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Orthogonal Polynomials and Special Functions - Richard Askey 1975-06-01
This volume presents the idea that one studies orthogonal polynomials and special functions to use them to solve problems.
Convex Analysis and Variational Problems - Ivar Ekeland 1999-12-01
This book contains different developments of infinite dimensional convex programming in the context of convex analysis, including duality, minmax and Lagrangians, and convexification of nonconvex optimization problems in the calculus of variations (infinite dimension). It also includes the theory of convex duality applied to partial differential equations; no other reference presents this in a systematic way. The minmax theorems contained in this book have many useful applications, in particular the robust control of partial differential equations in finite time horizon. First published in English in 1976, this SIAM Classics in Applied Mathematics edition contains the original text along with a new preface and some additional references.
Trust Region Methods - A. R. Conn 2000-01-01
Mathematics of Computing -- General.
MATHEON - Peter Deuflhard 2014
Mathematics: intellectual endeavor, production factor, key technology, key to key technologies? Mathematics is all of these; the last three of its facets are not well known, though. They have been the focus of the research and development in the Berlin-based DFG Research Center MATHEON in the last twelve years. Through these activities, MATHEON has become an international trademark. Its mission and its strategies for carrying out creative, application-driven research in mathematics and cooperating in the solution of complex problems in key technologies are by now a role model for the development of many other centers. Modern key technologies have become highly sophisticated, integrating aspects of engineering, computer, business and other sciences. At the same time, the innovation cycles get shorter and shorter. These simultaneous challenges can be mastered only by qualitatively and quantitatively rigorous methods. And that is where mathematics is indispensable. Flexible mathematical models, as well as fast and accurate methods for numerical simulation and optimization, open new possibilities to handle the indicated complexities, to react quickly, and to explore new options. Researchers in mathematical fields such as optimization, discrete mathematics, numerical analysis, scientific computing, applied analysis and stochastic analysis have to work hand in hand with scientists and engineers to fully exploit this potential and to strengthen the transversal role of mathematics in solving the challenging problems in key technologies. This book presents in seven chapters the research highlights of the research work carried out in the MATHEON application areas: Life Sciences, Networks, Production, Electronic and Photonic Devices, Finance, Visualization, and Education. The chapters summarize many of the contributions, put them in the context of current mathematical research activities, and outline their impact in various key technologies. To make some of the results more easily accessible to the general public, a large number of ``showcases'' are presented that illustrate a few success stories.
Journal of the Society for Industrial and Applied Mathematics - Society for Industrial and Applied Mathematics 1962

Computational Frameworks for the Fast Fourier Transform - Charles Van Loan 1992-01-01
The author captures the interplay between mathematics and the design of effective numerical algorithms.
Mathematical Models - Richard Haberman 1998-12-01
The author uses mathematical techniques to give an in-depth look at models for mechanical vibrations, population dynamics, and traffic flow.
Mathematics and Climate - Hans Kaper 2013-10-18
Mathematics and Climate is a timely textbook aimed at students and researchers in mathematics and statistics who are interested in current

issues of climate science, as well as at climate scientists who wish to become familiar with qualitative and quantitative methods of mathematics and statistics. The authors emphasize conceptual models that capture important aspects of Earth's climate system and present the mathematical and statistical techniques that can be applied to their analysis. Topics from climate science include the Earth?s energy balance, temperature distribution, ocean circulation patterns such as El Ni?o?Southern Oscillation, ice caps and glaciation periods, the carbon cycle, and the biological pump. Among the mathematical and statistical techniques presented in the text are dynamical systems and bifurcation theory, Fourier analysis, conservation laws, regression analysis, and extreme value theory. The following features make Mathematics and Climate a valuable teaching resource: issues of current interest in climate science and sustainability are used to introduce the student to the methods of mathematics and statistics; the mathematical sophistication increases as the book progresses and topics can thus be selected according to interest and level of knowledge; each chapter ends with a set of exercises that reinforce or enhance the material presented in the chapter and stimulate critical thinking and communication skills; and the book contains an extensive list of references to the literature, a glossary of terms for the nontechnical reader, and a detailed index.
SIAM Journal on Matrix Analysis and Applications - 2007

Applied Numerical Linear Algebra - James W. Demmel 1997-08-01
This comprehensive textbook is designed for first-year graduate students from a variety of engineering and scientific disciplines.
Uncountable - David Nirenberg 2021-10-25
Ranging from math to literature to philosophy, Uncountable explains how numbers triumphed as the basis of knowledge—and compromise our sense of humanity. Our knowledge of mathematics has structured much of what we think we know about ourselves as individuals and communities, shaping our psychologies, sociologies, and economies. In pursuit of a more predictable and more controllable cosmos, we have extended mathematical insights and methods to more and more aspects of the world. Today those powers are greater than ever, as computation is applied to virtually every aspect of human activity. Yet, in the process, are we losing sight of the human? When we apply mathematics so broadly, what do we gain and what do we lose, and at what risk to humanity? These are the questions that David and Ricardo L. Nirenberg ask in Uncountable, a provocative account of how numerical relations became the cornerstone of human claims to knowledge, truth, and certainty. There is a limit to these number-based claims, they argue, which they set out to explore. The Nirenbergs, father and son, bring together their backgrounds in math, history, literature, religion, and philosophy, interweaving scientific experiments with readings of poems, setting crises in mathematics alongside world wars, and putting medieval Muslim and Buddhist philosophers in conversation with Einstein, Schrödinger, and other giants of modern physics. The result is a powerful lesson in what counts as knowledge and its deepest implications for how we live our lives.
Industrial Mathematics - Avner Friedman 1994-01-01
Industrial mathematics is a fast growing field within the mathematical sciences. It is characterized by the origin of the problems which it engages; they all come from industry: research and development, finances, and communications. The common feature running through this enterprise is the goal of gaining a better understanding of industrial models and processes through mathematical ideas and computations. The authors of this book have undertaken the approach of presenting real industrial problems and their mathematical modeling as a motivation for developing mathematical methods that are needed for solving the problems. With each chapter presenting one important problem that arises in today's industry, and then studying the problem by mathematical analysis and computation, this book introduces the reader

to many new ideas and methods from ordinary and partial differential equations, and from integral equations and control theory. It brings the excitement of real industrial problems into the undergraduate mathematical curriculum. The problems selected are accessible to students who have already taken what in many colleges and universities constitutes the first two-year basic Calculus sequence. A working knowledge of Fortran, Pascal, or C language is required.

Combined Membership List of the American Mathematical Society, Mathematical Association of America, and the Society for Industrial and Applied Mathematics - American Mathematical Society 2001

Mathematics of Planet Earth - Hans G. Kaper 2019-11-01
Since its inception in 2013, Mathematics of Planet Earth (MPE) focuses on mathematical issues arising in the study of our planet. Interested in the impact of human activities on the Earth's system, this multidisciplinary field considers the planet not only as a physical system, but also as a system supporting life, a system organized by humans, and a system at risk. The articles collected in this volume demonstrate the breadth of techniques and tools from mathematics, statistics, and operations research used in MPE. Topics include climate modeling, the spread of infectious diseases, stability of ecosystems, ecosystem services, biodiversity, infrastructure restoration after an extreme event, urban environments, food security, and food safety. Demonstrating the mathematical sciences in action, this book presents real-world challenges for the mathematical sciences, highlighting applications to issues of current concern to society. Arranged into three topical sections (Geo- and Physical Sciences; Life Sciences, Ecology and Evolution; Socio-economics and Infrastructure), thirteen chapters address questions such as how to measure biodiversity, what mathematics can say about the sixth mass extinction, how to optimize the long-term human use of natural capital, and the impact of data on infrastructure management. The book also treats the subject of infectious diseases with new examples and presents an introduction to the mathematics of food systems and food security. Each chapter functions as an introduction that can be studied independently, offering source material for graduate student seminars and self-study. The range of featured research topics provides mathematical scientists with starting points for the study of our planet and the impact of human activities. At the same time, it offers application scientists a plethora of modern mathematical tools and techniques to address the various topics in practice. Including hundreds of references to the vast literature associated with each topic, this book serves as an inspiration for further research.

Neuro-Fuzzy Control of Industrial Systems with Actuator Nonlinearities - Frank L. Lewis 2002-01-01
Brings neural networks and fuzzy logic together with dynamical control systems. Each chapter presents powerful control approaches for the design of intelligent controllers to compensate for actuator nonlinearities.

Advanced Computing in Industrial Mathematics - Ivan Georgiev 2021-04-03
This book gathers the peer-reviewed proceedings of the 13th Annual Meeting of the Bulgarian Section of the Society for Industrial and Applied Mathematics, BGSIAM'18, held in Sofia, Bulgaria. The general theme of BGSIAM'18 was industrial and applied mathematics with particular focus on: mathematical physics, numerical analysis, high performance computing, optimization and control, mathematical biology, stochastic modeling, machine learning, digitization and imaging, advanced computing in environmental, biomedical and engineering applications.

Advanced Computing in Industrial Mathematics - Krassimir Georgiev 2018-09-27
This book gathers the peer-reviewed proceedings of the 12th Annual Meeting of the Bulgarian Section of the Society for Industrial and Applied Mathematics, BGSIAM'17, held in Sofia, Bulgaria, in December 2017. The general theme of BGSIAM'17 was industrial and applied mathematics, with a particular focus on: high-performance computing, numerical methods and algorithms, analysis of partial differential equations and their applications, mathematical biology, control and uncertain systems, stochastic models, molecular dynamics, neural networks, genetic algorithms, metaheuristics for optimization problems, generalized nets, and Big Data.

Mathematics in Industry - Angela Slavova 2015-09-18
In this book, a wide range of problems concerning recent achievements in the field of industrial and applied mathematics are presented. It

provides new ideas and research for scientists developing and studying mathematical methods and algorithms, and researchers applying them for solving real-life problems. The importance of the computing infrastructure is unquestionable for the development of modern science. The main focus of the book is the application of mathematics to industry and science. It promotes basic research in mathematics leading to new methods and techniques useful to industry and science. The volume also considers strategy-making integration between scientists of applied mathematics and those working in applied informatics, which has potential for long-lasting integration and co-operation. The integration role is regarded here as a tool for consolidation and reinforcement of the research, education and training, and for the transfer of scientific and management knowledge. This volume operates as a medium for the exchange of information and ideas between mathematicians and other technical and scientific personnel. The book will be essential for the promotion of interdisciplinary collaboration between applied mathematics and science, engineering and technology. The main topics examined in this volume are: numerical methods and algorithms; control systems and applications; partial differential equations and real-life applications; the high performance of scientific computing; linear algebra applications; neurosciences; algorithms in industrial mathematics; equations of mathematical physics; and industrial applications of mechanics.

Mathematical Models for Communicable Diseases - Fred Brauer 2013-02-07
A self-contained and comprehensive guide to the mathematical modeling of disease transmission, appropriate for graduate students.

Computational Matrix Analysis - Alan J. Laub 2012-01-01
Using an approach that author Alan Laub calls "matrix analysis for grown-ups," this new textbook introduces fundamental concepts of numerical linear algebra and their application to solving certain numerical problems arising in state-space control and systems theory. It is written for advanced undergraduate and beginning graduate students and can be used as a follow-up to Matrix Analysis for Scientists and Engineers (SIAM, 2005), a compact single-semester introduction to matrix analysis for engineers and computational scientists by the same author. Computational Matrix Analysis provides readers with a one-semester introduction to numerical linear algebra; an introduction to statistical condition estimation in book form for the first time; and an overview of certain computational problems in control and systems theory. The book features a number of elements designed to help students learn to use numerical linear algebra in day-to-day computing or research, including a brief review of matrix analysis, including notation, and an introduction to finite (IEEE) arithmetic; discussion and examples of conditioning, stability, and rounding analysis; an introduction to mathematical software topics related to numerical linear algebra; a thorough introduction to Gaussian elimination, along with condition estimation techniques; coverage of linear least squares, with orthogonal reduction and QR factorization; variants of the QR algorithm; and applications of the discussed algorithms.

The Mathematics of Data - Michael W. Mahoney 2018-11-15
Nothing provided

Nonlinear Waves - Lokenath Debnath 1983-12-30
The outcome of a conference held in East Carolina University in June 1982, this book provides an account of developments in the theory and application of nonlinear waves in both fluids and plasmas. Twenty-two contributors from eight countries here cover all the main fields of research, including nonlinear water waves, K-dV equations, solitions and inverse scattering transforms, stability of solitary waves, resonant wave interactions, nonlinear evolution equations, nonlinear wave phenomena in plasmas, recurrence phenomena in nonlinear wave systems, and the structure and dynamics of envelope solitions in plasmas.

Foundations of Applied Mathematics, Volume I - Jeffrey Humpherys 2017-07-07
This book provides the essential foundations of both linear and nonlinear analysis necessary for understanding and working in twenty-first century applied and computational mathematics. In addition to the standard topics, this text includes several key concepts of modern applied mathematical analysis that should be, but are not typically, included in advanced undergraduate and beginning graduate mathematics curricula. This material is the introductory foundation upon which algorithm analysis, optimization, probability, statistics, differential equations, machine learning, and control theory are built. When used in concert with the free supplemental lab materials, this text teaches students both the theory and the computational practice of modern mathematical

analysis. Foundations of Applied Mathematics, Volume 1: Mathematical Analysis?includes several key topics not usually treated in courses at this level, such as uniform contraction mappings, the continuous linear extension theorem, Daniell?Lebesgue integration, resolvents, spectral resolution theory, and pseudospectra. Ideas are developed in a mathematically rigorous way and students are provided with powerful tools and beautiful ideas that yield a number of nice proofs, all of which contribute to a deep understanding of advanced analysis and linear algebra. Carefully thought out exercises and examples are built on each other to reinforce and retain concepts and ideas and to achieve greater depth. Associated lab materials are available that expose students to applications and numerical computation and reinforce the theoretical ideas taught in the text. The text and labs combine to make students technically proficient and to answer the age-old question, "When am I going to use this?

Education in Applied Mathematics - Society for Industrial and Applied Mathematics 1967

Mathematical Theory of Reliability - Richard E. Barlow 1996-01-01
This monograph presents a survey of mathematical models useful in solving reliability problems. It includes a detailed discussion of life distributions corresponding to wearout and their use in determining maintenance policies, and covers important topics such as the theory of increasing (decreasing) failure rate distributions, optimum maintenance policies, and the theory of coherent systems. The emphasis throughout the book is on making minimal assumptions - and only those based on plausible physical considerations - so that the resulting mathematical deductions may be safely made about a large variety of commonly occurring reliability situations. The first part of the book is concerned with component reliability, while the second part covers system reliability, including problems that are as important today as they were in the 1960s. The enduring relevance of the subject of reliability and the continuing demand for a graduate-level book on this topic are the driving forces behind its re-publication.

Discrete Inverse Problems - Per Christian Hansen 2010
This book gives an introduction to the practical treatment of inverse problems by means of numerical methods, with a focus on basic mathematical and computational aspects. To solve inverse problems, we demonstrate that insight about them goes hand in hand with algorithms.

Algorithms from THE BOOK - Kenneth Lange 2020-05-04
Algorithms are a dominant force in modern culture, and every indication is that they will become more pervasive, not less. The best algorithms are undergirded by beautiful mathematics. This text cuts across discipline boundaries to highlight some of the most famous and successful algorithms. Readers are exposed to the principles behind these examples and guided in assembling complex algorithms from simpler building blocks. Written in clear, instructive language within the constraints of mathematical rigor, Algorithms from THE BOOK includes a large number of classroom-tested exercises at the end of each chapter. The appendices cover background material often omitted from undergraduate courses. Most of the algorithm descriptions are accompanied by Julia code, an ideal language for scientific computing. This code is immediately available for experimentation. Algorithms from THE BOOK is aimed at first-year graduate and advanced undergraduate students. It will also serve as a convenient reference for professionals throughout the mathematical sciences, physical sciences, engineering, and the quantitative sectors of the biological and social sciences.

Numerical Methods for Special Functions - Amparo Gil 2007-01-01
Special functions arise in many problems of pure and applied mathematics, mathematical statistics, physics, and engineering. This book provides an up-to-date overview of numerical methods for computing special functions and discusses when to use these methods depending on the function and the range of parameters. Not only are standard and simple parameter domains considered, but methods valid for large and complex parameters are described as well. The first part of the book (basic methods) covers convergent and divergent series, Chebyshev expansions, numerical quadrature, and recurrence relations. Its focus is on the computation of special functions; however, it is suitable for general numerical courses. Pseudoalgorithms are given to help students write their own algorithms. In addition to these basic tools, the authors discuss other useful and efficient methods, such as methods for computing zeros of special functions, uniform asymptotic expansions, Padé approximations, and sequence transformations. The book also provides specific algorithms for computing several special functions (like Airy functions and parabolic cylinder functions, among others).

Parallel Processing for Scientific Computing - Michael A. Heroux 2006-01-01
Parallel processing has been an enabling technology in scientific computing for more than 20 years. This book is the first in-depth discussion of parallel computing in 10 years; it reflects the mix of topics that mathematicians, computer scientists, and computational scientists focus on to make parallel processing effective for scientific problems. Presently, the impact of parallel processing on scientific computing varies greatly across disciplines, but it plays a vital role in most problem domains and is absolutely essential in many of them. Parallel Processing for Scientific Computing is divided into four parts: The first concerns performance modeling, analysis, and optimization; the second focuses on parallel algorithms and software for an array of problems common to many modeling and simulation applications; the third emphasizes tools and environments that can ease and enhance the process of application development; and the fourth provides a sampling of applications that require parallel computing for scaling to solve larger and realistic models that can advance science and engineering.

Trends in Industrial and Applied Mathematics - Abul Hasan Siddiqi 2013-12-01
An important objective of the study of mathematics is to analyze and visualize phenomena of nature and real world problems for its proper understanding. Gradually, it is also becoming the language of modem financial instruments. To project some of these developments, the conference was planned under the joint auspices of the Indian Society of Industrial and Applied mathematics (ISlAM) and Guru Nanak Dev University (G. N. D. U.), Amritsar, India. Dr. Pammy Manchanda, chairperson of Mathematics Department, G. N. D. U. , was appointed the organizing secretary and an organizing committee was constituted. The Conference was scheduled in World Mathematics Year 2000 but, due one reason or the other, it could be held during 22. -25. January 2001. How ever, keeping in view the suggestion of the International Mathematics union, we organized two symposia, Role of Mathematics in industrial development and vice-versa and How image of Mathematics can be improved in public. These two symposia aroused great interest among the participants and almost everyone participated in the deliberations. The discussion in these two themes could be summarized in the lengthy following lines: "Tradition of working in isolation is a barrier for interaction with the workers in the other fields of science and engineering, what to talk of non-academic areas, specially the private sector of finance and industry. Therefore, it is essential to build bridges within in stitutions and between institutions.

Principles of Computerized Tomographic Imaging - Avinash C. Kak 2001-01-01
A comprehensive, tutorial-style introduction to the algorithms necessary for tomographic imaging.

Applied Mathematical Models in Human Physiology - Johnny T. Ottesen 2004-01-01
This book introduces mathematicians to real applications from physiology. Using mathematics to analyze physiological systems, the authors focus on models reflecting current research in cardiovascular and pulmonary physiology. In particular, they present models describing blood flow in the heart and the cardiovascular system, as well as the transport of oxygen and carbon dioxide through the respiratory system and a model for baroreceptor regulation.

SIAM Journal on Numerical Analysis - 2002-12

Computational Methods for Inverse Problems - Curtis R. Vogel 2002
Provides a basic understanding of both the underlying mathematics and the computational methods used to solve inverse problems.

Optimal Design of Experiments - Friedrich Pukelsheim 2006-04-01
Optimal Design of Experiments offers a rare blend of linear algebra, convex analysis, and statistics. The optimal design for statistical experiments is first formulated as a concave matrix optimization problem. Using tools from convex analysis, the problem is solved generally for a wide class of optimality criteria such as D-, A-, or E-optimality. The book then offers a complementary approach that calls for the study of the symmetry properties of the design problem, exploiting such notions as matrix majorization and the Kiefer matrix ordering. The results are illustrated with optimal designs for polynomial fit models, Bayes designs, balanced incomplete block designs, exchangeable designs on the cube, rotatable designs on the sphere, and many other examples.

Journal of the Society for Industrial and Applied Mathematics. Series B: Numerical Analysis - Society for Industrial and Applied Mathematics 2005

Data Assimilation: Methods, Algorithms, and Applications - Mark Asch 2016-12-29
Data assimilation is an approach that combines observations and model output, with the objective of improving the latter. This book places data assimilation into the broader context of inverse problems and the theory, methods, and algorithms that are used for their solution. It provides a framework for, and insight into, the inverse problem nature of data assimilation, emphasizing ?why? and not just ?how.? Methods and diagnostics are emphasized, enabling readers to readily apply them to their own field of study. Readers will find a comprehensive guide that is accessible to nonexperts; numerous examples and diverse applications from a broad range of domains, including geophysics and geophysical flows, environmental acoustics, medical imaging, mechanical and biomedical engineering, economics and finance, and traffic control and urban planning; and the latest methods for advanced data assimilation, combining variational and statistical approaches.
SIAM Journal on Scientific Computing - 2007

The Mathematics of Computerized Tomography - Frank Natterer 2001-06-01
This book provides a unified view of tomographic techniques and an in-depth treatment of reconstruction algorithms.
Iterative Methods for Sparse Linear Systems - Yousef Saad 2003-04-01
Mathematics of Computing -- General.