Fourier Analysis And Applications Filtering Numerical Computation Wavelets Texts In Applied Mathematics

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Fourier Analysis and Applications - Claude Gasquet 1998-11-06
The object of this book is two-fold -- on the one hand it conveys to mathematical readers a rigorous presentation and exploration of the important applications of analysis leading to numerical calculations. On the other hand, it presents physics readers with a body of theory in which the well-known formulae find their justification. The basic study of

fundamental notions, such as Lebesgue integration and theory of distribution, allow the establishment of the following areas: Fourier analysis and convolution Filters and signal analysis time-frequency analysis (gabor transforms and wavelets). The whole is rounded off with a large number of exercises as well as selected worked-out solutions.
Mathematical Control Theory - Eduardo D. Sontag 2013-11-21
Geared primarily to an audience consisting of mathematically advanced undergraduate or beginning graduate students, this text may additionally be used by engineering students interested in a rigorous, proof-oriented systems course that goes beyond the classical frequency-domain material and more applied courses. The minimal mathematical background required is a working knowledge of linear algebra and differential equations. The book covers what constitutes the common core of control theory and is unique in its emphasis on foundational aspects. While covering a wide range of topics written in a standard theorem/proof style, it also develops the necessary techniques from scratch. In this second edition, new chapters and sections have been added, dealing with time optimal control of linear systems, variational and numerical approaches to nonlinear control, nonlinear controllability via Lie-algebraic methods, and controllability of recurrent nets and of linear systems with bounded controls.
Partial Differential Equations with Numerical Methods - Stig Larsson 2008-11-19
The main theme is the integration of the theory of linear PDE and the theory of finite difference and finite element methods. For each type of PDE, elliptic, parabolic, and hyperbolic, the text contains one chapter on the mathematical theory of the differential equation, followed by one chapter on finite difference methods and one on finite element methods. The chapters on elliptic equations

are preceded by a chapter on the two-point boundary value problem for ordinary differential equations. Similarly, the chapters on time-dependent problems are preceded by a chapter on the initial-value problem for ordinary differential equations. There is also one chapter on the elliptic eigenvalue problem and eigenfunction expansion. The presentation does not presume a deep knowledge of mathematical and functional analysis. The required background on linear functional analysis and Sobolev spaces is reviewed in an appendix. The book is suitable for advanced undergraduate and beginning graduate students of applied mathematics and engineering.

Geometric Control of Mechanical Systems - Francesco Bullo 2019-06-12

The area of analysis and control of mechanical systems using differential geometry is flourishing. This book collects many results over the last decade and provides a comprehensive introduction to the area.

Multidimensional Signal and Color Image Processing Using Lattices - Eric Dubois 2019-03-12

An Innovative Approach to Multidimensional Signals and Systems Theory for Image and Video Processing In this volume, Eric Dubois further develops the theory of multi-D signal processing wherein input and output are vector-value signals. With this framework, he introduces the reader to crucial concepts in signal processing such as continuous- and discrete-domain signals and systems, discrete-domain periodic signals, sampling and reconstruction, light and color, random field models, image representation and more. While most treatments use normalized representations for non-rectangular sampling, this approach obscures much of the geometrical and scale information of the signal. In contrast, Dr. Dubois uses actual units of space-time and frequency. Basis-independent representations appear as

much as possible, and the basis is introduced where needed to perform calculations or implementations. Thus, lattice theory is developed from the beginning and rectangular sampling is treated as a special case. This is especially significant in the treatment of color and color image processing and for discrete transform representations based on symmetry groups, including fast computational algorithms. Other features include: An entire chapter on lattices, giving the reader a thorough grounding in the use of lattices in signal processing Extensive treatment of lattices as used to describe discrete-domain signals and signal periodicities Chapters on sampling and reconstruction, random field models, symmetry invariant signals and systems and multidimensional Fourier transformation properties Supplemented throughout with MATLAB examples and accompanying downloadable source code Graduate and doctoral students as well as senior undergraduates and professionals working in signal processing or video/image processing and imaging will appreciate this fresh approach to multidimensional signals and systems theory, both as a thorough introduction to the subject and as inspiration for future research.

Numerical Partial Differential Equations - J.W. Thomas 2013-11-27

Continuing the theme of the first, this second volume continues the study of the uses and techniques of numerical experimentation in the solution of PDEs. It includes topics such as initial-boundary-value problems, a complete survey of theory and numerical methods for conservation laws, and numerical schemes for elliptic PDEs. The author stresses the use of technology and graphics throughout for both illustration and analysis.

Mathematical Models in Population Biology and Epidemiology - Fred Brauer 2013-03-09

The goal of this book is to search for a balance between simple and analyzable models

and unsolvable models which are capable of addressing important questions on population biology. Part I focusses on single species simple models including those which have been used to predict the growth of human and animal population in the past. Single population models are, in some sense, the building blocks of more realistic models -- the subject of Part II. Their role is fundamental to the study of ecological and demographic processes including the role of population structure and spatial heterogeneity -- the subject of Part III. This book, which will include both examples and exercises, is of use to practitioners, graduate students, and scientists working in the field.

Fourier Analysis and Applications - Claude Gasquet 2013-12-01

The object of this book is two-fold -- on the one hand it conveys to mathematical readers a rigorous presentation and exploration of the important applications of analysis leading to numerical calculations. On the other hand, it presents physics readers with a body of theory in which the well-known formulae find their justification. The basic study of fundamental notions, such as Lebesgue integration and theory of distribution, allow the establishment of the following areas: Fourier analysis and convolution Filters and signal analysis time-frequency analysis (gabor transforms and wavelets). The whole is rounded off with a large number of exercises as well as selected worked-out solutions.

Computational Mathematics and Applications - Dia Zeidan 2020-11-23

This book is a collection of invited and reviewed chapters on state-of-the-art developments in interdisciplinary mathematics. The book discusses recent developments in the fields of theoretical and applied mathematics, covering areas of interest to mathematicians, scientists, engineers, industrialists, researchers,

faculty, and students. Readers will be exposed to topics chosen from a wide range of areas including differential equations, integral reforms, operational calculus, numerical analysis, fluid mechanics, and computer science. The aim of the book is to provide brief and reliably expressed research topics that will enable those new or not aware of mathematical sciences in this part of the world. While the book has not been precisely planned to address any branch of mathematics, it presents contributions of the relevant topics to do so. The topics chosen for the book are those that we have found of significant interest to many researchers in the world. These also are topics that are applicable in many fields of computational and applied mathematics. This book constitutes the first attempt in Jordanian literature to scientifically consider the extensive need of research development at the national and international levels with which mathematics deals. The book grew not only from the international collaboration between the authors but rather from the long need for a research-based book from different parts of the world for researchers and professionals working in computational and applied mathematics. This is the modified version of the back-cover content on the print book

Introduction to Numerical Analysis - J. Stoer 2013-03-09
New edition of a well-known classic in the field; Previous edition sold over 6000 copies worldwide; Fully-worked examples; Many carefully selected problems

Introduction to Optimization - Pablo Pedregal 2006-04-18
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.

Nodal Discontinuous Galerkin Methods - Jan S. Hesthaven 2007-12-20

This book offers an introduction to the key ideas, basic analysis, and efficient implementation of discontinuous Galerkin finite element methods (DG-FEM) for the solution of partial differential equations. It covers all key theoretical results, including an overview of relevant results from approximation theory, convergence theory for numerical PDE's, and orthogonal polynomials. Through embedded Matlab codes, coverage discusses and implements the algorithms for a number of classic systems of PDE's: Maxwell's equations, Euler equations, incompressible Navier-Stokes equations, and Poisson- and Helmholtz equations.

New Trends in Applied Harmonic Analysis - Akram Aldroubi 2016-04-21

This volume is a selection of written notes corresponding to courses taught at the CIMPA School: "New Trends in Applied Harmonic Analysis: Sparse Representations, Compressed Sensing and Multifractal Analysis". New interactions between harmonic analysis and signal and image processing have seen striking development in the last 10 years, and several technological deadlocks have been solved through the resolution of deep theoretical problems in harmonic analysis. New Trends in Applied Harmonic Analysis focuses on two particularly active areas that are representative of such advances: multifractal analysis, and sparse representation and compressed sensing. The

contributions are written by leaders in these areas, and cover both theoretical aspects and applications. This work should prove useful not only to PhD students and postdocs in mathematics and signal and image processing, but also to researchers working in related topics.

Numerical Fourier Analysis - Gerlind Plonka 2019-02-05

This book offers a unified presentation of Fourier theory and corresponding algorithms emerging from new developments in function approximation using Fourier methods. It starts with a detailed discussion of classical Fourier theory to enable readers to grasp the construction and analysis of advanced fast Fourier algorithms introduced in the second part, such as nonequispaced and sparse FFTs in higher dimensions. Lastly, it contains a selection of numerical applications, including recent research results on nonlinear function approximation by exponential sums. The code of most of the presented algorithms is available in the authors' public domain software packages. Students and researchers alike benefit from this unified presentation of Fourier theory and corresponding algorithms.

Theoretical Numerical Analysis - Kendall Atkinson 2007-06-07

Mathematics is playing an ever more important role in the physical and biological sciences, provoking a blurring of boundaries between scienti?c disciplines and a resurgence of interest in the modern as well as the cl- sical techniques of applied mathematics. This renewal of interest, both in research and teaching, has led to the establishment of the series: Texts in Applied Mathematics (TAM).

Thedevelopmentofnewcoursesi sanaturalconsequenceofahighle velof excitement on the research frontier as newer techniques, such as numerical and symbolic computer systems, dynamical systems, and chaos, mix with and reinforce the traditional methods of applied

mathematics. Thus, the purpose of this textbook series is to meet the current and future needs of these advances and to encourage the teaching of new courses. TAM will publish textbooks suitable for use in advanced undergraduate and beginning graduate courses, and will complement the Applied Ma- ematical Sciences (AMS) series, which will focus on advanced textbooks and research-level monographs.

Numerical Partial Differential Equations: Finite Difference Methods - J.W. Thomas 1998-11-06

What makes this book stand out from the competition is that it is more computational. Once done with both volumes, readers will have the tools to attack a wider variety of problems than those worked out in the competitors' books. The author stresses the use of technology throughout the text, allowing students to utilize it as much as possible.

Numerical Mathematics - Alfio Quarteroni 2017-01-26

The purpose of this book is to provide the mathematical foundations of numerical methods, to analyze their basic theoretical properties and to demonstrate their performances on examples and counterexamples. Within any specific class of problems, the most appropriate scientific computing algorithms are reviewed, their theoretical analyses are carried out and the expected results are verified using the MATLAB software environment. Each chapter contains examples, exercises and applications of the theory discussed to the solution of real-life problems. While addressed to senior undergraduates and graduates in engineering, mathematics, physics and computer sciences, this text is also valuable for researchers and users of scientific computing in a large variety of professional fields.

Numerical Analysis in Modern Scientific Computing - Peter Deuflhard 2012-12-06

This book introduces the main topics of modern numerical analysis: sequence of linear equations, error analysis, least

squares, nonlinear systems, symmetric eigenvalue problems, three-term recursions, interpolation and approximation, large systems and numerical integrations. The presentation draws on geometrical intuition wherever appropriate and is supported by a large number of illustrations, exercises, and examples.

A Mathematical Introduction to Fluid Mechanics - Alexandre J. Chorin 2013-11-27

A presentation of some of the basic ideas of fluid mechanics in a mathematically attractive manner. The text illustrates the physical background and motivation for some constructions used in recent mathematical and numerical work on the Navier- Stokes equations and on hyperbolic systems, so as to interest students in this at once beautiful and difficult subject. This third edition incorporates a number of updates and revisions, while retaining the spirit and scope of the original book.

Ordinary Differential Equations with Applications - Carmen Chicone 2006-09-23

Based on a one-year course taught by the author to graduates at the University of Missouri, this book provides a student-friendly account of some of the standard topics encountered in an introductory course of ordinary differential equations. In a second semester, these ideas can be expanded by introducing more advanced concepts and applications. A central theme in the book is the use of Implicit Function Theorem, while the latter sections of the book introduce the basic ideas of perturbation theory as applications of this Theorem. The book also contains material differing from standard treatments, for example, the Fiber Contraction Principle is used to prove the smoothness of functions that are obtained as fixed points of contractions. The ideas introduced in this section can be extended to infinite dimensions.

Analytical and Computational

Methods of Advanced Engineering Mathematics - Grant B. Gustafson 2012-12-06
This book focuses on the topics which provide the foundation for practicing engineering mathematics: ordinary differential equations, vector calculus, linear algebra and partial differential equations. Destined to become the definitive work in the field, the book uses a practical engineering approach based upon solving equations and incorporates computational techniques throughout.
Introduction to Partial Differential Equations - Aslak Tveito 2008-01-21
Combining both the classical theory and numerical techniques for partial differential equations, this thoroughly modern approach shows the significance of computations in PDEs and illustrates the strong interaction between mathematical theory and the development of numerical methods. Great care has been taken throughout the book to seek a sound balance between these techniques. The authors present the material at an easy pace and exercises ranging from the straightforward to the challenging have been included. In addition there are some "projects" suggested, either to refresh the students memory of results needed in this course, or to extend the theories developed in the text. Suitable for undergraduate and graduate students in mathematics and engineering.
Partial Differential Equations - Michael E. Taylor 1996-06-25
This text provides an introduction to the theory of partial differential equations. It introduces basic examples of partial differential equations, arising in continuum mechanics, electromagnetism, complex analysis and other areas, and develops a number of tools for their solution, including particularly Fourier analysis, distribution theory, and Sobolev spaces. These tools are applied to the treatment of basic problems in linear PDE, including the Laplace equation, heat equation, and wave equation,

as well as more general elliptic, parabolic, and hyperbolic equations. Companion texts, which take the theory of partial differential equations further, are AMS volume 116, treating more advanced topics in linear PDE, and AMS volume 117, treating problems in nonlinear PDE. This book is addressed to graduate students in mathematics and to professional mathematicians, with an interest in partial differential equations, mathematical physics, differential geometry, harmonic analysis, and complex analysis.

Differential Equations and Their Applications - Martin Braun 2013-11-27

Used in undergraduate classrooms across the USA, this is a clearly written, rigorous introduction to differential equations and their applications. Fully understandable to students who have had one year of calculus, this book distinguishes itself from other differential equations texts through its engaging application of the subject matter to interesting scenarios. This fourth edition incorporates earlier introductory material on bifurcation theory and adds a new chapter on Sturm-Liouville boundary value problems. Computer programs in C, Pascal, and Fortran are presented throughout the text to show readers how to apply differential equations towards quantitative problems.

Differential Equations: A Dynamical Systems Approach - John H. Hubbard 2012-12-06

This is a continuation of the subject matter discussed in the first book, with an emphasis on systems of ordinary differential equations and will be most appropriate for upper level undergraduate and graduate students in the fields of mathematics, engineering, and applied mathematics, as well as in the life sciences, physics, and economics. After an introduction, there follow chapters on systems of differential equations, of linear differential equations, and of nonlinear differential

equations. The book continues with structural stability, bifurcations, and an appendix on linear algebra. The whole is rounded off with an appendix containing important theorems from parts I and II, as well as answers to selected problems.

Introduction to Mechanics and Symmetry - Jerrold E. Marsden 2013-03-19

A development of the basic theory and applications of mechanics with an emphasis on the role of symmetry. The book includes numerous specific applications, making it beneficial to physicists and engineers. Specific examples and applications show how the theory works, backed by up-to-date techniques, all of which make the text accessible to a wide variety of readers, especially senior undergraduates and graduates in mathematics, physics and engineering. This second edition has been rewritten and updated for clarity throughout, with a major revamping and expansion of the exercises. Internet supplements containing additional material are also available.

Computational Electromagnetics - Anders Bondeson 2006-02-07

Describes most popular computational methods used to solve problems in electromagnetics Matlab code is included throughout, so that the reader can implement the various techniques discussed Exercises included

Scientific Computing with Ordinary Differential Equations - Peter Deuflhard 2012-12-06

Well-known authors; Includes topics and results that have previously not been covered in a book; Uses many interesting examples from science and engineering; Contains numerous homework exercises; Scientific computing is a hot and topical area

Numerical Methods for Wave Equations in Geophysical Fluid Dynamics - Dale R. Durran 2013-03-14

Covering a wide range of techniques, this book describes methods for the solution of partial differential equations which govern wave propagation and are used in

modeling atmospheric and oceanic flows. The presentation establishes a concrete link between theory and practice.

Integral Transforms and Their Applications - Brian Davies 2012-12-06

This is a substantially updated, extended and reorganized third edition of an introductory text on the use of integral transforms. Chapter I is largely new, covering introductory aspects of complex variable theory. Emphasis is on the development of techniques and the connection between properties of transforms and the kind of problems for which they provide tools. Around 400 problems are accompanied in the text. It will be useful for graduate students and researchers working in mathematics and physics.

Introduction to Numerical Methods in Differential Equations - Mark H. Holmes 2007-04-05

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.

Introduction to the Foundations of Applied Mathematics - Mark H. Holmes 2009-07-01

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.

Introduction to Perturbation Methods - Mark H. Holmes 2013-12-01

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.

The XFT Quadrature in Discrete Fourier Analysis - Rafael G. Campos 2019-05-24

This book has two main objectives, the first of which is to extend the power of numerical Fourier analysis and to show by means of theoretical examples and

numerous concrete applications that when computing discrete Fourier transforms of periodic and non periodic functions, the usual kernel matrix of the Fourier transform, the discrete Fourier transform (DFT), should be replaced by another kernel matrix, the eXtended Fourier transform (XFT), since the XFT matrix appears as a convergent quadrature of a more general transform, the fractional Fourier transform. In turn, the book's second goal is to present the XFT matrix as a finite-dimensional transformation that links certain discrete operators in the same way that the corresponding continuous operators are related by the Fourier transform, and to show that the XFT matrix accordingly generates sequences of matrix operators that represent continuum operators, and which allow these operators to be studied from another perspective.

Mathematical Systems Theory I - Diederich Hinrichsen 2011-08-03

This book presents the mathematical foundations of systems theory in a self-contained, comprehensive, detailed and mathematically rigorous way. It is devoted to the analysis of dynamical systems and combines features of a detailed introductory textbook with that of a reference source. The book contains many examples and figures illustrating the text which help to bring out the intuitive ideas behind the mathematical constructions.

The Mathematical Theory of Finite Element Methods - Susanne Brenner 2007-12-22

This is the third and yet further updated edition of a highly regarded mathematical text. Brenner develops the basic mathematical theory of the finite element method, the most widely used technique for engineering design and analysis. Her volume formalizes basic tools that are commonly used by researchers in the field but not previously published. The book is ideal for mathematicians as well as engineers and physical

scientists. It can be used for a course that provides an introduction to basic functional analysis, approximation theory, and numerical analysis, while building upon and applying basic techniques of real variable theory. This new edition is substantially updated with additional exercises throughout and new chapters on Additive Schwarz Preconditioners and Adaptive Meshes.

Geometric Methods and Applications - Jean Gallier 2012-12-06

As an introduction to fundamental geometric concepts and tools needed for solving problems of a geometric nature using a computer, this book fills the gap between standard geometry books, which are primarily theoretical, and applied books on computer graphics, computer vision, or robotics that do not cover the underlying geometric concepts in detail. Gallier offers an introduction to affine, projective, computational, and Euclidean geometry, basics of differential geometry and Lie groups, and explores many of the practical applications of geometry. Some of these include computer vision, efficient communication, error correcting codes, cryptography, motion interpolation, and robot kinematics. This comprehensive text covers most of the geometric background needed for conducting research in computer graphics, geometric modeling, computer vision, and robotics and as such will be of interest to a wide audience including computer scientists, mathematicians, and engineers.

Exploiting Hidden Structure in Matrix Computations: Algorithms and Applications - Michele Benzi 2017-01-24

Focusing on special matrices and matrices which are in some sense `near' to structured matrices, this volume covers a broad range of topics of current interest in numerical linear algebra. Exploitation of these less obvious structural properties

can be of great importance in the design of efficient numerical methods, for example algorithms for matrices with low-rank block structure, matrices with decay, and structured tensor computations. Applications range from quantum chemistry to queuing theory. Structured matrices arise frequently in applications. Examples include banded and sparse matrices, Toeplitz-type matrices, and matrices with semi-separable or quasi-separable structure, as well as Hamiltonian and symplectic matrices. The associated literature is enormous, and many efficient algorithms have been developed for solving problems involving such matrices. The text arose from a C.I.M.E. course held in Cetraro (Italy) in June 2015 which aimed to present this fast growing field to young researchers, exploiting the expertise of five leading lecturers with different theoretical and application perspectives.

Multiscale Methods - Grigoris Pavliotis 2008-01-18

This introduction to multiscale methods gives you a broad overview of the methods' many uses and applications. The book begins by setting the theoretical foundations of the methods and then moves on to develop models and prove theorems. Extensive use of examples shows how to apply multiscale methods to solving a variety of problems. Exercises then enable you to build your own skills and put them into practice. Extensions and generalizations of the results presented in the book, as well as references to the literature, are provided in the Discussion and Bibliography section at the end of each chapter.With the exception of Chapter One, all chapters are supplemented with exercises.

Methods and Applications of Singular Perturbations - Ferdinand Verhulst 2006-06-04

Contains well-chosen examples and exercises A student-friendly introduction that follows a workbook type approach