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3E5 - LAILA RHETT

Presents the basic mathematical ideas and algorithms of the matrix analytic theory in a readable, up--to-date, and comprehensive manner.
Mathematics of Computing -- General.
In this book, there are five chapters: The Laplace Transform, Systems of Homogenous Linear Differential Equations (HLDE), Methods of First and Higher Orders Differential Equations, Extended Methods of First and Higher Orders Differential Equations, and Applications of Differential Equations. In addition, there are exercises at the end of each chapter above to let students practice additional sets of problems other than examples, and they can also check their solutions to some of these exercises by looking at "Answers to Odd-Numbered Exercises" section at the end of this book. This book is a very useful for college students who studied Calculus II, and other students who want to review some concepts of differential equations before studying courses such as partial differential equations, applied mathematics, and electric circuits II.
A groundbreaking introduction to vectors, matrices, and least squares for engineering applications, offering a wealth of practical examples.

This book is about making decisions driven by experience. In this context, a scenario is an observation that comes from the environment, and scenario optimization refers to optimizing decisions over a set of available scenarios. Scenario optimization can be applied across a variety of fields, including machine learning, quantitative finance, control, and identification. This concise, practical book provides readers with an easy access point to make the scenario approach understandable to nonexperts, and offers an overview of various decision frameworks in which the method can be used. It contains numerous examples and diverse applications from a broad range of domains, including systems theory, control, biomedical engineering, economics, and finance. Practitioners can find "easy--to-use recipes," while theoreticians will benefit from a rigorous treatment of the theoretical foundations of the method, making it an excellent starting point for scientists interested in doing research in this field. Introduction to the Scenario Approach will appeal to scientists working in optimization, practitioners working in myriad fields involving decision-making, and anyone interested in data-driven decision-making.
Broadly organized around the applications of Fourier analysis, "Methods of Applied Mathematics with a MATLAB Overview" covers both classical applications in partial differential equations and boundary value problems, as well as the concepts and methods associated to the Laplace, Fourier, and discrete transforms. Transform inversion problems are also examined, along with the necessary background in complex variables. A final chapter treats wavelets, short-time Fourier analysis, and geometrically-based transforms. The computer program MATLAB is emphasized throughout, and an introduction to MATLAB is provided in an appendix. Rich in examples, illustrations, and exercises of varying difficulty, this text can be used for a one- or two-semester course and is ideal for students in pure and applied mathematics, physics, and engineering.
This text presents a multi-disciplined view of optimization, providing students and researchers with a thorough examination of algorithms, methods, and tools from diverse areas of optimization without introducing excessive theoretical detail. This second edition includes additional topics, including global optimization and a real-world case study using important concepts from each chapter. Introduction to Applied Optimization is intended for advanced undergraduate and graduate students and will benefit scientists from diverse areas, including engineers.
FOAM. This acronym has been used for over ?fty years at Rensselaer to designate an upper-division course entitled, Foundations of Applied Ma- ematics. This course was started by George Handelman in 1956, when he came to Rensselaer from the Carnegie Institute of Technology. His objective was to closely integrate mathematical and physical reasoning, and in the p- cess enable students to obtain a qualitative understanding of the world we live in. FOAM was soon taken over by a young faculty member, Lee Segel. About this time a similar course, Introduction to Applied Mathematics, was introduced by Chia-Ch'iao Lin at the Massachusetts Institute of Technology. Together Lin and Segel, with help from Handelman, produced one of the landmark textbooks in applied mathematics, Mathematics Applied to - terministic Problems in the Natural Sciences. This was originally published in 1974, and republished in 1988 by the Society for Industrial and Applied Mathematics, in their Classics Series. This textbook comes from the author teaching FOAM over the last few years. In this sense, it is an updated version of the Lin and Segel textbook.

These notes are based on a one-quarter (i. e. very short) course in fluid mechanics taught in the Department of Mathematics of the University of California, Berkeley during the Spring of 1978. The goal of the course was not to provide an exhaustive account of fluid mechanics, nor to assess the engineering value of various approxima tion procedures. The goals were: (i) to present some of the basic ideas of fluid mechanics in a mathematically attractive manner (which does not mean "fully rigorous"); (ii) to present the physical back ground and motivation for some constructions which have been used in recent mathematical and numerical work on the Navier-Stokes equations and on hyperbolic systems; (iil.) 'to interest some of the students in this beautiful and difficult subject. The notes are divided into three chapters. The first chapter contains an elementary derivation of the equations; the concept of vorticity is introduced at an early stage. The second chapter contains a discussion of potential flow, vortex motion, and boundary layers. A construction of boundary layers using vortex sheets and random walks is presented; it is hoped that it helps to clarify the ideas. The third chapter contains an analysis of one-dimensional gas iv flow, from a mildly modern point of view. Weak solutions, Riemann problems, Glimm's scheme, and combustion waves are discussed. The style is informal and no attempt was made to hide the authors' biases and interests.
This book provides an extensive introduction to numerical computing from the viewpoint of backward error analysis. The intended audience includes students and researchers in science, engineering and mathematics. The approach taken is somewhat informal owing to the wide variety of backgrounds of the readers, but the central ideas of backward error and sensitivity (conditioning) are systematically emphasized. The book is divided into four parts: Part I provides the background preliminaries including floating-point arithmetic, polynomials and computer evaluation of functions; Part II covers numerical linear algebra; Part III covers interpolation, the FFT and quadrature; and Part IV covers numerical solutions of differential equations including initial-value problems, boundary-value problems, delay differential equations and a brief chapter on partial differential equations. The book contains detailed illustrations, chapter summaries and a variety of exercises as well some Matlab codes provided online as supplementary material. “I really like the focus on backward error analysis and condition. This is novel in a textbook and a practical approach that will bring welcome attention." Lawrence F. Shampine A Graduate Introduction to Numerical Methods and Backward Error Analysis” has been selected by Computing Reviews as a notable book in computing in 2013. Computing Reviews Best of 2013 list consists of book and article nominations from reviewers, CR category editors, the editors-in-chief of journals, and others in the computing community.
Mathematics is playing an increasing important role in society and the sciences, enhancing our ability to use models and handle data. While pure mathematics is mostly interested in abstract structures, applied mathematics sits at the interface between this abstract world and the world in which we live. This area of mathematics takes its nourishment from society and science and, in turn, provides a unified way to understand problems arising in diverse fields. This Very Short Introduction presents a compact yet comprehensive view of the field of applied mathematics, and explores its relationships with (pure) mathematics, science, and engineering. Explaining the nature of applied mathematics, Alain Goriely discusses its early achievements in physics and engineering, and its development as a separate field after World War II. Using historical examples, current applications, and challenges, Goriely illustrates the particular role that mathematics plays in the modern sciences today and its far-reaching potential. ABOUT THE SERIES: The Very Short Introductions series from Oxford University Press contains hundreds of titles in almost every subject area. These pocket-sized books are the perfect way to get ahead in a new subject quickly. Our expert authors combine facts, analysis, perspective, new ideas, and enthusiasm to make interesting and challenging topics highly readable.
This introduction to applied nonlinear dynamics and chaos places emphasis on teaching the techniques and ideas that will enable students to take specific dynamical systems and obtain some quantitative information about their behavior. The new edition has been updated and extended throughout, and contains a detailed glossary of terms. From the reviews: "Will serve as one of the most eminent introductions to the geometric theory of dynamical systems." --Monatshefte für Mathematik

This clear and concise textbook provides a rigorous introduction to the calculus of variations, depending on functions of one variable and their first derivatives. It is based on a translation of a German edition of the book Variationsrechnung (Vieweg+Teubner Verlag, 2010), translated and updated by the author himself. Topics include: the Euler-Lagrange equation for one-dimensional variational problems, with and without constraints, as well as an introduction to the direct methods. The book targets students who have a solid background in calculus and linear algebra, not necessarily in functional analysis. Some advanced mathematical tools, possibly not familiar to the reader, are given along with proofs in the appendix. Numerous figures, advanced problems and proofs, examples, and exercises with solutions accompany the book, making it suitable for self-study. The book will be particularly useful for beginning graduate students from the physical, engineering, and mathematical sciences with a rigorous theoretical background.
Offering a number of mathematical facts and techniques not commonly treated in courses in advanced calculus, this book explores linear algebraic equations, quadratic and Hermitian forms, the calculus of variations, more.
Partial Differential Equations presents a balanced and comprehensive introduction to the concepts and techniques required to solve problems containing unknown functions of multiple variables. While focusing on the three most classical partial differential equations (PDEs)—the wave, heat, and Laplace equations—this detailed text also presents a broad practical perspective that merges mathematical concepts with real-world application in diverse areas including molecular structure, photon and electron interactions, radiation of electromagnetic waves, vibrations of a solid, and many more. Rigorous pedagogical tools aid in student comprehension; advanced topics are introduced frequently, with minimal technical jargon, and a wealth of exercises reinforce vital skills and invite additional self-study. Topics are presented in a logical progression, with major concepts such as wave propagation, heat and diffusion, electrostatics, and quantum mechanics placed in contexts familiar to students of various fields in science and engineering. By understanding the properties and applications of PDEs, students will be equipped to better analyze and interpret central processes of the natural world.
From the Preface: "The material in this book is based on notes for a course which I gave several times at Brown University. The target of the course was juniors and seniors majoring in applied mathematics, engineering and other sciences. My basic goal in the course was to teach standard methods, or what I regard as a basic "bag of tricks". In my opinion the material contained here, for the most part, does not depart widely from traditional subject matter. One such departure is the discussion of discrete linear systems. Besides being interesting in its own right, this topic is included because the treatment of such systems leads naturally to the use of discrete Fourier series, discrete Fourier transforms, and their extension, the Z-transform. On making the transition to continuous systems we derive their continuous analogues, viz., Fourier series, Fourier transforms, Fourier integrals and Laplace transforms. A main advantage to the approach taken is that a wide variety of techniques are seen to result from one or two very simple but central ideas. Above all, this course is intended as being one which gives the student a "can-do" frame of mind about mathematics. Students should be given confidence in using mathematics and not be made fearful of it. I have, therefore, forgone the theorem-proof format for a more informal style. Finally, a concerted effort was made to present an assortment of examples from diverse applications with the hope of attracting the interest of the student, and an equally dedicated effort was made to be kind to the reader."

This undergraduate textbook introduces students of science and engineering to the fascinating field of optimization. It is a unique book that brings together the subfields of mathematical programming, variational calculus, and optimal control, thus giving students an overall view of all aspects of optimization in a single reference. As a primer on optimization, its main goal is to provide a succinct and accessible introduction to linear programming, nonlinear programming, numerical optimization algorithms, variational problems, dynamic programming, and optimal control. Prerequisites have been kept to a minimum, although a basic knowledge of calculus, linear algebra, and differential equations is assumed.
Over the past fifteen years two new techniques have yielded extremely important contributions toward the numerical solution of nonlinear systems of equations. This book provides an introduction to and an up-to-date survey of numerical continuation methods (tracing of implicitly defined curves) of both predictor-corrector and piecewise-linear types. It presents and analyzes implementations

aimed at applications to the computation of zero points, fixed points, nonlinear eigenvalue problems, bifurcation and turning points, and economic equilibria. Many algorithms are presented in a pseudo code format. An appendix supplies five sample FORTRAN programs with numerical examples, which readers can adapt to fit their purposes, and a description of the program package SCOUT for analyzing nonlinear problems via piecewise-linear methods. An extensive up-to-date bibliography spanning 46 pages is included. The material in this book has been presented to students of mathematics, engineering and sciences with great success, and will also serve as a valuable tool for researchers in the field.

Partial differential equations are fundamental to the modeling of natural phenomena. The desire to understand the solutions of these equations has always had a prominent place in the efforts of mathematicians and has inspired such diverse fields as complex function theory, functional analysis, and algebraic topology. This book, meant for a beginning graduate audience, provides a thorough introduction to partial differential equations.

The purpose of this book is to offer an overview of the most popular domain decomposition methods for partial differential equations (PDEs). These methods are widely used for numerical simulations in solid mechanics, electromagnetism, flow in porous media, etc., on parallel machines from tens to hundreds of thousands of cores. The appealing feature of domain decomposition methods is that, contrary to direct methods, they are naturally parallel. The authors focus on parallel linear solvers. The authors present all popular algorithms, both at the PDE level and at the discrete level in terms of matrices, along with systematic scripts for sequential implementation in a free open-source finite element package as well as some parallel scripts. Also included is a new coarse space construction (two-level method) that adapts to highly heterogeneous problems.÷

This book provides step-by-step instructions on how to analyze text generated from in-depth interviews and focus groups, relating predominantly to applied qualitative studies. The book covers all aspects of the qualitative data analysis process, employing a phenomenological approach which has a primary aim of describing the experiences and perceptions of research participants. Similar to Grounded Theory, the authors' approach is inductive, content-driven, and searches for themes within textual data.

On the occasion of this new edition, the text was enlarged by several new sections. Two sections on B-splines and their computation were added to the chapter on spline functions: Due to their special properties, their flexibility, and the availability of well-tested programs for their computation, B-splines play an important role in many applications. Also, the authors followed suggestions by many readers to supplement the chapter on elimination methods with a section dealing with the solution of large sparse systems of linear equations. Even though such systems are usually solved by iterative methods, the realm of elimination methods has been widely extended due to powerful techniques for handling sparse matrices. We will explain some of these techniques in connection with the Cholesky algorithm for solving positive definite linear systems. The chapter on eigenvalue problems was enlarged by a section on the Lanczos algorithm; the sections on the LR and QR algorithm were rewritten and now contain a description of implicit shift techniques. In order to some extent take into account the progress in the area of ordinary differential equations, a new section on implicit differential equa tions and differential-algebraic systems was added, and the section on stiff differential equations was updated by describing further methods to solve such equations.

Praise for the First Edition ". . . outstandingly appealing with regard to its style, contents, considerations of requirements of practice, choice of examples, and exercises." —Zentrablatt Math ". . . carefully structured with many detailed worked examples . . ." —The Mathematical Gazette ". . . an up--to-date and user-friendly account . . ." —Mathematika An Introduction to Numerical Methods and Analysis addresses the mathematics underlying approximation and scientific computing and successfully explains where approximation methods come from, why they sometimes work (or don't work), and when to use one of the many techniques that are available. Written in a style that emphasizes readability and usefulness for the numerical methods novice, the book begins with basic, elementary material and gradually builds up to more advanced topics. A selection of concepts required for the study of computational mathematics is introduced, and simple approximations using Taylor's Theorem are also treated in some depth. The text includes exercises that run the gamut from simple hand computations, to challenging derivations and minor proofs, to programming exercises. A greater emphasis on applied exercises as well as the cause and effect associated with numerical mathematics is featured throughout the book. An Introduction to Numerical Methods and Analysis is the ideal text for students in advanced undergraduate mathematics and engineering courses who are interested in gaining an understanding of numerical methods and numerical analysis.

Using the behavioural approach to mathematical modelling, this book views a system as a dynamical relation between manifest and latent variables. The emphasis is on dynamical systems that are represented by systems of linear constant coefficients. The first part analyses the structure of the set of trajectories generated by such dynamical systems, and derives the conditions for two systems of differential equations to be equivalent in the sense that they define the same behaviour. In addition the memory structure of the system is analysed through state space models. The second part of the book is devoted to a number of important system properties, notably controllability, observability, and stability. In the third part, control problems are considered, in particular stabilisation and pole placement questions. Suitable for advanced undergraduate or beginning graduate students in mathematics and engineering, this text contains numerous exercises, including simulation problems, and examples, notably of mechanical systems and electrical circuits.

An introduction to symmetry analysis for graduate students in science, engineering and applied mathematics.

This textbook is an introduction to the theory of solitons in the physical sciences.

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.

This book gives a comprehensive introduction to numerical methods and analysis of stochastic processes, random fields and stochastic differential equations, and offers graduate students and researchers powerful tools for understanding uncertainty quantification for risk analysis. Coverage includes traditional stochastic ODEs with white noise forcing, strong and weak approximation, and the multi-level Monte Carlo method. Later chapters apply the theory of random fields to the numerical solution of elliptic PDEs with correlated random data, discuss the Monte Carlo method, and introduce stochastic Galerkin finite-element methods. Finally, stochastic parabolic PDEs are developed. Assuming little previous exposure to probability and statistics, theory is developed in tandem with state-of-the-art computational methods through worked examples, exercises, theorems and proofs. The set of MATLAB codes included (and downloadable) allows readers to perform computations themselves and solve the test problems discussed. Practical examples are drawn from finance, mathematical biology, neuroscience, fluid flow modelling and materials science.

This is an introduction to stochastic integration and stochasticdifferential equations written in an understandable way for a wideaudience, from students of mathematics to practitioners in biology,-chemistry, physics, and finances. The presentation is based on thenaïve stochastic integration, rather than on abstract theoriesof measure and stochastic processes. The proofs are rather simplefor practitioners and, at the same time, rather rigorous formathematicians. Detailed application examples in natural sciencesand finance are presented. Much attention is paid to simulationdiffusion processes. The topics covered include Brownian motion; motivation ofstochastic models with Brownian motion; Itô and Stratonovichstochastic integrals, Itô's formula; stochasticdifferential equations (SDEs); solutions of SDEs as Markovprocesses; application examples in physical sciences and finance;simulation of solutions of SDEs (strong and weak approximations).Exercises with hints and/or solutions are also provided.

"This book is appropriate for an applied numerical analysis course for upper-level undergraduate and graduate students as well as computer science students. Actual programming is not covered, but an extensive range of topics includes round-off and function evaluation, real zeros of a function, integration, ordinary differential equations, optimization, orthogonal functions, Fourier series, and much more. 1989 edition"--Provided by publisher.

This introductory graduate text is based on a graduate course the author has taught repeatedly over the last ten years to students in applied mathematics, engineering sciences, and physics. Each chapter begins with an introductory development involving ordinary differential equations, and goes on to cover such traditional topics as boundary layers and multiple scales. However, it also contains material arising from current research interest, including homogenisation, slender body theory, symbolic computing, and discrete equations. Many of the excellent exercises are derived from problems of up-to-date research and are drawn from a wide range of application areas.

Numerous worked examples and exercises highlight this unified treatment. Simple explanations of difficult subjects make it accessible to undergraduates as well as an ideal self-study guide. 1990 edition.

This book shows how to derive, test and analyze numerical methods for solving differential equations, including both ordinary and partial differential equations. The objective is that students learn to solve differential equations numerically and understand the mathematical and computational issues that arise when this is done. Includes an extensive collection of exercises, which develop both the analytical and computational aspects of the material. In addition to more than 100 illustrations, the book includes a large collection of supplemental material: exercise sets, MATLAB computer codes for both student and instructor, lecture slides and movies.

This book teaches mathematical structures and how they can be applied in environmental science. Each chapter presents story problems with an emphasis on derivation. For each of these, the discussion follows the pattern of first presenting an example of a type of structure as applied to environmental science. The definition of the structure is presented, followed by additional examples using MATLAB, and analytic methods of solving and learning from the structure.

Introduction to Research Methods: A Hands-On Approach makes learning research methods easy for students by giving them activities they can experience and do on their own. With clear, simple, and even humorous prose, this text offers students a straightforward introduction to an exciting new world of social science and behavioral research. Rather than making research seem intimidating, author Bora Pajo shows students how research can be an easy, ongoing conversation on topics that matter in their lives. Each chapter includes real research examples that illustrate specific topics that the chapter covers, guides that help students explore actual research challenges in more depth, and ethical considerations relating to specific chapter topics. 3 Reasons Why You'll Want to Read This Book 1. Conducting research can be fun when you see it in terms that relate to your everyday life. 2. Knowing how to do research will open many doors for you in your career. It will open your mind to new ideas on what you might pursue in the future (e.g., becoming an entrepreneur, opening your own nongovernmental organization, or running your own health clinic), and give you an extra analytic skill to brag about in your job interviews. 3. Understanding research will make you an educated consumer. You will be able to evaluate the information before you and determine what to accept and what to reject. Truth be told, understanding research will save you money in the short and long term*. *From Chapter 1 of Introduction to Research Methods: A Hands-On Approach

Among the theoretical methods for solving many problems of applied mathematics, physics, and technology, asymptotic methods often provide results that lead to obtaining more effective algorithms of numerical evaluation. Presenting the mathematical methods of perturbation theory, Introduction to Asymptotic Methods reviews the most important m

Introduction to the Numerical Analysis of Incompressible Viscous Flows treats the numerical analysis of finite element computational fluid dynamics. Assuming minimal background, the text covers finite element methods; the derivation, behavior, analysis, and numerical analysis of Navier-Stokes equations; and turbulence and turbulence models used in simulations. Each chapter on theory is followed by a numerical analysis chapter that expands on the theory. This book provides the foundation for understanding the interconnection of the physics, mathematics, and numerics of the incompressible case, which is essential for progressing to the more complex flows not addressed in this book (e.g., viscoelasticity, plasmas, compressible flows, coating flows, flows of mixtures of fluids, and bubbly flows). With mathematical rigor and physical clarity, the book progresses from the mathematical preliminaries of energy and stress to finite element computational fluid dynamics in a format manageable in one semester. Audience: this unified treatment of fluid mechanics, analysis, and numerical analysis is intended for graduate students in mathematics, engineering, physics, and the sciences who are interested in understanding the foundations of methods commonly used for flow simulations.

Inverse problems are found in many applications, such as medical imaging, engineering, astronomy, and geophysics, among others. To solve an inverse problem is to recover an object from noisy, usually indirect observations. Solutions to inverse problems are subject to many potential sources of error introduced by approximate mathematical models, regularization methods, numerical approximations for efficient computations, noisy data, and limitations in the number of observations; thus it is important to include an assessment of the uncertainties as part of the solution. Such assessment is interdisciplinary by nature, as it requires, in addition to knowledge of the particular application, methods from applied mathematics, probability, and statistics. This book bridges applied mathematics and statistics by providing a basic introduction to probability and statistics for uncertainty quantification in the context of inverse problems, as well as an introduction to statistical regularization of inverse problems. The author covers basic statistical inference, introduces the framework of ill-posed inverse problems, and explains statistical questions that arise in their applications. An Introduction to Data Analysis and Uncertainty Quantification for Inverse Problems÷includes many examples that explain techniques which are useful to address general problems arising in uncertainty quantification, Bayesian and non-Bayesian statistical methods and discussions of their complementary roles, and analysis of a real data set to illustrate the methodology covered throughout the book.

Trieste Publishing has a massive catalogue of classic book titles. Our aim is to provide readers with the highest quality reproductions of fiction and non-fiction literature that has stood the test of time. The many thousands of books in our collection have been sourced from libraries and private collec-