Matrix Analysis And Applied Linear Algebra And Solutions Manual

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A Unified Introduction to Linear Algebra - Alan Tucker 1988

PETSc for Partial Differential Equations: Numerical Solutions in C and Python - Ed Bueler 2020-10-22
The Portable, Extensible Toolkit for Scientific Computation (PETSc) is an open-source library of advanced data structures and methods for solving linear and nonlinear equations and for managing discretizations. This book uses these modern numerical tools to demonstrate how to solve nonlinear partial differential equations (PDEs) in parallel. It starts from key mathematical concepts, such as Krylov space methods, preconditioning, multigrid, and Newton's method. In PETSc these components are composed at run time into fast solvers. Discretizations are introduced from the beginning, with an emphasis on finite difference and finite element methodologies. The example C programs of the first 12 chapters, listed on the inside front cover, solve (mostly) elliptic and parabolic PDE problems. Discretization leads to large, sparse, and generally nonlinear systems of algebraic equations. For such problems, mathematical solver concepts are explained and illustrated through the examples, with sufficient context to speed further development. PETSc for Partial Differential Equations addresses both discretizations and fast solvers for PDEs, emphasizing practice more than theory. Well-structured examples lead to run-time choices that result in high solver performance and parallel scalability. The last two chapters build on the reader's understanding of fast solver concepts when applying the Firedrake Python finite element solver library. This textbook, the first to cover PETSc programming for nonlinear PDEs, provides an on-ramp for graduate students and researchers to a major area of high-performance computing for science and engineering. It is suitable as a supplement for courses in scientific computing or numerical methods for differential equations.
Introduction to Matrix Analysis and Applications - Fumio Hiai 2014-02-06
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.

Applied Linear Algebra - Peter J. Olver 2018-05-30

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.

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.

Applied and Computational Matrix Analysis - Natália Bebiano 2017-03-01

This volume presents recent advances in the field of matrix analysis based on contributions at the MAT-TRIAD 2015 conference. Topics covered include interval linear algebra and computational complexity, Birkhoff polynomial basis, tensors, graphs, linear pencils, K-theory and statistic inference, showing the

ubiquity of matrices in different mathematical areas. With a particular focus on matrix and operator theory, statistical models and computation, the International Conference on Matrix Analysis and its Applications 2015, held in Coimbra, Portugal, was the sixth in a series of conferences. Applied and Computational Matrix Analysis will appeal to graduate students and researchers in theoretical and applied mathematics, physics and engineering who are seeking an overview of recent problems and methods in matrix analysis.

Matrix Analysis of Structures - Aslam Kassimali 2011-01-01

This book takes a fresh, student-oriented approach to teaching the material covered in the senior- and first-year graduate-level matrix structural analysis course. Unlike traditional texts for this course that are difficult to read, Kassimali takes special care to provide understandable and exceptionally clear explanations of concepts, step-by-step procedures for analysis, flowcharts, and interesting and modern examples, producing a technically and mathematically accurate presentation of the subject. Important Notice: Media content referenced within the product description or the product text may not be available in the ebook version.

Applied Linear Algebra - Ben Noble 1977

This classic volume applies linear algebra to a variety of disciplines-engineering, the physical sciences, social sciences, and business. It motivates the reader with illustrative examples. This is a competitor to Strang.

Numerical Matrix Analysis - Ilse C. F. Ipsen 2009

The purpose of this book is to promote understanding of two phenomena: sensitivity of linear systems and least squares problems, and numerical stability of algorithms. Sensitivity and stability are analyzed as mathematical properties, without reference to finite precision arithmetic. The material is presented at a basic level, emphasizing ideas and intuition, but in a mathematically rigorous fashion. The derivations are simple and elegant, and the results are easy to understand and interpret. The book is self-contained. It was written for students in all areas of mathematics, engineering, and the computational sciences, but can easily be used for self-study. This text differs from other numerical linear algebra texts by offering the following: a systematic development of numerical conditioning; a simplified concept of numerical stability in exact arithmetic; simple derivations; a high-level view of algorithms; and results for complex matrices.

Applied Linear Algebra - Lorenzo Adlai Sadun 2007-12-20

Linear algebra permeates mathematics, as well as physics and engineering. In this text for junior and senior undergraduates, Sadun treats diagonalization as a central tool in solving complicated problems in these subjects by reducing coupled linear evolution problems to a sequence of simpler decoupled problems. This is the Decoupling Principle. Traditionally, difference equations, Markov chains, coupled oscillators, Fourier series, the wave equation, the Schrodinger equation, and Fourier transforms are treated separately, often in different courses. Here, they are treated as particular instances of the decoupling principle, and their solutions are remarkably similar. By understanding this general principle and the many applications given in the book,

students will be able to recognize it and to apply it in many other settings. Sadun includes some topics relating to infinite-dimensional spaces. He does not present a general theory, but enough so as to apply the decoupling principle to the wave equation, leading to Fourier series and the Fourier transform. The second edition contains a series of Explorations. Most are numerical labs in which the reader is asked to use standard computer software to look deeper into the subject. Some explorations are theoretical, for instance, relating linear algebra to quantum mechanics. There is also an appendix reviewing basic matrix operations and another with solutions to a third of the exercises.

Matrix Analysis - Roger A. Horn 2012-10-22

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 a text 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 Positivity - Charles R. Johnson 2020-10

This comprehensive reference, for mathematical, engineering and social scientists, covers matrix positivity classes and their applications.

Matrix Analysis and Computations - Zhong-Zhi Bai 2021-09-09

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

An Introduction to Applied Matrix Analysis - Xiao Qing Jin 2016-05-30

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.

Applied Linear Algebra and Matrix Analysis - Thomas S. Shores 2008-11-01

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 flavor is heavily computational and 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.

Matrix Analysis and Applied Linear Algebra - Carl D. Meyer 2000-06-01

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 applied linear algebra are included here which are not normally found in 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 examples and exercises, historical notes, and comments on numerical 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.

Linear Algebra and Matrix Analysis for Statistics - Sudipto Banerjee 2014-06-06

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.

Approximation Theory and Approximation Practice, Extended Edition - Lloyd N. Trefethen 2019-01-01

This is a textbook on classical polynomial and rational approximation theory for the twenty-first century. Aimed at advanced undergraduates and graduate students across all of applied mathematics, it uses MATLAB to teach the field□s most important ideas and results. Approximation Theory and Approximation Practice, Extended Edition differs fundamentally from other works on approximation theory in a number of ways: its emphasis is on topics close to numerical algorithms; concepts are illustrated with Chebfun; and each chapter is a PUBLISHable MATLAB M-file, available online. The book centers on theorems and methods for analytic functions, which appear so often in applications, rather than on functions at the edge of discontinuity with their seductive theoretical challenges. Original sources are cited rather than textbooks, and each item in the bibliography is accompanied by an editorial comment. In addition, each chapter has a collection of exercises, which span a wide range from mathematical theory to Chebfun-based numerical experimentation. This textbook is appropriate for advanced undergraduate or graduate students who have an understanding of numerical analysis and complex analysis. It is also appropriate for seasoned mathematicians who use MATLAB.

Applied Linear Algebra in Action - Vasilios Katsikis 2016-07-06

The present text book contains a collection of six high-quality articles. In particular, this book is devoted to Linear Mathematics by presenting problems in Applied Linear Algebra of general or special interest.

Linear Algebra and Matrices - Shmuel Friedland 2018-01-30

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.

Matrix Analysis and Applied Linear Algebra - Carl D. Meyer 2007-08-28

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 applied linear algebra are included here which are not normally found in 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 examples and exercises, historical notes, and comments on numerical 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.

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.

Applied Linear Algebra and Matrix Analysis - Thomas Shores 2000-08

This text is intended for a one or two semester sophomore/junior level course in linear algebra. It is designed to provide a balance of applications, theory and computation, and to emphasize their interdependence. The text has a strong orientation towards numerical computation and the linear algebra needed in applied mathematics. At the same time, it contains a rigorous and self-contained development of most of the traditional topics in a linear algebra course. It provides background for numerous projects, which frequently require computational tools, but is not tied to any one computational platform. A comprehensive set of exercises and projects is included.

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.

Applied Linear Algebra and Matrix Analysis - Thomas S. Shores 2007-03-12

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 flavor is heavily computational and 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.

A Second Course in Linear Algebra - Stephan Ramon Garcia 2017-05-11

A second course in linear algebra for undergraduates in mathematics, computer science, physics, statistics, and the biological sciences.

Functions of Matrices - Nicholas J. Higham 2008-01-01

A thorough and elegant treatment of the theory of matrix functions and numerical methods for computing them, including an overview of applications, new and unpublished research results, and improved algorithms. Key features include a detailed treatment of the matrix sign function and matrix roots; a development of the theory of conditioning and properties of the Fre;chet derivative; Schur decomposition; block Parlett recurrence; a thorough analysis of the accuracy, stability, and computational cost of numerical methods; general results on convergence and stability of matrix iterations; and a chapter devoted to the f(A)b problem. Ideal for advanced courses and for self-study, its broad content, references and appendix also make this book a convenient general reference. Contains an extensive collection of problems with solutions and MATLAB implementations of key algorithms.

Matrix Analysis and Applied Linear Algebra - Carl D. Meyer 2000-01-01

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 - Jörg Liesen 2015-11-20

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 functions, the singular value decomposition, the Kronecker product 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 computational experiments. Necessary basics for the use of MATLAB 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 for Scientists and Engineers - Alan J. Laub 2005-01-01

"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 - Rajendra Bhatia 2013-12-01

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 it discusses connections with other areas of mathematics.

Matrix Analysis - Roger A. Horn 1990-02-23

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

Matrix Analysis and Applications - Xian-Da Zhang 2017-10-05

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

Matrix Analysis and Applied Linear Algebra - Carl D. Meyer 2005

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.

Matrix Algebra From a Statistician's Perspective - David A. Harville 2008-06-27

A knowledge of matrix algebra is a prerequisite for the study of much of modern statistics, especially the areas of linear statistical models and multivariate statistics. This reference book provides the background in matrix algebra necessary to do research and understand the results in these areas. Essentially self-contained, the book is best-suited for a reader who has had some previous exposure to matrices. Solultions to the exercises are available in the author's "Matrix Algebra: Exercises and Solutions."

Introduction to Linear and Matrix Algebra - Nathaniel Johnston 2021-05-19

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 applications. Those continuing to a second course in linear 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. Investigation then focuses on the algebraic 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 accompany each section, including many designed to 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 will appreciate the ample opportunities to choose topics that align with the needs of each classroom, and the online homework sets that are available through WeBWorK.

Matrix Theory - Joel N. Franklin 2012-07-31

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.

Matrix Analysis and Applied Linear Algebra - Carl Dean Meyer 2000

Linear Algebra: Theory and Applications - Kenneth Kuttler 2012-01-29

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 undergraduate mathematics courses. Part of the reason for this is its 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.