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Introduction to Computational Science-Angela B. Shiflet 2014-03-30 Computational science is an exciting new field at the intersection of the sciences, computer science, and mathematics because much scientific investigation now involves computing as well as theory and experiment. This textbook provides students with a versatile and accessible introduction to the subject. It assumes only a background in high school algebra, enables instructors to follow tailored pathways through the material, and is the only textbook of its kind designed specifically for an introductory course in the computational science and engineering curriculum. While the text itself is generic, an accompanying website offers tutorials and files in a variety of software packages. This fully updated and expanded edition features two new chapters on agent-based simulations and modeling with matrices, ten new project modules, and an additional module on diffusion. Besides increased treatment of high-performance computing and its applications, the book also includes additional quick review questions with answers, exercises, and individual and team projects. The only introductory textbook of its kind—now fully updated and expanded Features two new chapters on agent-based simulations and modeling with matrices Increased coverage of high-performance computing and its applications Includes additional modules, review questions, exercises, and projects An online instructor's manual with exercise answers, selected project solutions, and a test bank and solutions (available only to professors) An online illustration package is available to professors
Linear Algebra and Learning from Data-Gilbert Strang 2019-01-31 Linear algebra and the foundations of deep learning, together at last! From Professor Gilbert Strang, acclaimed author of Introduction to Linear Algebra, comes Linear Algebra and Learning from Data, the first textbook that teaches linear algebra together with deep learning and neural nets. This readable yet rigorous textbook contains a complete course in the linear algebra and related mathematics that students need to know to get to grips with learning from data. Included are: the four fundamental subspaces, singular value decompositions, special matrices, large matrix computation techniques, compressed sensing, probability and statistics, optimization, the architecture of neural nets, stochastic gradient descent and backpropagation.
Introduction to Applied Mathematics-Gilbert Strang 1986-01-01 Renowned applied mathematician Gilbert Strang teaches applied mathematics with the clear explanations, examples and insights of an experienced teacher. This book progresses steadily through a range of topics from symmetric linear systems to differential equations to least squares and Kalman filtering and optimization. It clearly demonstrates the power of matrix algebra in engineering problem solving. This is an ideal book (beloved by many readers) for a first course on applied mathematics and a reference for more advanced applied mathematicians. The only prerequisite is a basic course in linear algebra.
Introduction to Applied Linear Algebra-Stephen Boyd 2018-06-07 A groundbreaking introduction to vectors, matrices, and least squares for engineering applications, offering a wealth of practical examples.
Numerical Solution of Partial Differential Equations in Science and Engineering-Leon Lapidus 2011-02-14 From the reviews of Numerical Solution of PartialDifferential Equations in Science and Engineering: "The book by Lapidus and Pinder is a very comprehensive, evenexhaustive, survey of the subject . . . [It] is unique in that itcovers equally finite difference and finite element methods." Burrelle's "The authors have selected an elementary (but not simplistic)mode of presentation. Many different computational schemes aredescribed in great detail . . . Numerous practical examples andapplications are described from beginning to the end, often withcalculated results given." Mathematics of Computing "This volume . . . devotes its considerable number of pages tolucid developments of the methods [for solving partial differentialequations] . . . the writing is very polished and I found it apleasure to read!" Mathematics of Computation Of related interest . . . NUMERICAL ANALYSIS FOR APPLIED SCIENCE Myron B. Allen andEli L. Isaacson. A modern, practical look at numerical analysis,this book guides readers through a broad selection of numericalmethods, implementation, and basic theoretical results, with anemphasis on methods used in scientific computation involvingdifferential equations. 1997 (0-471-55266-6) 512 pp. APPLIED MATHEMATICS Second Edition, J. David Logan.Presenting an easily accessible treatment of mathematical methodsfor scientists and engineers, this acclaimed work covers fluidmechanics and calculus of variations as well as more modernmethods-dimensional analysis and scaling, nonlinear wavepropagation, bifurcation, and singular perturbation. 1996(0-471-16513-1) 496 pp.
Nonlinear Inverse Problems in Imaging-Jin Keun Seo 2012-11-16 This book provides researchers and engineers in the imaging field with the skills they need to effectively deal with nonlinear inverse problems associated with different imaging modalities, including impedance imaging, optical tomography, elastography, and electrical source imaging. Focusing on numerically implementable methods, the book bridges the gap between theory and applications, helping readers tackle problems in applied mathematics and engineering. Complete, self-contained coverage includes basic concepts, models, computational methods, numerical simulations, examples, and case studies. Provides a step-by-step progressive treatment of topics for ease of understanding. Discusses the underlying physical phenomena as well as implementation details of image reconstruction algorithms as prerequisites for finding solutions to non linear inverse problems with practical significance and value. Includes end of chapter problems, case studies and examples with solutions throughout the book. Companion website will provide further examples and solutions, experimental data sets, open problems, teaching material such as PowerPoint slides and software including MATLAB m files. Essential reading for Graduate students and researchers in imaging science working across the areas of applied mathematics, biomedical engineering, and electrical engineering and specifically those involved in nonlinear imaging techniques, impedance imaging, optical tomography, elastography, and electrical source imaging
Splitting Methods in Communication, Imaging, Science, and Engineering-Roland Glowinski 2017-01-05 This book is about computational methods based on operator splitting. It consists of twenty-three chapters written by recognized splitting method contributors and practitioners, and covers a vast spectrum of topics and application areas, including computational mechanics, computational physics, image processing, wireless communication, nonlinear optics, and finance. Therefore, the book presents very versatile aspects of splitting methods and their applications, motivating the cross-fertilization of ideas.
Statistics and Probability with Applications for Engineers and Scientists-Bhisham C. Gupta 2013-04-29 "This book covers applied statistics and probability for undergraduate students in engineering and the natural sciences"--
Computational Science and its Applications-A. H. Siddiqi 2020-10-21 Computational science is a rapidly growing multidisciplinary field concerned with the design, implementation, and use of mathematical models to analyze and solve real-world problems. It is an area of science that spans many disciplines and which involves the development of models and allows the use of computers to perform simulations or numerical analysis to understand problems that are computational and theoretical. Computational Science and its Applications provides an opportunity for readers to develop abilities to pose and solve problems that combine insights from one or more disciplines from the natural sciences with mathematical tools and computational skills. This requires a unique combination of applied and theoretical knowledge and skills. The topics covered in this edited book are applications of wavelet and fractals, modeling by partial differential equations on flat structure as well as on graphs and networks, computational linguistics, prediction of natural calamities and diseases like epilepsy seizure, heart attack, stroke, biometrics, modeling through inverse problems, interdisciplinary topics of physics, mathematics, and medical science, and modeling of terrorist attacks and human behavior. The focus of this book is not to educate computer specialists, but to provide readers with a solid understanding of basic science as well as an integrated knowledge on how to use essential methods from computational science. Features: Modeling of complex systems Cognitive computing systems for real-world problems Presentation of inverse problems in medical science and their numerical solutions Challenging research problems in many areas of computational science This book could be used as a reference book for researchers working in theoretical research as well as those who are doing modeling and simulation in such disciplines as physics, biology, geoscience, and mathematics, and those who have a background in computational science.
Linear Algebra for Computational Sciences and Engineering-Ferrante Neri 2016-07-15 This book presents the main concepts of linear algebra from the viewpoint of applied scientists such as computer scientists and engineers, without compromising on mathematical rigor. Based on the idea that computational scientists and engineers need, in both research and professional life, an understanding of theoretical concepts of mathematics in order to be able to propose research advances and innovative solutions, every concept is thoroughly introduced and is accompanied by its informal interpretation. Furthermore, most of the theorems included are first rigorously proved and then shown in practice by a numerical example. When appropriate, topics are presented also by means of pseudocodes, thus highlighting the computer implementation of algebraic theory. It is structured to be accessible to everybody, from students of pure mathematics who are approaching algebra for the first time to researchers and graduate students in applied sciences who need a theoretical manual of algebra to successfully perform their research. Most importantly, this book is designed to be ideal for both theoretical and practical minds and to offer to both alternative and complementary perspectives to study and understand linear algebra.
Computational Differential Equations-K. Eriksson 1996-09-05 Textbook for teaching computational mathematics.
Linear Algebra and Its Applications-David C. Lay 2014-12-24 NOTE: Before purchasing, check with your instructor to ensure you select the correct ISBN. Several versions of Pearson's MyLab & Mastering products exist for each title, and registrations are not transferable. To register for and use Pearson's MyLab & Mastering products, you may also need a Course ID, which your instructor will provide. Used books, rentals, and purchases made outside of Pearson If purchasing or renting from companies other than Pearson, the access codes for Pearson's MyLab & Mastering products may not be included, may be incorrect, or may be previously redeemed. Check with the seller before completing your purchase. Note: You are purchasing a standalone product; MyMathLab does not come packaged with this content. MyMathLab is not a self-paced technology and should only be purchased when required by an instructor. If you would like to purchase both the physical text and MyMathLab, search for: 9780134022697 / 0134022696 Linear Algebra and Its Applications plus New MyMathLab with Pearson eText -- Access Card Package, 5/e With traditional linear algebra texts, the course is relatively easy for students during the early stages as material is presented in a familiar, concrete setting. However, when abstract concepts are introduced, students often hit a wall. Instructors seem to agree that certain concepts (such as linear independence, spanning, subspace, vector space, and linear transformations) are not easily understood and require time to assimilate. These concepts are fundamental to the study of linear algebra, so students' understanding of them is vital to mastering the subject. This text makes these concepts more accessible by introducing them early in a familiar, concrete Rn setting, developing them gradually, and returning to them throughout the text so that when they are discussed in the abstract, students are readily able to understand.
Adaptive Numerical Solution of PDEs-Peter Deuflhard 2012-08-31 Numerical mathematics is a subtopic of scientific computing. The focus lies on the efficiency of algorithms, i.e. speed, reliability, and robustness. This leads to adaptive algorithms. The theoretical derivation und analyses of algorithms are kept as elementary as possible in this book; the needed sligtly advanced mathematical theory is summarized in the appendix. Numerous figures and illustrating examples explain the complex data, as non-trivial examples serve problems from nanotechnology, chirurgy, and physiology. The book addresses students as well as practitioners in mathematics, natural sciences, and engineering. It is designed as a textbook but also suitable for self study.
Linear Algebra Done Right-Sheldon Axler 1997-07-18 This text for a second course in linear algebra, aimed at math majors and graduates, adopts a novel approach by banishing determinants to the end of the book and focusing on understanding the structure of linear operators on vector spaces. The author has taken unusual care to motivate concepts and to simplify proofs. For example, the book presents - without having defined determinants - a clean proof that every linear operator on a finite-dimensional complex vector space has an eigenvalue. The book starts by discussing vector spaces, linear independence, span, basics, and dimension. Students are introduced to inner-product spaces in the first half of the book and shortly thereafter to the finite- dimensional spectral theorem. A variety of interesting exercises in each chapter helps students understand and manipulate the objects of linear algebra. This second edition features new chapters on diagonal matrices, on linear functionals and adjoints, and on the spectral theorem; some sections, such as those on self-adjoint and normal operators, have been entirely rewritten; and hundreds of minor improvements have been made throughout the text.
Exercises in Computational Mathematics with MATLAB-Tom Lyche 2014-09-02 Designed to provide tools for independent study, this book contains student-tested mathematical exercises joined with MATLAB programming exercises. Most chapters open with a review followed by theoretical and programming exercises, with detailed solutions provided for all problems including programs. Many of the MATLAB exercises are presented as Russian dolls: each question improves and completes the previous program and results are provided to validate the intermediate programs. The book offers useful MATLAB commands, advice on tables, vectors, matrices and basic commands for plotting. It contains material on eigenvalues and eigenvectors and important norms of vectors and matrices including perturbation theory; iterative methods for solving nonlinear and linear equations; polynomial and piecewise polynomial interpolation; Bézier curves; approximations of functions and integrals and more. The last two chapters considers ordinary differential equations including two point boundary value problems, and deal with finite difference methods for some partial differential equations. The format is designed to assist students working alone, with concise Review paragraphs, Math Hint footnotes on the mathematical aspects of a problem and MATLAB Hint footnotes with tips on programming.
Elementary Linear Algebra-Stephen Andrilli 2010-02-04 Elementary Linear Algebra develops and explains in careful detail the computational techniques and fundamental theoretical results central to a first course in linear algebra. This highly acclaimed text focuses on developing the abstract thinking essential for further mathematical study The authors give early, intensive attention to the skills necessary to make students comfortable with mathematical proofs. The text builds a gradual and smooth transition from computational results to general theory of abstract vector spaces. It also provides flexbile coverage of practical applications, exploring a comprehensive range of topics. Ancillary list: * Maple Algorithmic testing- Maple TA- www.maplesoft.com Includes a wide variety of applications, technology tips and exercises, organized in chart format for easy reference More than 310 numbered examples in the text at least one for each new concept or application Exercise sets ordered by increasing difficulty, many with multiple parts for a total of more than 2135 questions Provides an early introduction to eigenvalues/eigenvectors A Student solutions manual, containing fully worked out solutions and instructors manual available
Introduction to Computation and Modeling for Differential Equations-Lennart Edsberg 2013-06-05 An introduction to scientific computing for differential equations Introduction to Computation and Modeling for Differential Equations provides a unified and integrated view of numerical analysis, mathematical modeling in applications, and programming to solve differential equations, which is essential in problem-solving across many disciplines, such as engineering, physics, and economics. This book successfully introduces readers to the subject through a unique "Five-M" approach: Modeling, Mathematics, Methods, MATLAB, and Multiphysics. This approach facilitates a thorough understanding of how models are created and preprocessed mathematically with scaling, classification, and approximation, and it also illustrates how a problem is solved numerically using the appropriate mathematical methods. The book's approach of solving a problem with mathematical, numerical, and programming tools is unique and covers a wide array of topics, from mathematical modeling to implementing a working computer program. The author utilizes the principles and applications of scientific computing to solve problems involving: Ordinary differential equations Numerical methods for Initial Value Problems (IVPs) Numerical methods for Boundary Value Problems (BVPs) Partial Differential Equations (PDEs) Numerical methods for parabolic, elliptic, and hyperbolic PDEs Mathematical modeling with differential equations Numerical solution Finite difference and finite element methods Real-world examples from scientific and engineering applications including mechanics, fluid dynamics, solid mechanics, chemical engineering, electromagnetic field theory, and control theory are solved through the use of MATLAB and the interactive scientific computing program Comsol Multiphysics. Numerous illustrations aid in the visualization of the solutions, and a related Web site features demonstrations, solutions to problems, MATLAB programs, and additional data. Introduction to Computation and Modeling for Differential Equations is an ideal text for courses in differential equations, ordinary differential equations, partial differential equations, and numerical methods at the upper-undergraduate and graduate levels. The book also serves as a valuable reference for researchers and practitioners in the fields of mathematics, engineering, and computer science who would like to refresh and revive their knowledge of the mathematical and numerical aspects as well as the applications of scientific computation.
Linear Algebra and Its Applications-Gilbert Strang 2006 Renowned professor and author Gilbert Strang demonstrates that linear algebra is a fascinating subject by showing both its beauty and value. While the mathematics is there, the effort is not all concentrated on proofs. Strang's emphasis is on understanding. He explains concepts, rather

than deduces. This book is written in an informal and personal style and teaches real mathematics. The gears change in Chapter 2 as students reach the introduction of vector spaces. Throughout the book, the theory is motivated and reinforced by genuine applications, allowing pure mathematicians to teach applied mathematics.
Adaptive Filtering-Paulo S.R. Diniz 2013-03-14 Adaptive Filtering: Algorithms and Practical Implementation, Second Edition, presents a concise overview of adaptive filtering, covering as many algorithms as possible in a unified form that avoids repetition and simplifies notation. It is suitable as a textbook for senior undergraduate or first-year graduate courses in adaptive signal processing and adaptive filters. The philosophy of the presentation is to expose the material with a solid theoretical foundation, to concentrate on algorithms that really work in a finite-precision implementation, and to provide easy access to working algorithms. Hence, practicing engineers and scientists will also find the book to be an excellent reference. This second edition contains a substantial amount of new material: -Two new chapters on nonlinear and subband adaptive filtering; -Linearly constrained Weiner filters and LMS algorithms; -LMS algorithm behavior in fast adaptation; -Affine projection algorithms; -Derivation smoothing; -MATLAB codes for algorithms.
Discrete Stochastic Processes-Robert G. Gallager 2012-12-06 Stochastic processes are found in probabilistic systems that evolve with time. Discrete stochastic processes change by only integer time steps (for some time scale), or are characterized by discrete occurrences at arbitrary times. Discrete Stochastic Processes helps the reader develop the understanding and intuition necessary to apply stochastic process theory in engineering, science and operations research. The book approaches the subject via many simple examples which build insight into the structure of stochastic processes and the general effect of these phenomena in real systems. The book presents mathematical ideas without recourse to measure theory, using only minimal mathematical analysis. In the proofs and explanations, clarity is favored over formal rigor, and simplicity over generality. Numerous examples are given to show how results fail to hold when all the conditions are not satisfied. Audience: An excellent textbook for a graduate level course in engineering and operations research. Also an invaluable reference for all those requiring a deeper understanding of the subject.
Analytical and Computational Methods of Advanced Engineering Mathematics-Grant B. Gustafson 2012-12-06 This book focuses on the topics which provide the foundation for practicing engineering mathematics: ordinary differential equations, vector calculus, linear algebra and partial differential equations. Destined to become the definitive work in the field, the book uses a practical engineering approach based upon solving equations and incorporates computational techniques throughout.
Splitting Methods in Communication, Imaging, Science, and Engineering-Roland Glowinski 2017-01-05 This book is about computational methods based on operator splitting. It consists of twenty-three chapters written by recognized splitting method contributors and practitioners, and covers a vast spectrum of topics and application areas, including computational mechanics, computational physics, image processing, wireless communication, nonlinear optics, and finance. Therefore, the book presents very versatile aspects of splitting methods and their applications, motivating the cross-fertilization of ideas.
Introduction to Linear Algebra-Gilbert Strang 1993 Book Description: Gilbert Strang's textbooks have changed the entire approach to learning linear algebra -- away from abstract vector spaces to specific examples of the four fundamental subspaces: the column space and nullspace of A and A'. Introduction to Linear Algebra, Fourth Edition includes challenge problems to complement the review problems that have been highly praised in previous editions. The basic course is followed by seven applications: differential equations, engineering, graph theory, statistics, Fourier methods and the FFT, linear programming, and computer graphics. Thousands of teachers in colleges and universities and now high schools are using this book, which truly explains this crucial subject.
Automated Solution of Differential Equations by the Finite Element Method-Anders Logg 2012-02-24 This book is a tutorial written by researchers and developers behind the FEniCS Project and explores an advanced, expressive approach to the development of mathematical software. The presentation spans mathematical background, software design and the use of FEniCS in applications. Theoretical aspects are complemented with computer code which is available as free/open source software. The book begins with a special introductory tutorial for beginners. Following are chapters in Part I addressing fundamental aspects of the approach to automating the creation of finite element solvers. Chapters in Part II address the design and implementation of the FEniCS software. Chapters in Part III present the application of FEniCS to a wide range of applications, including fluid flow, solid mechanics, electromagnetics and geophysics.
Introduction to Linear Algebra-Gilbert Strang 2016-08-11 Linear algebra is something all mathematics undergraduates and many other students, in subjects ranging from engineering to economics, have to learn. The fifth edition of this hugely successful textbook retains all the qualities of earlier editions while at the same time seeing numerous minor improvements and major additions. The latter include: • A new chapter on singular values and singular vectors, including ways to analyze a matrix of data • A revised chapter on computing in linear algebra, with professional-level algorithms and code that can be downloaded for a variety of languages • A new section on linear algebra and cryptography • A new chapter on linear algebra in probability and statistics. A dedicated and active website also offers solutions to exercises as well as new exercises from many different sources (e.g. practice problems, exams, development of textbook examples), plus codes in MATLAB, Julia, and Python.
Student Solutions Manual for Strang's Linear Algebra and Its Applications-Gilbert Strang 2005-07 Includes detailed step-by-step solutions to selected odd-numbered problems.
Introduction to Linear Algebra-Gilbert Strang 2009-02-10 This leading textbook for first courses in linear algebra comes from the hugely experienced MIT lecturer and author Gilbert Strang. The book's tried and tested approach is direct, offering practical explanations and examples, while showing the beauty and variety of the subject. Unlike most other linear algebra textbooks, the approach is not a repetitive drill. Instead it inspires an understanding of real mathematics. The book moves gradually and naturally from numbers to vectors to the four fundamental subspaces. This new edition includes challenge problems at the end of each section. Preview five complete sections at math.mit.edu/linearalgebra. Readers can also view freely available online videos of Gilbert Strang's 18.06 linear algebra course at MIT, via OpenCourseWare (ocw.mit.edu), that have been watched by over a million viewers. Also on the web (http://web.mit.edu/18.06/www/), readers will find years of MIT exam questions, MATLAB help files and problem sets to practise what they have learned.
Mathematics for Machine Learning-Marc Peter Deisenroth 2020-04-23 The fundamental mathematical tools needed to understand machine learning include linear algebra, analytic geometry, matrix decompositions, vector calculus, optimization, probability and statistics. These topics are traditionally taught in disparate courses, making it hard for data science or computer science students, or professionals, to efficiently learn the mathematics. This self-contained textbook bridges the gap between mathematical and machine learning texts, introducing the mathematical concepts with a minimum of prerequisites. It uses these concepts to derive four central machine learning methods: linear regression, principal component analysis, Gaussian mixture models and support vector machines. For students and others with a mathematical background, these derivations provide a starting point to machine learning texts. For those learning the mathematics for the first time, the methods help build intuition and practical experience with applying mathematical concepts. Every chapter includes worked examples and exercises to test understanding. Programming tutorials are offered on the book's web site.
Scientific Computing with MATLAB and Octave-Alfio Quarteroni 2010-05-30 Preface to the First Edition This textbook is an introduction to Scienti?c Computing. We will illustrate several numerical methods for the computer solution of c- tain classes of mathematical problems that cannot be faced by paper and pencil. We will show how to compute the zeros or the integrals of continuous functions, solve linear systems, approximate functions by polynomials and construct accurate approximations for the solution of di?erential equations. With this aim, in Chapter 1 we will illustrate the rules of the game thatcomputersadoptwhenstoringandoperatingwith realandcomplex numbers, vectors and matrices. In order to make our presentation concrete and appealing we will 1 adopt the programming environment MATLAB as a faithful c- panion. We will gradually discover its principal commands, statements and constructs. We will show how to execute all the algorithms that we introduce throughout the book. This will enable us to furnish an - mediate quantitative assessment of their theoretical properties such as stability, accuracy and complexity. We will solve several problems that will be raisedthrough exercises and examples, often stemming from s- ci?c applications.
Differential Equations-Hans Stephani 1989 In many branches of physics, mathematics, and engineering, solving a problem means solving a set of ordinary or partial differential equations. Nearly all methods of constructing closed form solutions rely on symmetries. The emphasis in this text is on how to find and use the symmetries; this is supported by many examples and more than 100 exercises. This book will form an introduction accessible to beginning graduate students in physics, applied mathematics, and engineering. Advanced graduate students and researchers in these disciplines will find the book a valuable reference.
Python Scripting for Computational Science-Hans Petter Langtangen 2013-03-14 Scripting with Python makes you productive and increases the reliability of your scientific work. Here, the author teaches you how to develop tailored, flexible, and efficient working environments built from small programs (scripts) written in Python. The focus is on examples and applications of relevance to computational science: gluing existing applications and tools, e.g. for automating simulation, data analysis, and visualization; steering simulations and computational experiments; equipping programs with graphical user interfaces; making computational Web services; creating interactive interfaces with a Maple/Matlab-like syntax to numerical applications in C/C++ or Fortran; and building flexible object-oriented programming interfaces to existing C/C++ or Fortran libraries.
Differential Equations and Linear Algebra-Gilbert Strang 2015-02-12 Differential equations and linear algebra are two central topics in the undergraduate mathematics curriculum. This innovative textbook allows the two subjects to be developed either separately or together, illuminating the connections between two fundamental topics, and giving increased flexibility to instructors. It can be used either as a semester-long course in differential equations, or as a one-year course in differential equations, linear algebra, and applications. Beginning with the basics of differential equations, it covers first and second order equations, graphical and numerical methods, and matrix equations. The book goes on to present the fundamentals of vector spaces, followed by eigenvalues and eigenvectors, positive definiteness, integral transform methods and applications to PDEs. The exposition illuminates the natural correspondence between solution methods for systems of equations in discrete and continuous settings. The topics draw on the physical sciences, engineering and economics, reflecting the author's distinguished career as an applied mathematician and expositor.
Mathematics for Physical Science and Engineering-Frank E. Harris 2014-05-24 Mathematics for Physical Science and Engineering is a complete text in mathematics for physical science that includes the use of symbolic computation to illustrate the mathematical concepts and enable the solution of a broader range of practical problems. This book enables professionals to connect their knowledge of mathematics to either or both of the symbolic languages Maple and Mathematica. The book begins by introducing the reader to symbolic computation and how it can be applied to solve a broad range of practical problems. Chapters cover topics that include: infinite series; complex numbers and functions; vectors and matrices; vector analysis; tensor analysis; ordinary differential equations; general vector spaces; Fourier series; partial differential equations; complex variable theory; and probability and statistics. Each important concept is clarified to students through the use of a simple example and often an illustration. This book is an ideal reference for upper level undergraduates in physical chemistry, physics, engineering, and advanced/applied mathematics courses. It will also appeal to graduate physicists, engineers and related specialties seeking to address practical problems in physical science. Clarifies each important concept to students through the use of a simple example and often an illustration Provides quick-reference for students through multiple appendices, including an overview of terms in most commonly used applications (Mathematica, Maple) Shows how symbolic computing enables solving a broad range of practical problems
Finite Element Procedures-Klaus-Jürgen Bathe 2006
Linear Algebra-Kuldeep Singh 2013-10 "This book is intended for first- and second-year undergraduates arriving with average mathematics grades ... The strength of the text is in the large number of examples and the step-by-step explanation of each topic as it is introduced. It is compiled in a way that allows distance learning, with explicit solutions to all of the set problems freely available online http://www.oup.co.uk/companion/singh" -- From preface.
Lectures on Advanced Computational Methods in Mechanics-Johannes Kraus 2007 This book contains four survey papers related to different topics in computational mechanics, in particular (1) novel discretization and solver techniques in mechanics and (2) inverse, control, and optimization problems in mechanics. These topics were considered in lectures, seminars, tutorials, and workshops at the Special Semester on Computational Mechanics held at the Johann Radon Institute for Computational and Applied Mathematics (RICAM), Linz, Austria, in December 2005.
Essays in Linear Algebra-Gilbert Strang 2012-04-26 The renowned mathematician and educator Gilbert Strang presents a collection of expository papers on the theory and applications of linear algebra, accompanied by video lectures on http://ocw.mit.edu. The essays are diverse in scope and range from purely theoretical studies on deep fundamental principles of matrix algebra to discussions on the teaching of calculus and an examination of the mathematical foundations of aspects of computational engineering. One thing these essays have in common is the way that they express both the importance and the beauty of the subject, as well as the author's passion for mathematics. This text will be of practical use to students and researchers across a whole spectrum of numerate disciplines. Furthermore, this collection provides a unique perspective on mathematics and the communication thereof as a human endeavour, complemented as these essays are by commentary from the author regarding their provenance and the reaction to them.
A First Course on Numerical Methods-Uri M. Ascher 2011-07-14 Offers students a practical knowledge of modern techniques in scientific computing.
Feedback Systems-Karl Johan Åström 2010-04-12 This book provides an introduction to the mathematics needed to model, analyze, and design feedback systems. It is an ideal textbook for undergraduate and graduate students, and is indispensable for researchers seeking a self-contained reference on control theory. Unlike most books on the subject, Feedback Systems develops transfer functions through the exponential response of a system, and is accessible across a range of disciplines that utilize feedback in physical, biological, information, and economic systems. Karl Åström and Richard Murray use techniques from physics, computer science, and operations research to introduce control-oriented modeling. They begin with state space tools for analysis and design, including stability of solutions, Lyapunov functions, reachability, state feedback observability, and estimators. The matrix exponential plays a central role in the analysis of linear control systems, allowing a concise development of many of the key concepts for this class of models. Åström and Murray then develop and explain tools in the frequency domain, including transfer functions, Nyquist analysis, PID control, frequency domain design, and robustness. They provide exercises at the end of every chapter, and an accompanying electronic solutions manual is available. Feedback Systems is a complete one-volume resource for students and researchers in mathematics, engineering, and the sciences. Covers the mathematics needed to model, analyze, and design feedback systems Serves as an introductory textbook for students and a self-contained resource for researchers Includes exercises at the end of every chapter Features an electronic solutions manual Offers techniques applicable across a range of disciplines