Implicit Two Derivative Runge Kutta Collocation Methods

In order to measure and quantify the complex behavior of real-world systems, either novel mathematical approaches or modifications of classical ones are required to precisely predict, monitor, and control complicated chaotic and stochastic processes. Though the term of entropy comes from Greek and emphasizes its analogy to energy, today, it has wandered to different branches of pure and applied sciences and is understood in a rather rough way, with emphasis placed on the transition from regular to chaotic states, stochastic and deterministic disorder, and uniform and non-uniform distribution or decay of diversity. This collection of papers addresses the notion of entropy in a very broad sense. The presented manuscripts follow from different branches of mathematical/physical sciences, natural/social sciences, and engineering-oriented sciences with emphasis placed on the complexity of dynamical systems. Topics like timing chaos and spatiotemporal chaos, bifurcation, synchronization and anti-synchronization, stability, lumped mass and continuous mechanical systems modeling, novel nonlinear phenomena, and resonances are discussed.
The numerical analysis of stochastic differential equations (SDEs) differs significantly from that of ordinary differential equations. This book provides an easily accessible

introduction to SDEs, their applications and the numerical methods to solve such equations. From the reviews: "The authors draw upon their own research and experiences in obviously many disciplines... considerable time has obviously been spent writing this in the simplest language possible." --ZAMP

This new book updates the exceptionally popular Numerical Analysis of Ordinary Differential Equations. "This book is...an indispensible reference for any researcher."-American Mathematical Society on the First Edition. Features: * New exercises included in each chapter. * Author is widely regarded as the world expert on Runge-Kutta methods * Didactic aspects of the book have been enhanced by interspersing the text with exercises. * Updated Bibliography.

"This book provides an introduction to modern methods for computer simulation of physical systems involving continuous variables. Particular emphasis is placed on the use of simulation languages and other software tools widely used in the simulation field. A simple simulation language (provided on 3.5 disk with the book) is used. Commercially available software is also described and applied. Case studies are included and simulation model validation is covered in detail. Real time simulation applications are also discussed."--Publisher's website.

This book introduces the challenges inherent in jointed structures and guides researchers to the still-open, pressing challenges that need to be solved to advance this critical field. The authors cover multiple facets of interfacial mechanics that pertain to jointed structures: tribological modeling and measurements of the interface surfaces, constitutive modeling of joints, numerical reduction techniques for structures with joints, and uncertainty quantification and propagation for these structures. Thus, the key subspecialties addressed are model reduction for nonlinear systems, uncertainty quantification, constitutive modeling of joints, and measurements of interfacial mechanics properties (including tribology). The diverse contributions to this volume fill a much needed void in the literature and present to a new generation of joints researchers the potential challenges that they can engage in in order to advance the state of the art. Clearly defines internationally recognized challenges in joint mechanics/jointed structures and provides a comprehensive assessment of the state-of-the-art for joint modeling; Identifies open research questions facing joint mechanics; Details methodologies for accounting for uncertainties (due both to missing physics and variability) in joints; Explains and illustrates best-practices for measuring joints' properties experimentally; Maximizes reader understanding of modeling joint dynamics with a comparison of multiple approaches.

This book consists of two strongly interweaved parts: the mathematical theory of stochastic processes and its applications to molecular theories of polymeric fluids. The comprehensive mathematical background provided in the first section will be equally useful in many other branches of engineering and the natural sciences. The second part provides readers with a more direct understanding of polymer dynamics, allowing them to identify exactly solvable models more easily, and to develop efficient computer simulation algorithms in a straightforward manner. In view of the examples and applications to problems taken from the front line of science, this volume may be used both as a basic textbook or as a reference book. Program examples written in FORTRAN are available via ftp from ftp.springer.de/pub/chemistry/polysim/.

The term differential-algebraic equation was coined to comprise differential equations with constraints (differential equations on manifolds) and singular implicit differential equations. Such problems arise in a variety of applications, e.g. constrained mechanical systems, fluid dynamics, chemical reaction kinetics, simulation of electrical networks, and control engineering. From a more theoretical viewpoint, the study of differential-algebraic problems gives insight into the behaviour of numerical methods for stiff ordinary differential equations. These lecture notes provide a self-contained and comprehensive treatment of the numerical solution of differential-algebraic systems using Runge-Kutta methods, and also extrapolation methods. Readers are expected to have a background in the numerical treatment of ordinary differential equations. The subject is treated in its various aspects ranging from the theory through the analysis to implementation and applications.

The present thesis investigates the usage of higher order accurate time integrators together with appropriate error estimators for small and finite dynamic (visco)plasticity. Therefore, a general (visco)plastic problem is defined which serves as a basis to create closed-form solution strategies. A classical access towards small and finite (visco)plasticity is integrated into this concept. This approach is based on the idea, that the balance of linear momentum is formulated in a weak sense and the material laws are included indirectly. Thus, separate time discretizations are implemented and an appropriate coupling between them is necessary. Limitations for the usage of time integrators are the consequence. In contrast, an alternative multifield formulation is derived, adapting the principle of Jourdain. The idea is to assume that the balance of energy - taking into account a pseudopotential representing dissipative effects – resembles a rate-type functional, whose stationarity condition leads to the equations describing small or finite dynamic (visco)plasticity. Accordingly, the material laws and the balance of linear momentum can be solved on the same level and only one single time discretization has to be performed. A greater freedom in the choice of time integrators is obtained and the application of higher order accurate schemes - such as Newmark’s method, fully implicit as well as diagonally implicit Runge-Kutta schemes, and continuous as well as discontinuous Galerkin methods - is facilitated. An analysis and a comparison of the classical and the multifield formulation is accomplished by means of distinct examples. In this context, a dynamic benchmark problem is developed, which allows to focus on the effect of different time integrators. For this investigation, a variety of time discretization error estimators are formulated, evaluated, and compared.

Two-derivative Runge-Kutta Methods for Differential EquationsThe Numerical Analysis of Ordinary Differential EquationsRunge-Kutta and General Linear MethodsJohn Wiley & Sons Incorporated

Stochastic differential equations have many applications in the natural sciences. Besides, the employment of probabilistic representations together with the Monte Carlo technique allows us to reduce solution of multi-dimensional problems for partial differential equations to integration of stochastic equations. This approach leads to powerful computational mathematics that is presented in the treatise. The authors propose many new special schemes, some published here for the first time. In the second part of the book they construct numerical methods for solving complicated problems for partial differential equations occurring in practical applications, both linear and nonlinear. All the methods are presented with proofs and hence founded on rigorous reasoning, thus giving the book textbook potential. An overwhelming majority of the methods are accompanied by the corresponding numerical algorithms which are ready for implementation in practice. The book addresses researchers and graduate students in numerical analysis, physics, chemistry, and engineering as well as mathematical biology and financial mathematics.

The second of two volumes, this edited proceedings book features research presented at the XVI International Conference on Hyperbolic Problems held in Aachen, Germany in summer 2016. It focuses on the theoretical, applied, and computational aspects of hyperbolic partial differential equations (systems of hyperbolic conservation laws, wave equations, etc.) and of related mathematical models (PDEs of mixed type, kinetic equations, nonlocal or/and discrete models) found in the field of applied sciences.

Mechanical engineering, an engineering discipline borne of the needs of the industrial revolution, is once again asked to do its substantial share in the call for industrial renewal. The general call is urgent as we face profound is sues of productivity and competitiveness that require engineering solutions, among others. The Mechanical Engineering Series features graduate texts and research monographs intended to address the need for information in contemporary areas of mechanical engineering. The series is conceived as a comprehensive one that covers a broad range of concentrations important to mechanical engineering graduate education and research. We are fortunate to have a distinguished rost er of consulting editors on the advisory board, each an expert in one the areas of concentra tion. The names of the consulting editors are listed on the next page of this volume. The areas of concentration are: applied mechanics; biome chan ics; computational mechanics; dynamic systems and control; energetics; mechanics of materials; processing; thermal science; and tribology.

A concise introduction to numerical methodsand the mathematicalframework neededto understand their performance Numerical Solution of Ordinary Differential Equationspresents a complete and easy-to-follow introduction to classicaltopics in the numerical solution of ordinary differentialequations. The book's approach not only explains the presentedmathematics, but also helps readers understand how these numericalmethods are used to solve real-world problems. Unifying perspectives are provided throughout the text, bringingtogether and categorizing different types of problems in order tohelp readers comprehend the applications of ordinary differentialequations. In addition, the authors' collective academic experienceensures a coherent and accessible discussion of key topics,including: Euler's method Taylor and Runge-Kutta methods General error analysis for multi-step methods Stiff differential equations

Differential algebraic equations Two-point boundary value problems Volterra integral equations Each chapter features problem sets that enable readers to testand build their knowledge of the presented methods, and a relatedWeb site features MATLAB® programs that facilitate theexploration of numerical methods in greater depth. Detailedreferences outline additional literature on both analytical andnumerical aspects of ordinary differential equations for furtherexploration of individual topics. Numerical Solution of Ordinary Differential Equations isan excellent textbook for courses on the numerical solution ofdifferential equations at the upper-undergraduate and beginninggraduate levels. It also serves as a valuable reference forresearchers in the fields of mathematics and engineering.

Based on a course developed by the author, Introduction to High Performance Scientific Computing introduces methods for adding parallelism to numerical methods for solving differential equations. It contains exercises and programming projects that facilitate learning as well as examples and discussions based on the C programming language, with additional comments for those already familiar with C++. The text provides an overview of concepts and algorithmic techniques for modern scientific computing and is divided into six self-contained parts that can be assembled in any order to create an introductory course using available computer hardware. Part I introduces the C programming language for those not already familiar with programming in a compiled language. Part II describes parallelism on shared memory architectures using OpenMP. Part III details parallelism on computer clusters using MPI for coordinating a computation. Part IV demonstrates the use of graphical programming units (GPUs) to solve problems using the CUDA language for NVIDIA graphics cards. Part V addresses programming on GPUs for non-NVIDIA graphics cards using the OpenCL

framework. Finally, Part VI contains a brief discussion of numerical methods and applications, giving the reader an opportunity to test the methods on typical computing problems.
This is Volume I of the four-volume set LNCS 3991-3994 constituting the refereed proceedings of the 6th International Conference on Computational Science, ICCS 2006. The 98 revised full papers and 29 revised poster papers of the main track presented together with 500 accepted workshop papers were carefully reviewed and selected for inclusion in the four volumes. The coverage spans the whole range of computational science.
The current paper establishes an axisymmetric model for an inductive heating process. Therein, the fully coupled MAXWELL equations, assuming a temperature dependent permeability, are combined with the non-linear heat conduction equation to yield a monolithic solution strategy. The latter is based on a consistent linearization together with a higher order finite element discretization using GALERKIN'S method in space. For the temporal discretization, the generalized Newmark-? methods, higher order RUNGE-KUTTA methods, and discontinuous and continuous GALERKIN methods are used. Furthermore, the residual error is introduced to open an alternative way to obtain a numerically efficient estimation of the time integration accuracy. Simulation results of the electric, magnetic and thermal fields are provided, together with parameter studies concerning spatial discretization, frequency dependence and penetration depth of the heating zone. Another topic analyzed is the residual error and its estimation quality regarding polynomial degree and time step size. A further aspect of this work is the investigation of the thermal fluid-structure interaction with respect to functionally graded materials. Different coupling strategies for the acceleration of the fixed-point iteration in each time step is in the foreground. Relaxation methods as well as

extrapolation methods make it possible to significantly reduce the number of fixed point iterations. At the same time, an adaptive strategy with higher order RUNGE-KUTTA methods can provide a further advantage in combination with acceleration methods.

Offering a unique balance between applications and calculations, Monte Carlo Methods and Models in Finance and Insurance incorporates the application background of finance and insurance with the theory and applications of Monte Carlo methods. It presents recent methods and algorithms, including the multilevel Monte Carlo method, the statistical Romberg method, and the Heath–Platen estimator, as well as recent financial and actuarial models, such as the Cheyette and dynamic mortality models. The authors separately discuss Monte Carlo techniques, stochastic process basics, and the theoretical background and intuition behind financial and actuarial mathematics, before bringing the topics together to apply the Monte Carlo methods to areas of finance and insurance. This allows for the easy identification of standard Monte Carlo tools and for a detailed focus on the main principles of financial and insurance mathematics. The book describes high-level Monte Carlo methods for standard simulation and the simulation of stochastic processes with continuous and discontinuous paths. It also covers a wide selection of popular models in finance and insurance, from Black–Scholes to stochastic volatility to interest rate to dynamic mortality. Through its many numerical and graphical illustrations and simple, insightful examples, this book provides a deep understanding of the scope of Monte Carlo methods and their use in various financial situations. The intuitive presentation encourages readers to implement and further develop the simulation methods.

Second Order Differential Equations presents a classical piece of theory concerning hypergeometric special functions as solutions of second-order linear differential equations. The theory is presented in an entirely self-contained way, starting with an introduction of the solution of the second-order differential equations and then focusingon the systematic treatment and classification of these solutions. Each chapter contains a set of problems which help reinforce the theory. Some of the preliminaries are covered in appendices at the end of the book, one of which provides an introduction to Poincaré-Perron theory, and the appendix also contains a new way of analyzing the asymptomatic behavior of solutions of differential equations. This textbook is appropriate for advanced undergraduate and graduate students in Mathematics, Physics, and Engineering interested in Ordinary and Partial Differntial Equations. A solutions manual is available online.

In this popular text for an Numerical Analysis course, the authors introduce several major methods of solving various partial differential equations (PDEs) including elliptic, parabolic, and hyperbolic equations. It covers traditional techniques including the classic finite difference method, finite element method, and state-of-the-art numercial methods.The text uniquely emphasizes both theoretical numerical analysis and practical implementation of the algorithms in MATLAB. This new edition includes a new chapter, Finite Value Method, the presentation has been tightened, new exercises and applications are included, and the text refers now to the latest release of MATLAB. Key Selling Points: A successful textbook for an undergraduate text on numerical analysis or methods taught in mathematics and computer engineering. This course is taught in every university throughout the world with an engineering department or school. Competitive advantage broader numerical methods (including finite difference, finite element, meshless method, and finite volume method), provides the MATLAB source code for most popular PDEs with detailed explanation about the implementation and theoretical analysis. No other existing textbook in the market offers a good combination of theoretical depth and practical source codes.

This book deals with methods for solving nonstiff ordinary differential equations. The first chapter describes the historical development of the classical theory, and the second chapter includes a modern treatment of Runge-Kutta and extrapolation methods. Chapter three begins with the classical theory of multistep methods, and concludes with the theory of general linear methods. The reader will benefit from many illustrations, a historical and didactic approach, and computer programs which help him/her learn to solve all kinds of ordinary differential equations. This new edition has been rewritten and new material has been included.

The intention of this textbook is to provide both, the theoretical and computational tools that are necessary to investigate and to solve optimal control problems with ordinary differential equations and differential-algebraic equations. An emphasis is placed on the interplay between the continuous optimal control problem, which typically is defined and analyzed in a Banach space setting, and discrete optimal control problems, which are obtained by discretization and lead to finite dimensional optimization problems.

Suitable for advanced undergraduate and graduate students, this text presents the general properties of partial differential equations, including the elementary theory of complex variables. Solutions. 1965 edition.

This book is a product of the Third International Conference on Computing, Mathematics and Statistics (iCMS2017) to be held in Langkawi in November 2017. It is divided into four sections according to the thrust areas: Computer Science, Mathematics, Statistics, and Multidisciplinary

Applications. All sections sought to confront current issues that society faces today. The book brings collectively quantitative, as well as qualitative, research methods that are also suitable for future research undertakings. Researchers in Computer Science, Mathematics and Statistics can use this book as a sourcebook to enrich their research works.

In the past few decades, many significant insights have been gained into several areas of computational methods in sciences and engineering. New problems and methodologies have appeared in some areas of sciences and engineering. There is always a need in these fields for the advancement of information exchange.The aim of this book is to facilitate the sharing of ideas, problems and methodologies between computational scientists and engineers in several disciplines. Extended abstracts of papers on the recent advances regarding computational methods in sciences and engineering are provided. The book briefly describes new methods in numerical analysis, computational mathematics, computational and theoretical physics, computational and theoretical chemistry, computational biology, computational mechanics, computational engineering, computational medicine, high performance computing, etc.

Semi-Lagrangian Advection Methods and Their Applications in Geoscience provides a much-needed resource on semi-Lagrangian theory, methods, and applications. Covering a variety of applications, the book brings together developments of the semi-Lagrangian in one place and offers a comparison of semi-Lagrangian methods with Eulerian-based approaches. It also includes a chapter dedicated to difficulties of dealing with the adjoint of semi-Lagrangian methods and illustrates the behavior of different schemes for different applications. This allows for a better understanding of which schemes are most efficient, stable, consistent, and likely to introduce the minimum model error into a given problem. Beneficial for students learning about numerical approximations to advection, researchers applying these techniques to geoscientific modeling, and practitioners looking for the best approach for modeling, Semi-Lagrangian Advection Methods and Their Applications in Geoscience fills a crucial gap in numerical modeling and data assimilation in geoscience. Provides a single resource for understanding semi-Lagrangian methods and what is involved in its application Includes exercises and codes to supplement learning and create opportunities for practice Includes coverage of adjoints, examining the advantages and disadvantages of different approaches in multiple coordinate systems and different discretizations Includes links to numerical datasets and animations to further enhance understanding

Build complex embedded systems faster and with lower costs by: * Knowing when and how much simulation testing is appropriate * Applying engineering methods to simulation design and development * Using the best tools available to develop simulations. * Va

Numerical Methods for Ordinary Differential Systems The Initial Value Problem J. D. Lambert Professor of Numerical Analysis University of Dundee Scotland In 1973 the author published a book entitled Computational Methods in Ordinary Differential Equations. Since then, there have been many new developments in this subject and the emphasis has changed substantially. This book reflects these changes; it is intended not as a revision of the earlier work but as a complete replacement for it. Although some basic material appears in both books, the treatment given here is generally different and there is very little overlap. In 1973 there were many methods competing for attention but more recently there has been increasing emphasis on just a few classes of methods for which sophisticated implementations now exist. This book places much more emphasis on such implementations—and on the important topic of stiffness—than did its predecessor. Also included are accounts of the structure of variable-step, variable-order methods, the Butcher and the Albrecht theories for Runge—Kutta methods, order stars and nonlinear stability theory. The author has taken a middle road between analytical rigour and a purely computational approach, key results being stated as theorems but proofs being provided only where they aid the reader's understanding of the result. Numerous exercises, from the straightforward to the demanding, are included in the text. This book will appeal to advanced students and teachers of numerical analysis and to users of numerical methods who wish to understand how algorithms for ordinary differential systems work and, on occasion, fail to work.

This book captures the state-of-the-art in the field of Strong Stability Preserving (SSP) time stepping methods, which have significant advantages for the time evolution of partial differential equations describing a wide range of physical phenomena. This comprehensive book describes the development of SSP methods, explains the types of problems which require the use of these methods and demonstrates the efficiency of these methods using a variety of numerical examples. Another valuable feature of this book is that it collects the most useful SSP methods, both explicit and implicit, and presents the other properties of these methods which make them desirable (such as low storage, small error coefficients, large linear stability domains). This book is valuable for both researchers studying the field of time-discretizations for PDEs, and the users of such methods.

Numerical Method for Initial Value Problems in Ordinary Differential Equations deals with numerical treatment of special differential equations: stiff, stiff oscillatory, singular, and discontinuous initial value problems, characterized by large Lipschitz constants. The book reviews the difference operators, the theory of interpolation, first integral mean value theorem, and numerical integration algorithms. The text explains the theory of one-step methods, the Euler scheme, the inverse Euler scheme, and also Richardson's extrapolation. The book discusses the general theory of Runge-Kutta processes, including the error estimation, and stepsize selection of the R-K process. The text evaluates the different linear multistep methods such as the explicit linear multistep methods (Adams-Bashforth, 1883), the implicit linear multistep methods (Adams-Moulton scheme, 1926), and the general theory of linear multistep methods. The book also reviews the existing stiff codes based on the implicit/semi-implicit, singly/diagonally implicit Runge-Kutta schemes, the backward differentiation formulas, the second derivative formulas, as well as the related extrapolation processes. The text is intended for undergraduates in mathematics, computer science, or engineering courses, andfor postgraduate students or researchers in related disciplines.

This guide to computational fluid mechanics introduces beginning graduate students to the subject's standard methods and common pitfalls.

"Whatever regrets may be, we have done our best." (Sir Ernest Shack 0 leton, turning back on 9 January 1909 at 88 23' South.) Brahms struggled for 20 years to write his first symphony. Compared to this, the 10 years we have been working on these two volumes may even appear short. This second volume treats stiff differential equations and differential algebraic equations. It contains three chapters: Chapter IV on one-step (Runge-Kutta) meth ods for stiff problems, Chapter V on multistep methods for stiff problems, and Chapter VI on singular perturbation and differential-algebraic equations. Each chapter is divided into sections. Usually the first sections of a chapter are of an introductory nature, explain numerical phenomena and exhibit numerical results. Investigations of a more theoretical nature are presented in the later sections of each chapter. As in Volume I, the formulas, theorems, tables and figures are numbered con secutively in each section and indicate, in addition, the section number. In cross references to other chapters the (latin) chapter number is put first. References to the bibliography are again by "author" plus "year" in parentheses. The bibliography again contains only those papers which are discussed in the text and is in no way meant to be complete.

This book is a guide to numerical methods for solving fluid dynamics problems. The most widely used discretization and solution methods, which are also found in most commercial CFD-programs, are described in detail. Some advanced topics, like moving grids, simulation of turbulence, computation of free-surface flows, multigrid methods and parallel computing, are also covered. Since CFD is a very broad field, we provide fundamental methods and ideas, with some illustrative examples, upon which more advanced techniques are built. Numerical accuracy and estimation of errors are important aspects and are discussed in many examples. Computer codes that include many of the methods described in the book can be obtained online. This 4th edition includes major revision of all chapters; some new methods are described and references to more recent publications with new approaches are included. Former Chapter 7 on solution of the Navier-Stokes equations has been split into two Chapters to allow for a more detailed description of several variants of the Fractional Step Method and a comparison with SIMPLE-like approaches. In Chapters 7 to 13, most examples have been replaced or recomputed, and hints regarding practical applications are made. Several new sections have been added, to cover, e.g., immersed-boundary methods, overset grids methods, fluid-structure interaction and conjugate heat transfer.

Gives graduate students and researchers an introductory overview of partial differential equation analysis of biomedical engineering systems through detailed examples.
This book introduces finite difference methods for both ordinary differential equations (ODEs) and partial differential equations (PDEs) and discusses the similarities and differences between algorithm design and stability analysis for different types of equations. A unified view of stability theory for ODEs and PDEs is presented, and the interplay between ODE and PDE analysis is stressed. The text emphasizes standard classical methods, but several newer approaches also are introduced and are described in the context of simple motivating examples.
Proceedings of the NATO Advanced Study Institute on Ion Exchange: Science and Technology, Troía, Portugal, July 14-26, 1985
The seven-volume set LNCS 12137, 12138, 12139, 12140, 12141, 12142, and 12143 constitutes the proceedings of the 20th International Conference on Computational Science, ICCS 2020, held in Amsterdam, The Netherlands, in June 2020.* The total of 101 papers and 248 workshop papers presented in this book set were carefully reviewed and selected from 719 submissions (230 submissions to the main track and 489 submissions to the workshops). The papers were organized in topical sections named: Part I: ICCS Main Track Part II: ICCS Main Track Part III: Track of Advances in High-Performance Computational Earth Sciences: Applications and Frameworks; Track of Agent-Based Simulations, Adaptive Algorithms and Solvers; Track of Applications of

Computational Methods in Artificial Intelligence and Machine Learning; Track of Biomedical and Bioinformatics Challenges for Computer Science Part IV: Track of Classifier Learning from Difficult Data; Track of Complex Social Systems through the Lens of Computational Science; Track of Computational Health; Track of Computational Methods for Emerging Problems in (Dis-)Information Analysis Part V: Track of Computational Optimization, Modelling and Simulation; Track of Computational Science in IoT and Smart Systems; Track of Computer Graphics, Image Processing and Artificial Intelligence Part VI: Track of Data Driven Computational Sciences; Track of Machine Learning and Data Assimilation for Dynamical Systems; Track of Meshfree Methods in Computational Sciences; Track of Multiscale Modelling and Simulation; Track of Quantum Computing Workshop Part VII: Track of Simulations of Flow and Transport: Modeling, Algorithms and Computation; Track of Smart Systems: Bringing Together Computer Vision, Sensor Networks and Machine Learning; Track of Software Engineering for Computational Science; Track of Solving Problems with Uncertainties; Track of Teaching Computational Science; Track of UNcErtainty QUantIficatiOn for ComputationAl modeLs *The conference was canceled due to the COVID-19 pandemic.

Numerical Mathematics and Applications

Mathematical and computational introduction. The Euler method and its generalizations. Analysis of Runge-Kutta methods. General linear methods.