or the "Bak-Tang-Wiesenfeld model". The book will be of interest to PhD students and researchers in mathematics, physics and biology.