

Jian Guo Zhou

Lattice Boltzmann Methods for Shallow Water Flows



Springer

Lattice Boltzmann Methods For Shallow Water Flows

**Mingfu Guan, Qiuhua Liang, Jingming
Hou**



Lattice Boltzmann Methods For Shallow Water Flows:

Lattice Boltzmann Methods for Shallow Water Flows Jian Guo Zhou, 2013-03-14 The lattice Boltzmann method LBM is a modern numerical technique very efficient flexible to simulate different flows within complex varying geometries It is evolved from the lattice gas automata LGA in order to overcome the difficulties with the LGA The core equation in the LBM turns out to be a special discrete form of the continuum Boltzmann equation leading it to be self explanatory in statistical physics The method describes the microscopic picture of particles movement in an extremely simplified way and on the macroscopic level it gives a correct average description of a fluid The averaged particle velocities behave in time and space just as the flow velocities in a physical fluid showing a direct link between discrete microscopic and continuum macroscopic phenomena In contrast to the traditional computational fluid dynamics CFD based on a direct solution of flow equations the lattice Boltzmann method provides an indirect way for solution of the flow equations The method is characterized by simple calculation parallel process and easy implementation of boundary conditions It is these features that make the lattice Boltzmann method a very promising computational method in different areas In recent years it receives extensive attentions and becomes a very potential research area in computational fluid dynamics However most published books are limited to the lattice Boltzmann methods for the Navier Stokes equations On the other hand shallow water flows exist in many practical situations such as tidal flows waves open channel flows and dam break flows

Lattice Boltzmann Methods for Shallow Water Flows Jian Guo Zhou, 2004-01-12 This book describes a modern numerical technique a lattice Boltzmann method for shallow water flows with or without flow turbulence This method requires only a simple microscopic equation to determine the depth and velocity based on its recovered macroscopic properties The method is accurate and efficient for simulating complicated flows and flows within complex geometries so it is becoming a powerful design tool in fluids engineering The book may be used as a reference for scientists and engineers a practical guide to the method for consultant organisations and a textbook for graduates in engineering sciences such as coastal civil and environmental engineering

Lattice Boltzmann Methods for Shallow Water Flow Applications Tumelo R.A. Uoane, 2011

Analysis and Applications of Lattice Boltzmann Simulations Valero-Lara, Pedro, 2018-05-04 Programming has become a significant part of connecting theoretical development and scientific application computation Fluid dynamics provide an important asset in experimentation and theoretical analysis Analysis and Applications of Lattice Boltzmann Simulations provides emerging research on the efficient and standard implementations of simulation methods on current and upcoming parallel architectures While highlighting topics such as hardware accelerators numerical analysis and sparse geometries this publication explores the techniques of specific simulators as well as the multiple extensions and various uses This book is a vital resource for engineers professionals researchers academics and students seeking current research on computational fluid dynamics high performance computing and numerical and flow simulations

Computer Vision, Imaging and Computer Graphics:

Theory and Applications Sebastiano Battiato, Sabine Coquillart, Robert S. Laramée, Andreas Kerren, José Braz, 2014-09-29 This book constitutes the refereed proceedings of the 8th International Conference VISIGRAPP 2013 consisting of the Joint Conferences on Computer Vision VISAPP the International Conference on Computer Graphics GRAPP 2013 and the International Conference on Information Visualization IVAPP 2013 held in Barcelona Spain in February 2013 The 15 revised full papers presented were carefully reviewed and selected from 445 submissions The papers are organized in topical sections on theory and applications in computer vision image analysis computer graphics and information visualization

Hydrodynamics Jin - Hai Zheng, 2012-03-14 With the amazing advances of scientific research Hydrodynamics Theory and Application presents the engineering applications of hydrodynamics from many countries around the world A wide range of topics are covered in this book including the theoretical experimental and numerical investigations on various subjects related to hydrodynamic problems The book consists of twelve chapters each of which is edited separately and deals with a specific topic The book is intended to be a useful reference to the readers who are working in this field *Advanced Numerical Models for Simulating Tsunami Waves and Runup* Philip L. F. Liu, 2008 This review volume is divided into two parts The first part includes five review papers on various numerical models Pedersen provides a brief but thorough review of the theoretical background for depth integrated wave equations which are employed to simulate tsunami runup LeVeque and George describe high resolution finite volume methods for solving the nonlinear shallow water equations The focus of their discussion is on the applications of these methods to tsunami runup In recent years several advanced 3D numerical models have been introduced to the field of coastal engineering to calculate breaking waves and wave structure interactions These models are still under development and are at different stages of maturity Rogers and Dalrymple discuss the Smooth Particles Hydrodynamics SPH method which is a meshless method Wu and Liu present their Large Eddy Simulation LES model for simulating the landslide generated waves Finally Frandsen introduces the lattice Boltzmann method with the consideration of a free surface The second part of the review volume contains the descriptions of the benchmark problems with eleven extended abstracts submitted by the workshop participants All these papers are compared with their numerical results with benchmark solutions

Lattice Boltzmann Method and Its Applications in Engineering Zhaoli Guo, Chang Shu, 2013 This book covers the fundamental and practical application of the Lattice Boltzmann method LBM This method is a relatively new simulation technique for the modeling of complex fluid systems and has attracted interest from researchers in computational physics **Advances in Neural Networks - ISSN 2012** Jun Wang, Gary G. Yen, Marios M.

Polycarpou, 2012-07-23 The two volume set LNCS 7367 and 7368 constitutes the refereed proceedings of the 9th International Symposium on Neural Networks ISSN 2012 held in Shenyang China in July 2012 The 147 revised full papers presented were carefully reviewed and selected from numerous submissions The contributions are structured in topical sections on mathematical modeling neurodynamics cognitive neuroscience learning algorithms optimization pattern

recognition vision image processing information processing neurocontrol and novel applications **Lattice Boltzmann**

Modeling Michael C. Sukop, Daniel T. Thorne, 2007-04-05 Here is a basic introduction to Lattice Boltzmann models that emphasizes intuition and simplistic conceptualization of processes while avoiding the complex mathematics that underlies LB models The model is viewed from a particle perspective where collisions streaming and particle particle particle surface interactions constitute the entire conceptual framework Beginners and those whose interest is in model application over detailed mathematics will find this a powerful quick start guide Example simulations exercises and computer codes are included *Facing the Multicore-Challenge* Rainer Keller, David Kramer, Jan-Philipp Weiss, 2010-10-06 This state of the art survey features topics related to the impact of multicore and coprocessor technologies in science and for large scale applications in an interdisciplinary environment The papers cover all issues of current research in mathematical modeling design of parallel algorithms aspects of microprocessor architecture parallel programming languages compilers hardware aware computing heterogeneous platforms emerging architectures tools performance tuning and requirements for large scale applications The contributions presented in this volume offer a survey on the state of the art the concepts and perspectives for future developments They are an outcome of an inspiring conference conceived and organized by the editors within the junior scientist program of Heidelberg Academy for Sciences and Humanities titled Facing the Multicore Challenge held at Heidelberg Germany in March 2010 The 12 revised full papers presented together with the extended abstracts of 3 invited lectures focus on combination of new aspects of multicore microprocessor technologies parallel applications numerical simulation software development and tools thus they clearly show the potential of emerging technologies in the area of multicore and manycore processors that are paving the way towards personal supercomputing

Handbook of HydroInformatics Saeid Eslamian, Faezeh Eslamian, 2022-12-06 Handbook of HydroInformatics Volume III Water Data Management Best Practices presents the latest and most updated data processing techniques that are fundamental to Water Science and Engineering disciplines These include a wide range of the new methods that are used in hydro modeling such as Atmospheric Teleconnection Pattern CONUS Scale Hydrologic Modeling Copula Function Decision Support System Downscaling Methods Dynamic System Modeling Economic Impacts and Models Geostatistics and Geospatial Frameworks Hydrologic Similarity Indices Hydropower Renewable Energy Models Sediment Transport Dynamics Advanced Models Social Data Mining and Wavelet Transforms This volume is an example of true interdisciplinary work The audience includes postgraduates and above interested in Water Science Geotechnical Engineering Soil Science Civil Engineering Chemical Engineering Computer Engineering Engineering Applied Science Earth and Geoscience Atmospheric Science Geography Environment Science Natural Resources Mathematical Science and Social Sciences It is a fully comprehensive handbook which provides all the information needed related to the best practices for managing water data Contributions from global experts in the fields of data management research climate change and resilience insufficient data problem etc

Thorough applied examples and case studies in each chapter providing the reader with real world scenarios for comparison Includes a wide range of new methods that are used in hydro modeling with step by step guides on how to use them

Advances in Hydraulics and Hydroinformatics Jianguo Zhou,Jianmin Zhang,Yong Peng,Alistair Borthwick,2020-12-29 This Special Issue reports on recent research trends in hydraulics hydrodynamics and hydroinformatics and their novel applications in practical engineering The Issue covers a wide range of topics including open channel flows sediment transport dynamics two phase flows flow induced vibration and water quality The collected papers provide insight into new developments in physical mathematical and numerical modelling of important problems in hydraulics and hydroinformatics and include demonstrations of the application of such models in water resources engineering **Smart Approaches to**

Predict Urban Flooding: Current Advances and Challenges Mingfu Guan,Qiuhua Liang,Jingming Hou,2021-07-29

Recent Advancements from Aquifers to Skies in Hydrogeology, Geoecology, and Atmospheric Sciences Haroun Chenchouni,Zhihua Zhang,Deepak Singh Bisht,Matteo Gentilucci,Mingjie Chen,Helder I. Chaminé,Maurizio Barbieri,Mahesh Kumar Jat,Jesús Rodrigo-Comino,Dionysia Panagoulia,Amjad Kallel,Arkoprovo Biswas,Veyssel Turan,Jasper Knight,Attila Çiner,Carla Candeias,Zeynal Abiddin Ergüler,2024-03-19 This book is based on the accepted papers for presentation at the 2nd MedGU Annual Meeting Marrakesh 2022 It presents a series of newest research studies that are nowadays relevant mainly to Middle East Mediterranean region and Africa It includes major subjects related to hydrology hydrogeology hydrogeochemistry including but not limited to isotope hydrology groundwater models water resources and systems and related subjects It also includes research studies on biogeochemistry which mainly focus on the interactions between life and the chemical cycles in the Earth system Some case studies on geobiology and geoecology investigate the structure and function of geocosystems their components and their environment The book also presents major subjects related to atmospheric oceanic meteorology and climatic science with recent developments in the field By cutting across these traditional subject boundaries this book brings together the major elements that are important for understanding the weather climate water systems and geocosystems in these regions **Algorithms and Architectures for Parallel**

Processing Arrens Hua,Shih-Liang Chang,2009-07-10 This book constitutes the refereed proceedings of the 9th International Conference on Algorithms and Architectures for Parallel Processing ICA3PP 2009 held in Taipei Taiwan in June 2009 The 80 revised full papers were carefully reviewed and selected from 243 submissions The papers are organized in topical sections on bioinformatics in parallel computing cluster grid and fault tolerant computing cluster distributed parallel operating systems dependability issues in computer networks and communications dependability issues in distributed and parallel systems distributed scheduling and load balancing industrial applications information security internet multi core programming software tools multimedia in parallel computing parallel distributed databases parallel algorithms parallel architectures parallel IO systems and storage systems performance of parallel ditributed computing systems scientific

applications self healing self protecting and fault tolerant systems tools and environments for parallel and distributed software development and Web service

Analysis of Lattice-Boltzmann Methods Martin Rheinländer, 2007 Doctoral Thesis Dissertation from the year 2007 in the subject Mathematics Analysis University of Constance Fachbereich Mathematik Statistik 69 entries in the bibliography language English abstract Lattice Boltzmann algorithms represent a quite novel class of numerical schemes which are used to solve evolutionary partial differential equations PDEs In contrast to other methods FEM FVM lattice Boltzmann methods rely on a mesoscopic approach The idea consists in setting up an artificial grid based particle dynamics which is chosen such that appropriate averages provide approximate solutions of a certain PDE typically in the area of fluid dynamics As lattice Boltzmann schemes are closely related to finite velocity Boltzmann equations being singularly perturbed by special scalings their consistency is not obvious This work is concerned with the analysis of lattice Boltzmann methods also focusing certain numeric phenomena like initial layers multiple time scales and boundary layers As major analytic tool regular Hilbert expansions are employed to establish consistency Exemplarily two and three population algorithms are studied in one space dimension mostly discretizing the advection diffusion equation It is shown how these model schemes can be derived from two dimensional schemes in the case of special symmetries The analysis of the schemes is preceded by an examination of the singular limit being characteristic of the corresponding scaled finite velocity Boltzmann equations Convergence proofs are obtained using a Fourier series approach and alternatively a general regular expansion combined with an energy estimate The appearance of initial layers is investigated by multiscale and irregular expansions Among others a hierarchy of equations is found which gives insight into the internal coupling of the initial layer and the regular part of the solution Next the consistency of the model algorithms is considered followed by Informatics, Networking and Intelligent Computing Jiaxing Zhang, 2015-05-06 This proceedings volume contains selected papers presented at the 2014 International Conference on Informatics Networking and Intelligent Computing held in Shenzhen China Contributions cover the latest developments and advances in the field of Informatics Networking and Intelligent Computing

River Flow 2014 Anton J. Schleiss, Giovanni de Cesare, Mario J. Franca, Michael Pfister, 2014-08-12 The behaviour of river systems is a result of the complex interaction between flow sediments morphology and habitats Furthermore rivers are often used as a source of water supply and energy production as well as a waterway for transportation The main challenge faced by river engineers today in collaboration with environmental and ecological scientists is to restore the channelized rivers under the constraints of high urbanization and limited space as well as sustainable water use During the seventh International Conference on Fluvial Hydraulics River Flow 2014 at cole Polytechnique F d rale de Lausanne EPFL Switzerland scientists and professionals from all over the world addressed this challenge and exchanged their knowledge regarding fluvial hydraulics and river morphology This book comprises the proceedings of the high quality contributions of the participants which reflect the state of the art in the fields of river

hydrodynamics morphodynamics sediment transport river engineering and restoration The conference was organized under the auspices of the Committee on Fluvial Hydraulics of the International Association for Hydro Environment Engineering and Research IAHR Past River Flow conferences have witnessed a significant increase in participation of our community of river engineers and researchers confirming the need for such a forum

Applications of Heat, Mass and Fluid Boundary Layers R. O. Fagbenle, O. M. Amoo, S. Aliu, A. Falana, 2020-01-22 Applications of Heat Mass and Fluid Boundary Layers brings together the latest research on boundary layers where there has been remarkable advancements in recent years This book highlights relevant concepts and solutions to energy issues and environmental sustainability by combining fundamental theory on boundary layers with real world industrial applications from among others the thermal nuclear and chemical industries The book's editors and their team of expert contributors discuss many core themes including advanced heat transfer fluids and boundary layer analysis physics of fluid motion and viscous flow thermodynamics and transport phenomena alongside key methods of analysis such as the Merk Chao Fagbenle method This book's multidisciplinary coverage will give engineers scientists researchers and graduate students in the areas of heat mass fluid flow and transfer a thorough understanding of the technicalities methods and applications of boundary layers with a unified approach to energy climate change and a sustainable future Presents up to date research on boundary layers with very practical applications across a diverse mix of industries Includes mathematical analysis to provide detailed explanation and clarity Provides solutions to global energy issues and environmental sustainability

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