Linear Algebra And Matrix Analysis For Statistics Chapman Hallcrc Texts In Statistical Science

This is the revised and expanded edition of the problem book Linear Algebra: Challenging Problems for Students, now entitled Problems in Linear Algebra and Matrix Theory. This new edition contains about fifty-five examples and many new problems, based on the author's lecture notes of Advanced Linear Algebra classes at Nova Southeastern University (NSU-Florida) and short lectures Matrix Gems at Shanghai University and Beijing Normal University.The book is intended for upper division undergraduate and beginning graduate students, and it can be used as text or supplement for a second course in linear algebra. Each chapter starts with Definitions, Facts, and Examples, followed by problems. Hints and solutions to all problems are also provided.

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.

Linear Algebra and Matrix Analysis for Statistics offers a gradual exposition to linear algebra without sacrificing the rigor of the subject. It presents both the vector space approach and the canonical forms in matrix theory. The book is as self-contained as possible, assuming no prior knowledge of linear algebra. The authors first address the rudimentary mechanics of linear systems using Gaussian elimination and the resulting decompositions. They introduce Euclidean vector spaces using less abstract concepts and make connections to systems of linear equations wherever possible. After illustrating the importance of the rank of a matrix, they discuss complementary subspaces, oblique projectors, orthogonality, orthogonal projections and projectors, and orthogonal reduction. The text then shows how the theoretical concepts developed are handy in analyzing solutions for linear systems. The authors also explain how determinants are useful for characterizing and deriving properties concerning matrices and linear systems. They then cover eigenvalues, eigenvectors, singular value decomposition, Jordan decomposition (including a proof), quadratic forms, and Kronecker and Hadamard products. The book concludes with accessible treatments of advanced topics, such as linear iterative systems, convergence of matrices, more general vector spaces, linear transformations, and Hilbert spaces.

This introductory textbook grew out of several courses in linear algebra given over more than a decade and includes such helpful material as constructive discussions about the motivation of fundamental concepts, many worked-out problems in each chapter, and topics rarely covered in typical linear algebra textbooks.The authors use abstract notions and arguments to give the complete proof of the Jordan canonical form and, more generally, the rational canonical form of square matrices over fields. They also provide the notion of tensor products of vector spaces and linear transformations. Matrices are treated in depth, with coverage of the stability of matrix iterations, the eigenvalue properties of linear transformations in inner product spaces, singular value decomposition, and min-max characterizations of Hermitian matrices and nonnegative irreducible matrices. The authors show the many topics and tools encompassed by modern linear algebra to emphasize its relationship to other areas of mathematics. The text is intended for advanced undergraduate students. Beginning graduate students seeking an introduction to the subject will also find it of interest.

Applied Linear Algebra and Matrix Analysis

Linear Algebra and Matrix Computations with MATLAB®

Numerical Matrix Analysis

This book presents a substantial part of matrix analysis that is functional analytic in spirit. Topics covered include the theory of majorization, variational principles for eigenvalues, operator monotone and convex functions, and perturbation of matrix functions and matrix inequalities. The book offers several powerful methods and techniques of wide applicability, and i

This is a book on linear algebra and matrix theory. While it is self contained, it will work best for those who have already had some exposure to linear algebra. It is also assumed that the reader has had calculus. Some optional topics require more analysis than this, however. I think that the subject of linear algebra is likely the most significant topic discussed in und usefulness in unifying so many different topics. Linear algebra is essential in analysis, applied math, and even in theoretical mathematics. This is the point of view of this book, more than a presentation of linear algebra for its own sake. This is why there are numerous applications, some fairly unusual.

This book avoids the traditional definition-theorem-proof format: instead a fresh approach introduces a variety of problems and examples all in a clear and informal style. The in-depth focus on applications separates this book from others, and helps students to see how linear algebra can be applied to real-life situations. Some of the more contemporary topics of ap undergraduate textbooks. Theoretical developments are always accompanied with detailed examples, and each section ends with a number of exercises from which students can gain further insight. Moreover, the inclusion of historical information provides personal insights into the mathematicians who developed this subject. The textbook contains numerous examp performance and the possible pitfalls of algorithms. Solutions to all of the exercises are provided, as well as a CD-ROM containing a searchable copy of the textbook.

This self-contained textbook takes a matrix-oriented approach to linear algebra and presents a complete theory, including all details and proofs, culminating in the Jordan canonical form and its proof. Throughout the development, the applicability of the results is highlighted. Additionally, the book presents special topics from applied linear algebra including matrix fur and linear matrix equations. The matrix-oriented approach to linear algebra leads to a better intuition and a deeper understanding of the abstract concepts, and therefore simplifies their use in real world applications. Some of these applications are presented in detailed examples. In several 'MATLAB-Minutes' students can comprehend the concepts and results using are presented in a short introduction. Students can also actively work with the material and practice their mathematical skills in more than 300 exercises.

Matrix Analysis and Applications

Matrix Theory

Problems In Linear Algebra And Matrix Theory

Theory, Computations, and Applications in Statistics

Assuming no prior knowledge of linear algebra, this self-contained text offers a gradual exposition to linear algebra without sacrificing the rigor of the subject. It presents both the vector space approach and the canonical forms in matrix theory. The book covers important topics in linear algebra that are useful for statisticians, including the concept of rank, the fundamental theorem of linear algebra, projectors, and quadratic forms. It also provides an extensive collection of exercises on theoretical concepts and numerical computations.

An accessible and clear introduction to linear algebra with a focus on matrices and engineering applications Providing comprehensive coverage of matrix theory from a geometric and physical perspective, Fundamentals of Matrix Analysis with Applications describes the functionality of matrices and their ability to quantify and analyze many practical applications. Written by a highly qualified author team, the book presents tools for matrix analysis and is illustrated with extensive examples and software implementations. Beginning with a detailed exposition and review of the Gauss elimination method, the authors maintain readers' interest with refreshing discussions regarding the issues of operation counts, computer speed and precision, complex arithmetic formulations, parameterization of solutions, and the logical traps that dictate strict adherence to Gauss's instructions. The book heralds matrix formulation both as notational shorthand and as a quantifier of physical operations such as rotations, projections, reflections, and the Gauss reductions. Inverses and eigenvectors are visualized first in an operator context before being addressed computationally. Least squares theory is expounded in all its manifestations including optimization, orthogonality, computational accuracy, and even function theory. Fundamentals of Matrix Analysis with Applications also features: Novel approaches employed to explicate the QR, singular value, Schur, and Jordan decompositions and their applications Coverage of the role of the matrix exponential in the solution of linear systems of differential equations with constant coefficients Chapter-by-chapter summaries, review problems, technical writing exercises, select solutions, and group projects to aid comprehension of the presented concepts Fundamentals of Matrix Analysis with Applications is an excellent textbook for undergraduate courses in linear algebra and matrix theory for students majoring in mathematics, engineering, and science. The book is also an accessible go-to reference for readers seeking clarification of the fine points of kinematics, circuit theory, control theory, computational statistics, and numerical algorithms.

This textbook develops the essential tools of linear algebra, with the goal of imparting technique alongside contextual understanding. Applications go hand-in-hand with theory, each reinforcing and explaining the other. This approach encourages students to develop not only the technical proficiency needed to go on to further study, but an appreciation for when, why, and how the tools of linear algebra can be used across modern applied mathematics. Providing an extensive treatment of essential topics such as Gaussian elimination, inner products and norms, and eigenvalues and singular values, this text can be used for an in-depth first course, or an application-driven second course in linear algebra. In this second edition, applications have been updated and expanded to include numerical methods, dynamical systems, data analysis, and signal processing, while the pedagogical flow of the core material has been improved. Throughout, the text emphasizes the conceptual connections between each application and the underlying linear algebraic techniques, thereby enabling students not only to learn how to apply the mathematical tools in routine contexts, but also to understand what is required to adapt to unusual or emerging problems. No previous knowledge of linear algebra is needed to approach this text, with single-variable calculus as the only formal prerequisite. However, the reader will need to draw upon some mathematical maturity to engage in the increasing abstraction inherent to the subject. Once equipped with the main tools and concepts from this book, students will be prepared for further study in differential equations, numerical analysis, data science and statistics, and a broad range of applications. The first author's text, Introduction to Partial Differential Equations, is an ideal companion volume, forming a natural extension of the linear mathematical methods developed here.

Clear prose, tight organization, and a wealth of examples and computational techniques make Basic Matrix Algebra with Algorithms and Applications an outstanding introduction to linear algebra. The author designed this treatment specifically for freshman majors in mathematical subjects and upper-level students in natural resources, the social sciences, business, or any discipline that eventually requires an understanding of linear models. With extreme pedagogical clarity that avoids abstraction wherever possible, the author emphasizes minimal polynomials and their computation using a Krylov algorithm. The presentation is highly visual and relies heavily on work with a graphing calculator to allow readers to focus on concepts and techniques rather than on tedious arithmetic. Supporting materials, including test preparation Maple worksheets, are available for download from the Internet. This unassuming but insightful and remarkably original treatment is organized into bite-sized, clearly stated objectives. It goes well beyond the LACSG recommendations for a first course while still implementing their philosophy and core material. Classroom tested with great success, it prepares readers well for the more advanced studies their fields ultimately will require.

Linear Algebra

Matrix Analysis

Topics in Matrix Analysis

Matrices and Linear Transformations

Basic textbook covers theory of matrices and its applications to systems of linear equations and related topics such as determinants, eigenvalues, and differential equations. Includes numerous exercises.

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 flexible 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

"Prerequisites for using this text are knowledge of calculus and some previous exposure to matrices and linear algebra, including, for example, a basic knowledge of determinants, singularity of matrices, eigenvalues and eigenvectors, and positive definite matrices. There are exercises at the end of each chapter."--BOOK JACKET.

Matrix Analysis and Applied Linear Algebra is an honest math text that circumvents the traditional definition-theorem-proof format that has bored students in the past. Meyer uses a fresh approach to introduce a variety of problems and examples ranging from the elementary to the challenging and from simple applications to discovery problems. The focus on applications is a big difference between this book and others. Meyer's book is more rigorous and goes into more depth than some. He includes some of the more contemporary topics of applied linear algebra which are not normally found in undergraduate textbooks. Modern concepts and notation are used to introduce the various aspects of linear equations, leading readers easily to numerical computations and applications. The theoretical developments are always accompanied with examples, which are worked out in detail. Each section ends with a large number of carefully chosen exercises from which the students can gain further insight.

Linear Algebra: Theory and Applications

Matrix Analysis and Applied Linear Algebra

Matrix Analysis and Computations

A First Course in Linear Algebra

This book focuses the solutions of linear algebra and matrix analysis problems, with the exclusive use of MATLAB. The topics include representations, fundamental analysis, transformations of matrices, matrix equation solutions as well as matrix functions. Attempts on matrix and linear algebra applications are also explored.

Building on the foundations of its predecessor volume, Matrix Analysis, this book treats in detail several topics in matrix theory not included in the previous volume, but with important applications and of special mathematical interest. As with the previous volume, the authors assume a background knowledge of elementary linear algebra and rudimentary analytical concepts. Many examples and exercises of varying difficulty are included.

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.

A self-contained introduction to matrix analysis theory and applications in the field of statistics Comprehensive in scope, Matrix Algebra for Linear Modelsoffers a succinct summary of matrix theory and its relatedapplications to statistics, especially linear models. The bookprovides a unified presentation of the mathematical properties andstatistical applications of matrices in order to define andmanipulate data. Written for theoretical and applied statisticians, the bookutilizes multiple numerical examples to illustrate key ideas,methods, and techniques crucial to understanding matrixalgebra's application in linear models. Matrix Algebra forLinear Models expertly balances concepts and methods allowingfor a side-by-side presentation of matrix theory and its linearmodel applications. Including concise summaries on each topic, thebook also features: Methods of deriving results from the properties of eigenvaluesand the singular value decomposition Solutions to matrix optimization problems for obtaining moreefficient biased estimators for parameters in linear regressionmodels A section on the generalized singular value decomposition Multiple chapter exercises with selected answers to enhanceunderstanding of the presented material Matrix Algebra for Linear Models is an ideal textbook foradvanced undergraduate and graduate-level courses on statistics,matrices, and linear algebra. The book is also an excellentreference for statisticians, engineers, economists, and readersinterested in the linear statistical model.

Elementary Linear Algebra

Matrix Theory and Applications with MATLAB

Introduction to Linear Algebra

Fundamentals of Matrix Analysis with Applications

This textbook emphasizes the interplay between algebra and geometry to motivate the study of linear algebra. Matrices and linear transformations are presented as two sides of the same coin, with their connection motivating inquiry throughout the book. By focusing on this interface, the author offers a conceptual appreciation of the mathematics that is at the heart of further theory and app algebra will appreciate the companion volume Advanced Linear and Matrix Algebra. Starting with an introduction to vectors, matrices, and linear transformations, the book focuses on building a geometric intuition of what these tools represent. Linear systems offer a powerful application of the ideas seen so far, and lead onto the introduction of subspaces, linear independence, bases, and rank. In properties of matrices that illuminate the geometry of the linear transformations that they represent. Determinants, eigenvalues, and eigenvectors all benefit from this geometric viewpoint. Throughout, "Extra Topic" sections augment the core content with a wide range of ideas and applications, from linear programming, to power iteration and linear recurrence relations. Exercises of all levels ac be tackled using computer software. Introduction to Linear and Matrix Algebra is ideal for an introductory proof-based linear algebra course. The engaging color presentation and frequent marginal notes showcase the author's visual approach. Students are assumed to have completed one or two university-level mathematics courses, though calculus is not an explicit requirement. Instructors wil

"A First Course in Linear Algebra, originally by K. Kuttler, has been redesigned by the Lyryx editorial team as a first course for the general students who have an understanding of basic high school algebra and intend to be users of linear algebra methods in their profession, from business & economics to science students. All major topics of linear algebra are available in detail, as well as justification to topics covered in advanced courses are introduced. The textbook is designed in a modular fashion to maximize flexibility and facilitate adaptation to a given course outline and student profile. Each chapter begins with a list of student learning outcomes, and examples and diagrams are given throughout the text to reinforce ideas and provide guidance on how to approach various problems. Su section, with selected answers at the end of the textbook."--BCcampus website.

The theory, methods and applications of matrix analysis are presented here in a novel theoretical framework.

This new book offers a fresh approach to matrix and linear algebra by providing a balanced blend of applications, theory, and computation, while highlighting their interdependence. Intended for a one-semester course, Applied Linear Algebra and Matrix Analysis places special emphasis on linear algebra as an experimental science, with numerous examples, computer exercises, and projects. While the experimental, the text is independent of specific hardware or software platforms. Throughout the book, significant motivating examples are woven into the text, and each section ends with a set of exercises.

An Introduction to Applied Matrix Analysis

Computational Matrix Analysis

Applied Linear Algebra

Applied Engineering Analysis

It is well known that most problems in science and engineering eventually progress into matrix problems. This book gives an elementary introduction to applied matrix theory and it also includes some new results obtained in recent years. The book consists of eight chapters. It includes perturbation and error analysis; the conjugate gradient method for solving linear systems; preconditioning techniques; and least squares algorithms based on orthogonal transformations, etc. The last two chapters include some latest development in the area. In Chap. 7, we construct optimal preconditioners for functions of matrices. More precisely, let f be a function of matrices. Given a matrix A, there are two choices of constructing optimal preconditioners for f(A). Properties of these preconditioners are studied for different functions. In Chap. 8, we study the Bottcher–Wenzel conjecture and discuss related problems. This is a textbook for senior undergraduate or junior graduate students majoring in science and engineering. The material is accessible to students who, in various disciplines, have basic linear algebra, calculus, numerical analysis, and computing knowledge. The book is also useful to researchers in computational science who are interested in applied matrix theory.

Matrix analysis presented in the context of numerical computation at a basic level.

Matrices can be studied in different ways. They are a linear algebraic structure and have a topological/analytical aspect (for example, the normed space of matrices) and they also carry an order structure that is induced by positive semidefinite matrices. The interplay of these closely related structures is an essential feature of matrix analysis. This book explains these aspects of matrix analysis from a functional analysis point of view. After an introduction to matrices and functional analysis, it covers more advanced topics such as matrix monotone functions, matrix means, majorization and entropies. Several applications to quantum information are also included. Introduction to Matrix Analysis and Applications is appropriate for an advanced graduate course on matrix analysis, particularly aimed at studying quantum information. It can also be used as a reference for researchers in quantum information, statistics, engineering and economics.

Mathematically rigorous introduction covers vector and matrix norms, the condition-number of a matrix, positive and irreducible matrices, much more. Only elementary algebra and calculus required. Includes problem-solving exercises. 1968 edition.

Introduction to Applied Linear Algebra

Matrices and Linear Algebra

Introduction to Matrix Analysis and Applications

Second Edition

Undergraduate-level introduction to linear algebra and matrix theory. Explores matrices and linear systems, vector spaces, determinants, spectral decomposition, Jordan canonical form, much more. Over 375 problems. Selected answers. 1972 edition.

Applied Engineering Analysis Tai-Ran Hsu, San Jose State University, USA A resource book applying mathematics to solve engineering problems Applied Engineering Analysis is a concise textbook which demonstrates how to apply mathematics to solve engineering problems. It begins with an overview of engineering analysis and an introduction to mathematical modeling, followed by vector calculus, matrices and linear algebra, and applications of first and second order differential equations. Fourier series and Laplace transform are also covered, along with partial differential equations, numerical solutions to nonlinear and differential equations and an introduction to finite element analysis. The book also covers statistics with applications to design and statistical process controls. Drawing on the author's extensive industry and teaching experience, spanning 40 years, the book takes a pedagogical approach and includes examples, case studies and end of chapter problems. It is also accompanied by a website hosting a solutions manual and PowerPoint slides for instructors. Key features: Strong emphasis on deriving equations, not just solving given equations, for the solution of engineering problems. Examples and problems of a practical nature with illustrations to enhance student's self-learning. Numerical methods and techniques, including finite element analysis. Includes coverage of statistical methods for probabilistic design analysis of structures and statistical process control (SPC). Applied Engineering Analysis is a resource book for engineering students and professionals to learn how to apply the mathematics experience and skills that they have already acquired to their engineering profession for innovation, problem solving, and decision making.

This volume concisely presents fundamental ideas, results, and techniques in linear algebra and mainly matrix theory. Each chapter focuses on the results, techniques, and methods that are beautiful, interesting, and representative, followed by carefully selected problems. For many theorems several different proofs are given. The only prerequisites are a decent background in elementary linear algebra and calculus.

Linear algebra and matrix theory are essentially synonymous terms for an area of mathematics that has become one of the most useful and pervasive tools in a wide range of disciplines. It is also a subject of great mathematical beauty. In consequence of both of these facts, linear algebra has increasingly been brought into lower levels of the curriculum, either in conjunction with the calculus or separate from it but at the same level. A large and still growing number of textbooks has been written to satisfy this need, aimed at students at the junior, sophomore, or even freshman levels. Thus, most students now obtaining a bachelor's degree in the sciences or engineering have had some exposure to linear algebra. But rarely, even when solid courses are taken at the junior or senior levels, do these students have an adequate working knowledge of the subject to be useful in graduate work or in research and development activities in government and industry. In particular, most elementary courses stop at the point of canonical forms, so that while the student may have "seen" the Jordan and other canonical forms, there is usually little appreciation of their usefulness. And there is almost never time in the elementary courses to deal with more specialized topics like nonnegative matrices, inertia theorems, and so on. In consequence, many graduate courses in mathematics, applied mathematics, or applications develop certain parts of matrix theory as needed.

Matrix Analysis for Scientists and Engineers

Matrix Theory: A Second Course

Vectors, Matrices, and Least Squares

Basic Matrix Algebra with Algorithms and Applications

Linear Algebra and Matrix Analysis for StatisticsCRC Press

Designed for use in a second course on linear algebra, Matrix Theory and Applications with MATLAB covers the basics of the subject-from a review of matrix algebra through vector spaces to matrix calculus and unitary similarity-in a presentation that stresses insight, understanding, and applications. Among its most outstanding features is the integration of MATLAB throughout the text. Each chapter includes a MATLAB subsection that discusses the various commands used to do the computations in that section and offers code for the graphics and some algorithms used in the text. All of the material is presented from a matrix point of view with enough rigor for students to learn to compose arguments and proofs and adjust the material to cover other problems. The treatment includes optional subsections covering applications, and the final chapters move beyond basic matrix theory to discuss more advanced topics, such as decompositions, positive definite matrices, graphics, and topology. Filled with illustrations, examples, and exercises that reinforce understanding, Matrix Theory and Applications with MATLAB allows readers to experiment and visualize results in a way that no other text does. Its rigor, use of MATLAB, and focus on applications better prepares them to use the material in their future work and research, to extend the material, and perhaps obtain new results of their own.

This comprehensive book is presented in two parts; the first part introduces the basics of matrix analysis necessary for matrix computations, and the second part presents representative methods and the corresponding theories in matrix computations. Among the key features of the book are the extensive exercises at the end of each chapter. Matrix Analysis and Computations provides readers with the matrix theory necessary for matrix computations, especially for direct and iterative methods for solving systems of linear equations. It includes systematic methods and rigorous theory on matrix splitting iteration methods and Krylov subspace iteration methods, as well as current results on preconditioning and iterative methods for solving standard and generalized saddle-point linear systems. This book can be used as a textbook for graduate students as well as a self-study tool and reference for researchers and engineers interested in matrix analysis and matrix computations. It is appropriate for courses in numerical analysis, numerical optimization, data science, and approximation theory, among other topics

A groundbreaking introduction to vectors, matrices, and least squares for engineering applications, offering a wealth of practical examples.

Matrix Algebra

Linear Algebra and Matrix Analysis for Statistics

Basic Results and Techniques

Matrix Algebra for Linear Models

Linear algebra and matrix theory are fundamental tools in mathematical and physical science, as well as fertile fields for research. This second edition of this acclaimed text presents results of both classic and recent matrix analysis using canonical forms as a unifying theme, and demonstrates their importance in a variety of applications. This thoroughly revised and updated second edition is for a second course on linear algebra and has more than 1,100 problems and exercises, new sections on the singular value and CS decompositions and the Weyr canonical form, expanded treatments of inverse problems and of block matrices, and much more.

Matrix Analysis presents the classical and recent results for matrix analysis that have proved to be important to applied mathematics.

After reading this book, students should be able to analyze computational problems in linear algebra such as linear systems, least squares- and eigenvalue problems, and to develop their own algorithms for solving them. Since these problems can be large and difficult to handle, much can be gained by understanding and taking advantage of special structures. This in turn requires a good grasp of basic numerical linear algebra and matrix factorizations. Factoring a matrix into a product of simpler matrices is a crucial tool in numerical linear algebra, because it allows us to tackle complex problems by solving a sequence of easier ones. The main characteristics of this book are as follows: It is self-contained, only assuming that readers have completed first-year calculus and an introductory course on linear algebra, and that they have some experience with solving mathematical problems on a computer. The book provides detailed proofs of virtually all results. Further, its respective parts can be used independently, making it suitable for self-study. The book consists of 15 chapters, divided into five thematically oriented parts. The chapters are designed for a one-week-per-chapter, semester course. To facilitate self-study, an introductory chapter includes a brief review of linear algebra.

This much-needed work presents, among other things, the relevant aspects of the theory of matrix algebra for applications in statistics. Written in an informal style, it addresses computational issues and places more emphasis on applications than existing texts.

Linear Systems and Least Squares

Numerical Linear Algebra and Matrix Factorizations

Linear Algebra and Matrices

Introduction to Linear and Matrix Algebra