A Lagrangian Moving Grid Scheme For One Dimensional Evolutionary Partial Differential Equations Report Centrum Voor Wiskunde En Informatica

A collection of 27 invited refereed papers by scientists in the field of numerical modelling, this volume provides a comprehensive referecne for students and researchers of numerical weather prediction, climate simulation, dynamic meterology and ocean modelling."

The general Method of Lines (MOL) procedure provides a flexible format for the solution of all the major classes of partial differential equations (PDEs) and is particularly well suited to evolutionary, nonlinear wave PDEs. Despite its utility, however, there are relatively few texts that explore it at a more advanced level and reflect the method's current state of development. Written by distinguished researchers in the field, Adaptive Method of Lines reflects the diversity of techniques and applications related to the MOL. Most of its chapters focus on a particular application but also provide a discussion of underlying philosophy and technique. Particular attention is paid to the concept of both temporal and spatial adaptivity in solving time-dependent PDEs. Many important ideas and methods are introduced, including moving grids and grid refinement, static and dynamic gridding, the equidistribution principle and the concept of a monitor function, the minimization of a functional, and the moving finite element method. Applications addressed include shallow water flow, combustion and flame propagation, transport in porous media, gas dynamics, chemical engineering processes, solitary waves, and magnetohydrodynamics. As the first advanced text to represent the modern era of the method of lines, this monograph offers an outstanding opportunity to discover new concepts, learn new techniques, and explore a wide range of applications.

Segregation is a pervasive phenomenon whereby a flowing granular mass consisting of particles with diverse physical properties becomes spatially inhomogeneous. In the industrial sector that deals with the handling and processing of bulk solids, this non-uniformity is highly undesirable since blend homogeneity is generally a stringent requirement of most products. In the arena of geophysical flows, segregation can enhance the destructive capabilities of natural events such as avalanches and landslides. During the last 15 years, these issues have provided motivation and fostered collaborations between the communities of mathematicians, engineers, industrial researchers, and physicists to develop predictive models of segregation by integrating the perspectives and approaches of each. The collection of unique papers brings to light many of the perplexing scientific and technical issues in our current understanding of this complex phenomenon. It addresses advances in experiment, computational modeling and theory. This volume is one of the very few books devoted entirely to problems of segregation of particulate solids.

This monograph is devoted to the theory and approximation by finite volume methods of nonlinear hyperbolic systems of conservation laws in one or two space variables. It follows directly a previous publication on hyperbolic systems of conservation laws by the same authors. Since the earlier work concentrated on the mathematical theory of multidimensional scalar conservation laws, this book will focus on systems and the theoretical aspects which are needed in the applications, such as the solution of the Riemann problem and further insights into more sophisticated problems, with special attention to the system of gas dynamics. This new edition includes more examples such as MHD and shallow water, with an insight on multiphase flows. Additionally, the text includes source terms and well-balanced/asymptotic preserving schemes, introducing relaxation schemes and addressing problems related to resonance and discontinuous fluxes while adding details on the low Mach number situation.

Numerical Methods for Hyperbolic Equations is a collection of 49 articles presented at the International Conference on Numerical Methods for Hyperbolic Equations: Theory and Applications (Santiago de Compostela, Spain, 4-8 July 2011). The conference was organized to honour Professor Eleuterio Toro in the month of his 65th birthday. The topics cover

This volume in the series Lecture Notes in Computational Science and Engineering presents a collection of papers presented at the International Workshop on FSI, held in October 2005 in Hohenwart and organized by DFG's Research Unit 493 "FSI: Modeling, Simulation, and Optimization". The papers address partitioned and monolithic coupling approaches, methodical issues and applications, and discuss FSI from the mathematical, informatics, and engineering points of view.

Fluid-Solid Interaction Dynamics: Theory, Variational Principles, Numerical Methods and Applications gives a comprehensive accounting of fluid-solid interaction dynamics, including theory, numerical methods and their solutions for various FSI problems in engineering. The title provides the fundamental theories, methodologies and results developed in the application of FSI dynamics. Four numerical approaches that can be used with almost all integrated FSI systems in engineering are presented. Methods are linked with examples to illustrate results. In addition, numerical results are compared with available experiments or numerical data in order to demonstrate the accuracy of the approaches and their value to engineering applications. The title gives readers the state-of-the-art in theory, variational principles, numerical modeling and applications for fluid-solid interaction dynamics. Readers will be able to independently formulate models to solve their engineering FSI problems using information from this book. Presents the state-of-the-art in fluid-solid interaction dynamics, providing theory, method and results Takes an integrated approach to formulate, model and simulate FSI problems in engineering Illustrates results with concrete examples Gives four numerical approaches and related theories that are suitable for almost all integrated FSI systems Provides the necessary information for bench scientists to independently formulate, model, and solve physical FSI problems in engineering

Computation of Unsteady Internal Flows provides an in-depth understanding of unsteady flow modeling and algorithms. This understanding enables suitable algorithms and approaches for particular fields of application to be selected. In addition, the understanding of the behavior of algorithms gained allows practitioners to use them more safely in existing codes, enabling meaningful results to be produced more economically. Features of Computation of Unsteady Internal Flows: Specialized unsteady flow modeling algorithms, their traits, and practical tips relating to their use are presented. Case studies considering complex, practically significant problems are given. Source code and set-up files are included. Intended to be of a tutorial nature, these enable the reader to reproduce and extend case studies and to further explore algorithm performances. Mathematical derivations are used in a fashion that illuminates understanding of the physical implications of different numerical schemes. Physically intuitive mathematical concepts are used. New material on adaptive time stepping is included. £/LIST£ Audience: Researchers in both the academic and industrial areas who wish to gain in-depth knowledge of unsteady flow modeling will find Computation of Unsteady Internal Flows invaluable. It can also be used as a text in courses centered on computational fluid dynamics.

A "Sonderforschungsbereich" (SFB) is a programme of the "Deutsche For schungsgemeinschaft" to financially support a concentrated research effort of a number of scientists located principally at one University, Research La boratory or a number of these situated in close proximity to one another so that active interaction among individual scientists is easily possible. Such SFB are devoted to a topic, in our case "Deformation and Failure in Metallic and Granular M aterialK' , and financing is based on a peer reviewed proposal for three (now four) years with the intention of several prolongations after evaluation of intermediate progress and continuation reports. An SFB is terminated in general by a formal

workshop, in which the state of the art of the achieved results is presented in oral or I and poster communications to which also guests are invited with whom the individual project investigators may have collaborated. Moreover, a research report in book form is produced in which a number of articles from these lectures are selected and collected, which present those research results that withstood a rigorous reviewing pro cess (with generally two or three referees). The theme deformation and failure of materials is presented here in two volumes of the Lecture Notes in Applied and Computational Mechanics by Springer Verlag, and the present volume is devoted to granular and porous continua. The complementary volume (Lecture Notes in Applied and Com putational Mechanics, vol. 10, Eds. K. HUTTER & H.
Selected, peer reviewed papers from the 2012 International Conference on Mechanical Engineering, Industrial Electronics and Informatization (MEIEI 2012), December 28-30, 2012, Qinhuangdao, Hebei, China. The papers are grouped as follows: Chapter 1: Applied Mechanics and Advances in Mechanical Engineering; Chapter 2: Control Technology and Industrial Electronics; Chapter 3: Network and Computer Technology. Applied Methods of Computing; Chapter 4: Advanced Technologies in Materials Science.
This multi-authored volume provides a comprehensive and in-depth account of the highly interdisciplinary science and technology of liquid film coating. The book covers fundamental principles from a wide range of scientific disciplines, including fluid mechanics aand transport phenomena, capillary hydrodynamics, surface and colloid science. The authors, all acknowledged eperts in their fields, represent a balance between industrial and academic points of view. Throughout the text, many case studies illustrate how scientific principles together with advanced experimental and theoretical methods are applied to develop and optimize manufacturing processes of eve increasing sophiatication and efficiency. In the first part of the book, the authors systematically recount the underlying physical principles and important material properties. The second part of the book gives a comprehensive overview of the most advanced experimental, mathematical and computational methods available today to investigate coating processes. The third part provides an overview and critical literature review for all major classes of liquid film coating processes of industrial importance.
Computer aided process engineering (CAPE) tools have been very successfully used in process design and product engineering for a long time. In particular, simulation and modelling tools have enabled engineers to analyse and understand the behaviour of selected processes prior to building actual plants. The aim of design or retrofit of chemical processes is to produce profitably products that satisfy the societal needs, ensuring safe and reliable operation of each process, as well as minimising any effects on the environment. This involves the conceptual design or retrofit of plants and processes, novel manufacturing approaches, process/control system design interactions and operability, manufacturability, environmental and safety issues. Backed by current studies, this 2-volume set gives a comprehensive survey of the various approaches and latest developments on the use of CAPE in the process industry. An invaluable reference to the scientific and industrial community in the field of computer aided process and product engineering.
The first volume of the proceedings of the 7th conference on "Finite Volumes for Complex Applications" (Berlin, June 2014) covers topics that include convergence and stability analysis, as well as investigations of these methods from the point of view of compatibility with physical principles. It collects together the focused invited papers, as well as the reviewed contributions from internationally leading researchers in the field of analysis of finite volume and related methods. Altogether, a rather comprehensive overview is given of the state of the art in the field. The finite volume method in its various forms is a space discretization technique for partial differential equations based on the fundamental physical principle of conservation. Recent decades have brought significant success in the theoretical understanding of the method. Many finite volume methods preserve further qualitative or asymptotic properties,

including maximum principles, dissipativity, monotone decay of free energy, and asymptotic stability. Due to these properties, finite volume methods belong to the wider class of compatible discretization methods, which preserve qualitative properties of continuous problems at the discrete level. This structural approach to the discretization of partial differential equations becomes particularly important for multiphysics and multiscale applications. Researchers, PhD and masters level students in numerical analysis, scientific computing and related fields such as partial differential equations will find this volume useful, as will engineers working in numerical modeling and simulations.

Handbook of Numerical Methods for Hyperbolic Problems explores the changes that have taken place in the past few decades regarding literature in the design, analysis and application of various numerical algorithms for solving hyperbolic equations. This volume provides concise summaries from experts in different types of algorithms, so that readers can find a variety of algorithms under different situations and readily understand their relative advantages and limitations. Provides detailed, cutting-edge background explanations of existing algorithms and their analysis Ideal for readers working on the theoretical aspects of algorithm development and its numerical analysis Presents a method of different algorithms for specific applications and the relative advantages and limitations of different algorithms for engineers or readers involved in applications Written by leading subject experts in each field who provide breadth and depth of content coverage

The Classical Stefan Problem: Basic Concepts, Modelling and Analysis with Quasi-Analytical Solutions and Methods, New Edition, provides the fundamental theory, concepts, modeling, and analysis of the physical, mathematical, thermodynamical, and metallurgical properties of classical Stefan and Stefan-like problems as applied to heat transfer problems with phase-changes, such as from liquid to solid. This self-contained work reports and derives the results from tensor analysis, differential geometry, non-equilibrium thermodynamics, physics, and functional analysis, and is thoroughly enriched with many appropriate references for in-depth background reading on theorems. Each chapter in this fully revised and updated edition begins with basic concepts and objectives, also including direction on how the subject matter was developed. It contains more than 400 pages of new material on quasi-analytical solutions and methods of classical Stefan and Stefan-like problems.The book aims to bridge the gap between the theoretical and solution aspects of the afore-mentioned problems. Provides both the phenomenology and mathematics of Stefan problems Bridges physics and mathematics in a concrete and readable manner Presents well-organized chapters that start with proper definitions followed by explanations and references for further reading Includes both numerical and quasi-analytical solutions and methods of classical Stefan and Stefan-like problems

A Lagrangian Moving Grid Scheme for One-dimensional Evolutionary Partial Differential EquationsTheory, Numerics and Applications of Hyperbolic Problems IAachen, Germany, August 2016Springer

A comprehensive introductory graduate textbook illustrating specialised topics in current physics.

After centuries of research, turbulence in fluids is still an unsolved problem. The graduate-level lectures in this volume cover the state of the art of numerical methods for fluid mechanics. The research in this collection covers wavelet-based methods, the semi-Lagrangian method, the Lagrangian multi-pole method, continuous adaptation of curvilinear grids, finite volume methods, shock-capturing methods, and ENO schemes. The most recent research on large eddy simulations and Reynolds stress modeling is

presented in a way that is accessible to engineers, postdoctoral researchers, and graduate students. Applications cover industrial flows, aerodynamics, two-phase flows, astrophysical flows, and meteorology. This volume would be suitable as a textbook for graduate students with a background in fluid mechanics.

The first 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.

Advances in Applied Mechanics

Volume is indexed by Thomson Reuters CPCI-S (WoS). The collection of peer reviewed papers covers all aspects of mechanics and materials: theoretical, experimental, and computational. Specific topics of interest include: mechanics of materials, rock and soil mechanics, fluid and heat mechanics, machine parts and mechanisms, composites, micro/nano materials, steel and alloys, and building materials and other related topics.

This book provides a survey of the frontiers of research in the numerical modeling and mathematical analysis used in the study of the atmosphere and oceans. The details of the current practices in global atmospheric and ocean models, the assimilation of observational data into such models and the numerical techniques used in theoretical analysis of the atmosphere and ocean are among the topics covered. • Truly interdisciplinary: scientific interactions between specialties of atmospheric and ocean sciences and applied and computational mathematics • Uses the approach of computational mathematicians, applied and numerical analysts and the tools appropriate for unsolved problems in the atmospheric and oceanic sciences • Contributions uniquely address central problems and provide a survey of the frontier of research

This is an overview of the development of adaptive techniques for atmospheric modeling. Written in an educational style, it functions as a starting point for readers interested in adaptive modeling, in atmospheric sciences and beyond. Coverage includes paradigms of adaptive techniques, such as error estimation and adaptation criteria. Mesh generation methods are presented for triangular/tetrahedral and quadrilateral/hexahedral meshes, with a special section on initial meshes for the sphere.

This book contains papers presented at the 11th Symposium of Computer Aided Process Engineering (ESCAPE-11), held in Kolding, Denmark, from May 27-30, 2001. The objective of ESCAPE-11 is to highlight the use of computers and information technology tools, that is, the traditional CAPE topics as well as the new CAPE topics of current and future interests. The main theme for ESCAPE-11 is process and tools integration with emphasis on hybrid processing, cleaner and efficient technologies (process integration), computer aided systems for modelling, design, synthesis, control (tools integration) and industrial case

studies (application of integrated strategies). The papers are arranged in terms of the following themes: computer aided control/operations, computer aided manufacturing, process and tools integration, and new frontiers in CAPE. A total of 188 papers, consisting of 5 keynote and 183 contributed papers are included in this book.

This textbook is a collection of technical papers that were presented at the 10th International Symposium on Unsteady Aerodynamics, Aeroacoustics, and Aeroelasticity of Turbomachines held September 8-11, 2003 at Duke University in Durham, North Carolina. The papers represent the latest in state of the art research in the areas of aeroacoustics, aerothermodynamics, computational methods, experimental testing related to flow instabilities, flutter, forced response, multistage, and rotor-stator effects for turbomachinery.

In this book experts discuss research and applications in interfacial fluid dynamics.

There has been rapid development in the area of adaptive computation over the past decade. The International Conference on Recent Advances in Adaptive Computation was held at Zhejiang University (Hangzhou, China) to explore these new directions. The conference brought together specialists to discuss modern theories and practical applications of adaptive methods. This volume contains articles reflecting the invited talks given by leading mathematicians at the conference. It is suitable for graduate students and researchers interested in methods of computation.

Hyperbolic partial differential equations describe phenomena of material or wave transport in physics, biology and engineering, especially in the field of fluid mechanics. The mathematical theory of hyperbolic equations has recently made considerable progress. Accurate and efficient numerical schemes for computation have been and are being further developed. This two-volume set of conference proceedings contains about 100 refereed and carefully selected papers. The books are intended for researchers and graduate students in mathematics, science and engineering interested in the most recent results in theory and practice of hyperbolic problems. Applications touched in these proceedings concern one-phase and multiphase fluid flow, phase transitions, shallow water dynamics, elasticity, extended thermodynamics, electromagnetism, classical and relativistic magnetohydrodynamics, cosmology. Contributions to the abstract theory of hyperbolic systems deal with viscous and relaxation approximations, front tracking and wellposedness, stability of shock profiles and multi-shock patterns, traveling fronts for transport equations. Numerically oriented articles study finite difference, finite volume, and finite element schemes, adaptive, multiresolution, and artificial dissipation methods.

This book focuses on the interplay between Eulerian and Lagrangian conservation laws for systems that admit physical motivation and originate from continuum mechanics. Ultimately, it highlights what is specific to and beneficial in the Lagrangian approach and its numerical methods. The two first chapters present a selection of well-known

features of conservation laws and prepare readers for the subsequent chapters, which are dedicated to the analysis and discretization of Lagrangian systems. The text is at the frontier of applied mathematics and scientific computing and appeals to students and researchers interested in Lagrangian-based computational fluid dynamics. It also serves as an introduction to the recent corner-based Lagrangian finite volume techniques.

Unique book on Reaction-Advection-Diffusion problems

The field of Large Eddy Simulation (LES) and hybrids is a vibrant research area. This book runs through all the potential unsteady modelling fidelity ranges, from low-order to LES. The latter is probably the highest fidelity for practical aerospace systems modelling. Cutting edge new frontiers are defined. One example of a pressing environmental concern is noise. For the accurate prediction of this, unsteady modelling is needed. Hence computational aeroacoustics is explored. It is also emerging that there is a critical need for coupled simulations. Hence, this area is also considered and the tensions of utilizing such simulations with the already expensive LES. This work has relevance to the general field of CFD and LES and to a wide variety of non-aerospace aerodynamic systems (e.g. cars, submarines, ships, electronics, buildings). Topics treated include unsteady flow techniques; LES and hybrids; general numerical methods; computational aeroacoustics; computational aeroelasticity; coupled simulations and turbulence and its modelling (LES, RANS, transition, VLES, URANS). The volume concludes by pointing forward to future horizons and in particular the industrial use of LES. The writing style is accessible and useful to both academics and industrial practitioners. From the reviews: "Tucker's volume provides a very welcome, concise discussion of current capabilities for simulating and modellng unsteady aerodynamic flows. It covers the various pos sible numerical techniques in good, clear detail and presents a very wide range of practical applications; beautifully illustrated in many cases. This book thus provides a valuable text for practicing engineers, a rich source of background information for students and those new to this area of Research & Development, and an excellent state-of-the-art review for others. A great achievement." Mark Savill FHEA, FRAeS, C.Eng, Professor of Computational Aerodynamics Design & Head of Power & Propulsion Sciences, Department of Power & Propulsion, School of Engineering, Cranfield University, Bedfordshire, U.K. "This is a very useful book with a wide coverage of many aspects in unsteady aerodynamics method development and applications for internal and external flows." L. He, Rolls-Royce/RAEng Chair of Computational Aerothermal Engineering, Oxford University, U.K. "This comprehensive book ranges from classical concepts in both numerical methods and turbulence modelling approaches for the beginner to latest state-of-the-art for the advanced practitioner and constitutes an extremely valuable contribution to the specific Computational Fluid Dynamics literature in Aeronautics. Student and expert alike will benefit greatly by reading it from cover to cover." Sébastien Deck, Onera, Meudon, France

This NATO Advanced Research Workshop was devoted to the pre sentation, evaluation, and critical discussion of numerical methods in nonrelativistic and relativistic hydrodynamics, radia tive transfer, and radiation-coupled hydrodynamics. The unifying theme of the lectures was the successful application of these methods to challenging problems in astrophysics. The workshop was subdivided into 3 somewhat independent

topics, each with their own subtheme. Under the heading radiation hydrodynamics were brought together context, theory, methodology, and application of radia tive transfer and radiation hydrodynamics in astrophysics. The intimate coupling between astronomy and radiation physics was underscored by examples from past and present research. Frame-dependence of both the equation of transfer (plus moments) and the underlying radiation quantities was discussed and clarified. Limiting regimes in radiation-coupled flow were identified and described; the dynamic diffusion regime received special emphasis. Numerical methods for continuum and line transfer equations in a given background were presented. Two examples of methods for computing dynamically coupled radia tion/matter fields were given. In l-d and assuming LTE the complete equations of radiation hydrodynamics can be solved with current computers. Such is not the case in 2- or 3-d, which were identified as target areas for research. The use of flux-limiters was vigorously discussed in this connection, and enlivened the meeting.