

Matematica Numerica Unitem Vol 77

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Numerical Mathematics and Advanced Applications ENUMATH 2015

The European Conference on Numerical Mathematics and Advanced Applications (ENUMATH), held every 2 years, provides a forum for discussing recent advances in and aspects of numerical mathematics and scientific and industrial applications. The previous ENUMATH meetings took place in Paris (1995), Heidelberg (1997), Jyvaskyla (1999), Ischia (2001), Prague (2003), Santiago de Compostela (2005), Graz (2007), Uppsala (2009), Leicester (2011) and Lausanne (2013). This book presents a selection of invited and contributed lectures from the ENUMATH 2015 conference, which was organised by the Institute of Applied Mathematics (IAM), Middle East Technical University, Ankara, Turkey, from September 14 to 18, 2015. It offers an overview of central recent developments in numerical analysis, computational mathematics, and applications in the form of contributions by leading experts in the field.

Numerical Mathematics

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.

Snapshot-Based Methods and Algorithms

An increasing complexity of models used to predict real-world systems leads to the need for algorithms to replace complex models with far simpler ones, while preserving the accuracy of the predictions.

This two-volume handbook covers methods as well as applications. This second volume focuses on applications in engineering, biomedical engineering, computational physics and computer science.

Matematica Numerica

La Matematica Numerica è elemento fondante del calcolo scientifico. Punto di contatto di diverse discipline nella matematica e nelle moderne scienze applicate, ne diventa strumento di indagine qualitativa e quantitativa. Scopo di questo testo è fornire i fondamenti metodologici della matematica numerica, richiamandone le principali proprietà, quali la stabilità, l'accuratezza e la complessità algoritmica. Nel contesto di ogni specifica classe di problemi vengono illustrati gli algoritmi più idonei, ne viene fatta l'analisi teorica e se ne verificano i risultati previsti implementandoli con l'ausilio di programmi in linguaggio MATLAB. Ogni capitolo è integrato da esercizi e temi svolti, questi ultimi corredati da programmi MATLAB. Il volume è indirizzato principalmente agli studenti delle facoltà scientifiche, con particolare attenzione ai corsi di laurea in Ingegneria, Matematica e Scienze dell'Informazione. L'enfasi posta sullo sviluppo di software lo rende interessante anche per ricercatori e utilizzatori delle tecniche del calcolo scientifico nei campi professionali più disparati. La quarta edizione contiene numerose integrazioni in quasi tutti i capitoli. Diverse sezioni sono inoltre state rivisitate con lo scopo di rendere più chiari concetti ed argomenti di considerevole complessità.

A Textbook on Ordinary Differential Equations

This book offers readers a primer on the theory and applications of Ordinary Differential Equations. The style used is simple, yet thorough and rigorous. Each chapter ends with a broad set of exercises that range from the routine to the more challenging and thought-provoking. Solutions to selected exercises can be found at the end of the book. The book contains many interesting examples on topics such as electric circuits, the pendulum equation, the logistic equation, the Lotka-Volterra system, the Laplace Transform, etc., which introduce students to a number of interesting aspects of the theory and applications. The work is mainly intended for students of Mathematics, Physics, Engineering, Computer Science and other areas of the natural and social sciences that use ordinary differential equations, and who have a firm grasp of Calculus and a minimal understanding of the basic concepts used in Linear Algebra. It also studies a few more advanced topics, such as Stability Theory and Boundary Value Problems, which may be suitable for more advanced undergraduate or first-year graduate students. The second edition has been revised to correct minor errata, and features a number of carefully selected new exercises, together with more detailed explanations of some of the topics. A complete Solutions Manual, containing solutions to all the exercises published in the book, is available. Instructors who wish to adopt the book may request the manual by writing directly to one of the authors.

Mathematical Models and Numerical Simulation in Electromagnetism

The book represents a basic support for a master course in electromagnetism oriented to numerical simulation. The main goal of the book is that the reader knows the boundary-value problems of partial differential equations that should be solved in order to perform computer simulation of electromagnetic processes. Moreover it includes a part devoted to electric circuit theory based on ordinary differential equations. The book is mainly oriented to electric engineering applications, going from the general to the specific, namely, from the full Maxwell's equations to the particular cases of electrostatics, direct current, magnetostatics and eddy currents models. Apart from standard exercises related to analytical calculus, the book includes some others oriented to real-life applications solved with MaxFEM free simulation software.

Shape Optimization, Homogenization and Optimal Control

The contributions in this volume give an insight into current research activities in Shape Optimization, Homogenization and Optimal Control performed in Africa, Germany and internationally. Seeds for collaboration can be found in the first four papers in the field of homogenization. Modelling and optimal control in partial differential equations is the topic of the next six papers, again mixed from Africa and Germany. Finally, new results in the field of shape optimization are discussed in the final international three papers. This workshop, held at the AIMS Center Senegal, March 13-16, 2017, has been supported by the Deutsche Forschungsgemeinschaft (DFG) and by the African Institute for Mathematical Sciences (AIMS) in Senegal, which is one of six centres of a pan-African network of centres of excellence for postgraduate education, research and outreach in mathematical sciences.

Learning MATLAB

This comprehensive and stimulating introduction to Matlab, a computer language now widely used for technical computing, is based on an introductory course held at Qian Weichang College, Shanghai University, in the fall of 2014. Teaching and learning a substantial programming language aren't always straightforward tasks. Accordingly, this textbook is not meant to cover the whole range of this high-performance technical programming environment, but to motivate first- and second-year undergraduate students in mathematics and computer science to learn Matlab by studying representative problems, developing algorithms and programming them in Matlab. While several topics are taken from the field of scientific computing, the main emphasis is on programming. A wealth of examples are completely discussed and solved, allowing students to learn Matlab by doing: by solving problems, comparing approaches and assessing the proposed solutions.

A Primer on Mathematical Modelling

In this book we describe the magic world of mathematical models: starting from real-life problems, we formulate them in terms of equations, transform equations into algorithms and algorithms into programs to be executed on computers. A broad variety of examples and exercises illustrate that properly designed models can, e.g.: predict the way the number of dolphins in the Aeolian Sea will change as food availability and fishing activity vary; describe the blood flow in a capillary network; calculate the PageRank of websites. This book also includes a chapter with an elementary introduction to Octave, an open-source programming language widely used in the scientific community. Octave functions and scripts for dealing with the problems presented in the text can be downloaded from <https://paola-gervasio.unibs.it/quarteroni-gervasio> This book is addressed to any student interested in learning how to construct and apply mathematical models.

A Primer on PDEs

This book is designed as an advanced undergraduate or a first-year graduate course for students from various disciplines like applied mathematics, physics, engineering. It has evolved while teaching courses on partial differential equations during the last decade at the Politecnico of Milan. The main purpose of these courses was twofold: on the one hand, to train the students to appreciate the interplay between theory and modelling in problems arising in the applied sciences and on the other hand to give them a solid background for numerical methods, such as finite differences and finite elements.

Partial Differential Equations in Action

The book is intended as an advanced undergraduate or first-year graduate course for students from various disciplines, including applied mathematics, physics and engineering. It has evolved from courses offered on partial differential equations (PDEs) over the last several years at the Politecnico di Milano. These courses had a twofold purpose: on the one hand, to teach students to appreciate the interplay between theory and modeling in problems arising in the applied sciences, and on the other to provide them with a solid theoretical background in numerical methods, such as finite elements. Accordingly, this textbook is divided into two parts. The first part, chapters 2 to 5, is more elementary in nature and focuses on developing and studying basic problems from the macro-areas of diffusion, propagation and transport, waves and vibrations. In turn the second part, chapters 6 to 11, concentrates on the development of Hilbert spaces methods for the variational formulation and the analysis of (mainly) linear boundary and initial-boundary value problems.

Frontiers in PDE-Constrained Optimization

This volume provides a broad and uniform introduction of PDE-constrained optimization as well as to document a number of interesting and challenging applications. Many science and engineering applications necessitate the solution of optimization problems constrained by physical laws that are described by systems of partial differential equations (PDEs). As a result, PDE-constrained optimization problems arise in a variety of disciplines including geophysics, earth and climate science, material science, chemical and mechanical engineering, medical imaging and physics. This volume is divided into two parts. The first part provides a comprehensive treatment of PDE-constrained optimization including discussions of problems constrained by PDEs with uncertain inputs and problems constrained by variational inequalities. Special emphasis is placed on algorithm development and numerical computation. In addition, a comprehensive treatment of inverse problems arising in the oil and gas

industry is provided. The second part of this volume focuses on the application of PDE-constrained optimization, including problems in optimal control, optimal design, and inverse problems, among other topics.

Scientific Computing with MATLAB and Octave

Preface to the First Edition This textbook is an introduction to Scientific Computing. We will illustrate several numerical methods for the computer solution of certain classes of mathematical problems that cannot be faced by paper and pencil. We will show how to compute the zeros or the integrals of continuous functions, solve linear systems, approximate functions by polynomials and construct accurate approximations for the solution of differential equations. With this aim, in Chapter 1 we will illustrate the rules of the game that computers adopt when storing and operating with real and complex numbers, vectors and matrices. In order to make our presentation concrete and appealing we will adopt the programming environment MATLAB as a faithful companion. We will gradually discover its principal commands, statements and constructs. We will show how to execute all the algorithms that we introduce throughout the book. This will enable us to furnish an immediate quantitative assessment of their theoretical properties such as stability, accuracy and complexity. We will solve several problems that will be raised through exercises and examples, often stemming from scientific applications.

Linear Algebra for Everyone

This book provides students with the rudiments of Linear Algebra, a fundamental subject for students in all areas of science and technology. The book would also be good for statistics students studying linear algebra. It is the translation of a successful textbook currently being used in Italy. The author is a mathematician sensitive to the needs of a general audience. In addition to introducing fundamental ideas in Linear Algebra through a wide variety of interesting examples, the book also discusses topics not usually covered in an elementary text (e.g. the "cost" of operations, generalized inverses, approximate solutions). The challenge is to show why the "everyone" in the title can find Linear Algebra useful and easy to learn. The translation has been prepared by a native English speaking mathematician, Professor Anthony V. Geramita.

Measure, Integral and Probability

This very well written and accessible book emphasizes the reasons for studying measure theory, which is the foundation of much of probability. By focusing on measure, many illustrative examples and applications, including a thorough discussion of standard probability distributions and densities, are opened. The book also includes many problems and their fully worked solutions.

Software for Exascale Computing - SPPEXA 2016-2019

This open access book summarizes the research done and results obtained in the second funding phase of the Priority Program 1648 "Software for Exascale Computing" (SPPEXA) of the German Research Foundation (DFG) presented at the SPPEXA Symposium in Dresden during October 21-23, 2019. In that respect, it both represents a continuation of Vol. 113 in Springer's series Lecture Notes in Computational Science and Engineering, the corresponding report of SPPEXA's first funding phase, and provides an overview of SPPEXA's contributions towards exascale computing in today's supercomputer technology. The individual chapters address one or more of the research directions (1) computational algorithms, (2) system software, (3) application software, (4) data management and exploration, (5) programming, and (6) software tools. The book has an interdisciplinary appeal: scholars from computational sub-fields in computer science, mathematics, physics, or engineering will find it of particular interest.

Probability Essentials

This introduction can be used, at the beginning graduate level, for a one-semester course on probability theory or for self-direction without benefit of a formal course; the measure theory needed is developed in the text. It will also be useful for students and teachers in related areas such as finance theory, electrical engineering, and operations research. The text covers the essentials in a directed and lean way with 28 short chapters, and assumes only an undergraduate background in mathematics. Readers are taken right up to a knowledge of the basics of Martingale Theory, and the interested student will be

ready to continue with the study of more advanced topics, such as Brownian Motion and Ito Calculus, or Statistical Inference.

Random Polynomials

Probability and Mathematical Statistics: A Series of Monographs and Textbooks: Random Polynomials focuses on a comprehensive treatment of random algebraic, orthogonal, and trigonometric polynomials. The publication first offers information on the basic definitions and properties of random algebraic polynomials and random matrices. Discussions focus on Newton's formula for random algebraic polynomials, random characteristic polynomials, measurability of the zeros of a random algebraic polynomial, and random power series and random algebraic polynomials. The text then elaborates on the number and expected number of real zeros of random algebraic polynomials; number and expected number of real zeros of other random polynomials; and variance of the number of real zeros of random algebraic polynomials. Topics include the expected number of real zeros of random orthogonal polynomials and the number and expected number of real zeros of trigonometric polynomials. The book takes a look at convergence and limit theorems for random polynomials and distribution of the zeros of random algebraic polynomials, including limit theorems for random algebraic polynomials and random companion matrices and distribution of the zeros of random algebraic polynomials. The publication is a dependable reference for probabilists, statisticians, physicists, engineers, and economists.

The Digital Humanist

This book offers a critical introduction to the core technologies underlying the Internet from a humanistic perspective. It provides a cultural critique of computing technologies, by exploring the history of computing and examining issues related to writing, representing, archiving and searching. The book raises awareness of, and calls for, the digital humanities to address the challenges posed by the linguistic and cultural divides in computing, the clash between communication and control, and the biases inherent in networked technologies. A common problem with publications in the Digital Humanities is the dominance of the Anglo-American perspective. While seeking to take a broader view, the book attempts to show how cultural bias can become an obstacle to innovation both in the methodology and practice of the Digital Humanities. Its central point is that no technological instrument is culturally unbiased, and that all too often the geography that underlies technology coincides with the social and economic interests of its producers. The alternative proposed in the book is one of a world in which variation, contamination and decentralization are essential instruments for the production and transmission of digital knowledge. It is thus necessary not only to have spaces where DH scholars can interact (such as international conferences, THATCamps, forums and mailing lists), but also a genuine sharing of technological know-how and experience. "This is a truly exceptional work on the subject of the digital....Students and scholars new to the field of digital humanities will find in this book a gentle introduction to the field, which I cannot but think would be good and perhaps even inspirational for them....Its history of the development of machines and programs and communities bent on using computers to advance science and research merely sets the stage for an insightful analysis of the role of the digital in the way both scholars and everyday people communicate and conceive of themselves and "others" in written forms - from treatises to credit card transactions." Peter Shillingsburg

The Digital Humanist is not simply a translation of the Italian book *L'umanista digitale* (il Mulino 2010), but a new version tailored to an international audience through the improvement and expansion of the sections on social, cultural and ethical problems of the most widely used methodologies, resources and applications.

TABLE OF CONTENTS // Preface: Digital Humanities at a Political Turn? by Geoffrey Rockwell / PART I: The Socio-Historical Roots - Chap. 1: Technology and the Humanities: A History of Interaction - Chap. 2: Internet, or The Humanistic Machine / PART II: Theoretical and Practical Dimensions - Chap. 3: Writing and Content Production - Chap. 4: Representing and Archiving - Chap. 5: Searching and Organizing / Conclusions: DH in a Global Perspective

Engineering Web Applications

Nowadays, Web applications are almost omnipresent. The Web has become a platform not only for information delivery, but also for eCommerce systems, social networks, mobile services, and distributed learning environments. Engineering Web applications involves many intrinsic challenges due to their distributed nature, content orientation, and the requirement to make them available to a wide spectrum of users who are unknown in advance. The authors discuss these challenges in the context of well-established engineering processes, covering the whole product lifecycle from requirements engineering

through design and implementation to deployment and maintenance. They stress the importance of models in Web application development, and they compare well-known Web-specific development processes like WebML, WSDM and OOHDM to traditional software development approaches like the waterfall model and the spiral model. .

Smart and Multifunctional Concrete Toward Sustainable Infrastructures

This book presents the latest research advances and findings in the field of smart/multifunctional concretes, focusing on the principles, design and fabrication, test and characterization, performance and mechanism, and their applications in infrastructures. It also discusses future challenges in the development and application of smart/multifunctional concretes, providing useful theory, ideas and principles, as well as insights and practical guidance for developing sustainable infrastructures. It is a valuable resource for researchers, scientists and engineers in the field of civil-engineering materials and infrastructures.

Mathematica Cookbook

Mathematica Cookbook helps you master the application's core principles by walking you through real-world problems. Ideal for browsing, this book includes recipes for working with numerics, data structures, algebraic equations, calculus, and statistics. You'll also venture into exotic territory with recipes for data visualization using 2D and 3D graphic tools, image processing, and music. Although Mathematica 7 is a highly advanced computational platform, the recipes in this book make it accessible to everyone -- whether you're working on high school algebra, simple graphs, PhD-level computation, financial analysis, or advanced engineering models. Learn how to use Mathematica at a higher level with functional programming and pattern matching Delve into the rich library of functions for string and structured text manipulation Learn how to apply the tools to physics and engineering problems Draw on Mathematica's access to physics, chemistry, and biology data Get techniques for solving equations in computational finance Learn how to use Mathematica for sophisticated image processing Process music and audio as musical notes, analog waveforms, or digital sound samples

Proceedings of the International Conference on Mathematics Textbook Research and Development (ICMT-2014)

ICMT-2014, the International Conference on Mathematics Textbook Research and Development, brought together mathematics educators, textbook researchers and developers, and policy makers from different parts of the world to share their research results, development experiences and reform ideas, and discuss issues and directions concerning mathematics textbook research and development. These proceedings contain all the papers presented at the conference, including the plenary presentations and plenary panel, as well as the symposia, research papers, and workshops. This volume provides a comprehensive record of the ICMT-2014 conference and serves as an essential reference for education researchers, practitioners, and policy makers and curriculum developers interested in mathematics textbook research and development.

Mathematical Knowledge Management

This book constitutes the refereed proceedings of the 5th International Conference on Mathematical Knowledge Management, MKM 2006, held in Wokingham, UK, August 2006. The book presents 22 revised full papers. Coverage extends to the mathematical knowledge management at the intersection of mathematics, computer science, library science, and scientific publishing. The papers are organized in topical sections on proof representations, proof processing, knowledge extraction, knowledge representation, as well as systems and tools.

Technological Developments in Networking, Education and Automation

Technological Developments in Networking, Education and Automation includes a set of rigorously reviewed world-class manuscripts addressing and detailing state-of-the-art research projects in the following areas: Computer Networks: Access Technologies, Medium Access Control, Network architectures and Equipment, Optical Networks and Switching, Telecommunication Technology, and Ultra Wideband Communications. Engineering Education and Online Learning: including development of courses and systems for engineering, technical and liberal studies programs; online laboratories; intelligent testing using fuzzy logic; taxonomy of e-courses; and evaluation of online courses. Pedagogy:

including benchmarking; group-learning; active learning; teaching of multiple subjects together; ontology; and knowledge management. Instruction Technology: including internet textbooks; virtual reality labs, instructional design, virtual models, pedagogy-oriented markup languages; graphic design possibilities; open source classroom management software; automatic email response systems; tablet-pcs; personalization using web mining technology; intelligent digital chalkboards; virtual room concepts for cooperative scientific work; and network technologies, management, and architecture. Coding and Modulation: Modeling and Simulation, OFDM technology, Space-time Coding, Spread Spectrum and CDMA Systems. Wireless technologies: Bluetooth, Cellular Wireless Networks, Cordless Systems and Wireless Local Loop, HIPERLAN, IEEE 802.11, Mobile Network Layer, Mobile Transport Layer, and Spread Spectrum. Network Security and applications: Authentication Applications, Block Ciphers Design Principles, Block Ciphers Modes of Operation, Electronic Mail Security, Encryption & Message Confidentiality, Firewalls, IP Security, Key Cryptography & Message Authentication, and Web Security. Robotics, Control Systems and Automation: Distributed Control Systems, Automation, Expert Systems, Robotics, Factory Automation, Intelligent Control Systems, Man Machine Interaction, Manufacturing Information System, Motion Control, and Process Automation. Vision Systems: for human action sensing, face recognition, and image processing algorithms for smoothing of high speed motion. Electronics and Power Systems: Actuators, Electro-Mechanical Systems, High Frequency Converters, Industrial Electronics, Motors and Drives, Power Converters, Power Devices and Components, and Power Electronics.

Special Issues in Early Childhood Mathematics Education Research

In this book, 23 contributors offer new insights on key issues in mathematics education in early childhood.

Working with the Anthropological Theory of the Didactic in Mathematics Education

This book presents the main research veins developed within the framework of the Anthropological Theory of the Didactic (ATD), a paradigm that originated in French didactics of mathematics. While a great number of publications on ATD are available in French and Spanish, *Working with the Anthropological Theory of the Didactic in Mathematics Education* is the first directed at English-speaking international audiences. Written and edited by leading researchers in ATD, the book covers all aspects of ATD theory and practice, including teaching applications. The chapters feature the most relevant and recent investigations presented at the 6th international conference on the ATD, offering a unique opportunity for an international audience interested in the study of mathematics teaching and learning to keep in touch with advances in educational research. The book is divided into four sections and the contributions explore key topics such as: The core concept of 'praxeology', including its development and functionalities The need for new teaching praxeologies in the paradigm of questioning the world The impact of ATD on the teaching profession and the education of teachers This is the second volume in the *New Perspectives on Research in Mathematics Education*. This comprehensive casebook is an indispensable resource for researchers, teachers and graduate students around the world.

The 11th International Conference on European Transnational Educational (ICEUTE 2020)

This book contains accepted papers presented at ICEUTE 2020 held in the beautiful and historic city of Burgos (Spain), in September 2020. The 11th International Conference on European Transnational Education (ICEUTE 2020) has been a meeting point for people working on transnational education within Europe. It has provided a stimulating and fruitful forum for presenting and discussing the latest works and advances on transnational education within European countries. After a thorough peer-review process, the ICEUTE 2020 International Program Committee selected 44 papers which are published in these conference proceedings achieving an acceptance rate of 41%. Due to the COVID-19 outbreak, the ICEUTE 2020 edition was blended, combining on-site and on-line participation. In this relevant edition, a special emphasis was put on the organization of five special sessions related to relevant topics as Role of English in Transnational Education and Teacher Training, Personalization and ICT: a Path to Educational Inclusion, Innovation and Research Findings in Engineering Higher Education, Practical Implementations of Novel Initiatives, and Innovation in Computer Science Higher Education. The selection of papers was extremely rigorous in order to maintain the high quality of the conference, and we would like to thank the members of the Program Committees for their hard work in the reviewing process. This is a crucial process to the creation of a high standard conference, and the ICEUTE conference would not exist without their help.

Curves and Surfaces

The book provides an introduction to Differential Geometry of Curves and Surfaces. The theory of curves starts with a discussion of possible definitions of the concept of curve, proving in particular the classification of 1-dimensional manifolds. We then present the classical local theory of parametrized plane and space curves (curves in n -dimensional space are discussed in the complementary material): curvature, torsion, Frenet's formulas and the fundamental theorem of the local theory of curves. Then, after a self-contained presentation of degree theory for continuous self-maps of the circumference, we study the global theory of plane curves, introducing winding and rotation numbers, and proving the Jordan curve theorem for curves of class C^2 , and Hopf theorem on the rotation number of closed simple curves. The local theory of surfaces begins with a comparison of the concept of parametrized (i.e., immersed) surface with the concept of regular (i.e., embedded) surface. We then develop the basic differential geometry of surfaces in R^3 : definitions, examples, differentiable maps and functions, tangent vectors (presented both as vectors tangent to curves in the surface and as derivations on germs of differentiable functions; we shall consistently use both approaches in the whole book) and orientation. Next we study the several notions of curvature on a surface, stressing both the geometrical meaning of the objects introduced and the algebraic/analytical methods needed to study them via the Gauss map, up to the proof of Gauss' Teorema Egregium. Then we introduce vector fields on a surface (flow, first integrals, integral curves) and geodesics (definition, basic properties, geodesic curvature, and, in the complementary material, a full proof of minimizing properties of geodesics and of the Hopf-Rinow theorem for surfaces). Then we shall present a proof of the celebrated Gauss-Bonnet theorem, both in its local and in its global form, using basic properties (fully proved in the complementary material) of triangulations of surfaces. As an application, we shall prove the Poincaré-Hopf theorem on zeroes of vector fields. Finally, the last chapter will be devoted to several important results on the global theory of surfaces, like for instance the characterization of surfaces with constant Gaussian curvature, and the orientability of compact surfaces in R^3 .

Jewels Of Stringology: Text Algorithms

The term "stringology" is a popular nickname for text algorithms, or algorithms on strings. This book deals with the most basic algorithms in the area. Most of them can be viewed as "algorithmic jewels" and deserve reader-friendly presentation. One of the main aims of the book is to present several of the most celebrated algorithms in a simple way by omitting obscuring details and separating algorithmic structure from combinatorial theoretical background. The book reflects the relationships between applications of text-algorithmic techniques and the classification of algorithms according to the measures of complexity considered. The text can be viewed as a parade of algorithms in which the main purpose is to discuss the foundations of the algorithms and their interconnections. One can partition the algorithmic problems discussed into practical and theoretical problems. Certainly, string matching and data compression are in the former class, while most problems related to symmetries and repetitions in texts are in the latter. However, all the problems are interesting from an algorithmic point of view and enable the reader to appreciate the importance of combinatorics on words as a tool in the design of efficient text algorithms. In most textbooks on algorithms and data structures, the presentation of efficient algorithms on words is quite short as compared to issues in graph theory, sorting, searching, and some other areas. At the same time, there are many presentations of interesting algorithms on words accessible only in journals and in a form directed mainly at specialists. This book fills the gap in the book literature on algorithms on words, and brings together the many results presently dispersed in the masses of journal articles. The presentation is reader-friendly; many examples and about two hundred figures illustrate nicely the behaviour of otherwise very complex algorithms.

Optimal Control of Partial Differential Equations

This is a book on optimal control problems (OCPs) for partial differential equations (PDEs) that evolved from a series of courses taught by the authors in the last few years at Politecnico di Milano, both at the undergraduate and graduate levels. The book covers the whole range spanning from the setup and the rigorous theoretical analysis of OCPs, the derivation of the system of optimality conditions, the proposition of suitable numerical methods, their formulation, their analysis, including their application to a broad set of problems of practical relevance. The first introductory chapter addresses a handful of representative OCPs and presents an overview of the associated mathematical issues. The rest of the book is organized into three parts: part I provides preliminary concepts of OCPs for algebraic and dynamical systems; part II addresses OCPs involving linear PDEs (mostly elliptic and parabolic type) and quadratic cost functions; part III deals with more general classes of OCPs that stand behind the advanced applications mentioned above. Starting from simple problems that allow a "hands-on"

treatment, the reader is progressively led to a general framework suitable to face a broader class of problems. Moreover, the inclusion of many pseudocodes allows the reader to easily implement the algorithms illustrated throughout the text. The three parts of the book are suitable to readers with variable mathematical backgrounds, from advanced undergraduate to Ph.D. levels and beyond. We believe that applied mathematicians, computational scientists, and engineers may find this book useful for a constructive approach toward the solution of OCPs in the context of complex applications.

Modeling of Physiological Flows

This book offers a mathematical update of the state of the art of the research in the field of mathematical and numerical models of the circulatory system. It is structured into different chapters, written by outstanding experts in the field. Many fundamental issues are considered, such as: the mathematical representation of vascular geometries extracted from medical images, modelling blood rheology and the complex multilayer structure of the vascular tissue, and its possible pathologies, the mechanical and chemical interaction between blood and vascular walls, and the different scales coupling local and systemic dynamics. All of these topics introduce challenging mathematical and numerical problems, demanding for advanced analysis and efficient simulation techniques, and pay constant attention to applications of relevant clinical interest. This book is addressed to graduate students and researchers in the field of bioengineering, applied mathematics and medicine, wishing to engage themselves in the fascinating task of modeling the cardiovascular system or, more broadly, physiological flows.

Algebra, Meaning, and Computation

This volume - honoring the computer science pioneer Joseph Goguen on his 65th Birthday - includes 32 refereed papers by leading researchers in areas spanned by Goguen's work. The papers address a variety of topics from meaning, meta-logic, specification and composition, behavior and formal languages, as well as models, deduction, and computation, by key members of the research community in computer science and other fields connected with Joseph Goguen's work.

Drafting a Conservation Blueprint

Drafting a Conservation Blueprint lays out for the first time in book form a step-by-step planning process for conserving the biological diversity of entire regions. In an engaging and accessible style, the author explains how to develop a regional conservation plan and offers experience-based guidance that brings together relevant information from the fields of ecology, conservation biology, planning, and policy. Individual chapters outline and discuss the main steps of the planning process, including: • an overview of the planning framework • selecting conservation targets and setting goals • assessing existing conservation areas and filling information gaps • assessing population viability and ecological integrity • selecting and designing a portfolio of conservation areas • assessing threats and setting priorities A concluding section offers advice on turning conservation plans into action, along with specific examples from around the world. The book brings together a wide range of information about conservation planning that is grounded in both a strong scientific foundation and in the realities of implementation.

Integrating Gestures

Gestures are ubiquitous and natural in our everyday life. They convey information about culture, discourse, thought, intentionality, emotion, intersubjectivity, cognition, and first and second language acquisition. Additionally, they are used by non-human primates to communicate with their peers and with humans. Consequently, the modern field of gesture studies has attracted researchers from a number of different disciplines such as anthropology, cognitive science, communication, neuroscience, psycholinguistics, primatology, psychology, robotics, sociology and semiotics. This volume presents an overview of the depth and breadth of current research in gesture. Its focus is on the interdisciplinary nature of gesture. The twenty-six chapters included in the volume are divided into six sections or themes: the nature and functions of gesture, first language development and gesture, second language effects on gesture, gesture in the classroom and in problem solving, gesture aspects of discourse and interaction, and gestural analysis of music and dance.

The Greek Qabalah

This book will be of interest to a wide range of readers, from students of Ancient History and early Christianity, to Qabalists and modern magicians. Extensive notes and citations from original sources

will make this authoritative work an essential reference for researchers and practitioners for years to come. Includes are appendices for tables of alphabetic symbolism, a list of authors, and a numeric dictionary of Greek words, which represents the largest collection of gematria in print.

Diagrammatic Representation and Inference

This book constitutes the refereed proceedings of the 12th International Conference on the Theory and Application of Diagrams, Diagrams 2021, held virtually in September 2021. The 16 full papers and 25 short papers presented together with 16 posters were carefully reviewed and selected from 94 submissions. The papers are organized in the following topical sections: design of concrete diagrams; theory of diagrams; diagrams and mathematics; diagrams and logic; new representation systems; analysis of diagrams; diagrams and computation; cognitive analysis; diagrams as structural tools; formal diagrams; and understanding thought processes. 10 chapters are available open access under a Creative Commons Attribution 4.0 International License via link.springer.com.

Linear Algebra for Everyone

Linear algebra has become the subject to know for people in quantitative disciplines of all kinds. No longer the exclusive domain of mathematicians and engineers, it is now used everywhere there is data and everybody who works with data needs to know more. This new book from Professor Gilbert Strang, author of the acclaimed Introduction to Linear Algebra, now in its fifth edition, makes linear algebra accessible to everybody, not just those with a strong background in mathematics. It takes a more active start, beginning by finding independent columns of small matrices, leading to the key concepts of linear combinations and rank and column space. From there it passes on to the classical topics of solving linear equations, orthogonality, linear transformations and subspaces, all clearly explained with many examples and exercises. The last major topics are eigenvalues and the important singular value decomposition, illustrated with applications to differential equations and image compression. A final optional chapter explores the ideas behind deep learning.

An Introduction to Excel for Civil Engineers

It's a Excel basics book that every civil engineer should have read by now. It addresses skills that may not be covered in most Excel for civil engineering texts, such as step by step guides to create an application program and how to convert the steps into VBA code, how to perform matrix operations (multiplication and inversion) using Excel-VBA, macro for creating an engineering chart, a brief and simple guide to become an instant Excel-VBA programmer, and more... Also to be presented the depiction in AutoCAD program. Yes! AutoCAD is chosen because one of its advantages that relies on high drawing accuracy. You will learn how to create a simple AutoCAD script file using Excel formulas and Excel-VBA. It is expected that you will be able to create simple Cartesian graph in AutoCAD, even you are an AutoCAD first time user! With the ease of working with Excel, coupled with benefit of the given examples in this book, it is expected to increase the interest of the reader to create new original application programs. Thus, each model or even a specific calculation will be an exciting challenge for a programming job is already enjoyable. Happy Excel programming!

Languages and Machines