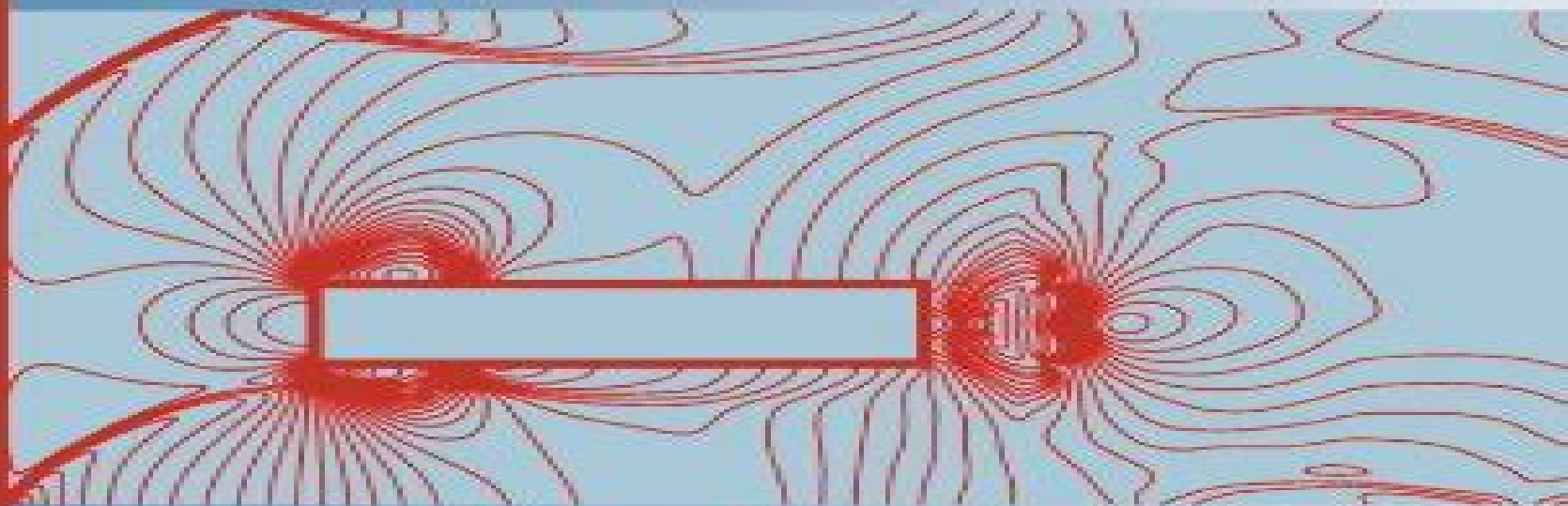


Godunov-type Schemes

An introduction for engineers



Vincent Guinot

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Godunov-type Schemes V. Guinot, 2003-01-29 Godunov type schemes appear as good candidates for the next generation of commercial modelling software packages the capability of which to handle discontinuous solution will be a basic requirement It is in the interest of practising engineers and developers to be familiar with the specific features of discontinuous wave propagation problems and to be aware of the possibilities offered by Godunov type schemes for their solution This book aims to present the principles of such schemes in a way that is easily understandable to practising engineers The features of hyperbolic conservation laws and their solutions are presented in the first two chapters The principles of Godunov type schemes are outlined in a third chapter Chapters 4 and 5 cover the application of the original Godunov scheme to scalar laws and to hyperbolic systems of conservation laws respectively Chapter 6 is devoted to higher order schemes in one dimension of space The design of such a scheme is described for the general case and applied to some well known schemes such as the MUSCL and PPM schemes Chapter 7 focuses on multidimensional problems The classical alternate directions and finite volume approaches are presented together with the wave splitting technique that is described in depth with an application to two dimensional systems Chapter 8 deals with large time step algorithms These include front tracking based methods explicit implicit techniques and the time line interpolation technique Three appendices provide notions on accuracy and stability issues Riemann solvers and the user instructions for the computational codes provided in the enclosed CD ROM

Godunov-type Schemes Vincent Guinot, 2003

Godunov Methods E.F. Toro, 2001-12-31 This edited review book on Godunov methods contains 97 articles all of which were presented at the international conference on Godunov Methods Theory and Applications held at Oxford in October 1999 to commemorate the 70th birthday of the Russian mathematician Sergei K Godunov The meeting enjoyed the participation of 140 scientists from 20 countries one of the participants commented everyone is here meaning that virtually everybody who had made a significant contribution to the general area of numerical methods for hyperbolic conservation laws along the lines first proposed by Godunov in the fifties was present at the meeting Sadly there were important absentees who due to personal circumstance could not attend this very exciting gathering The central theme of the meeting and of this book was numerical methods for hyperbolic conservation laws following Godunov's key ideas contained in his celebrated paper of 1959 But Godunov's contributions to science are not restricted to Godunov's method

Wave Propagation in Fluids Vincent Guinot, 2012-12-27 This second edition with four additional chapters presents the physical principles and solution techniques for transient propagation in fluid mechanics and hydraulics The application domains vary including contaminant transport with or without sorption the motion of immiscible hydrocarbons in aquifers pipe transients open channel and shallow water flow and compressible gas dynamics The mathematical formulation is covered from the angle of conservation laws with an emphasis on multidimensional problems and discontinuous flows such as steep fronts and shock waves Finite difference finite volume and finite element based

numerical methods including discontinuous Galerkin techniques are covered and applied to various physical fields Additional chapters include the treatment of geometric source terms as well as direct and adjoint sensitivity modeling for hyperbolic conservation laws A concluding chapter is devoted to practical recommendations to the modeler Application exercises with on line solutions are proposed at the end of the chapters *Hydrobiological Modelling* Brian J. Williams, 2006 The book describes models of aquatic ecosystems ranging from lakes to estuaries to the deep ocean It provides a background in the physical and biological processes numerical methods and elementary ecosystem models It describes two of the most widely used hydrodynamic models and presents a number of case studies The practice of modelling in management is discussed

Riemann Solvers and Numerical Methods for Fluid Dynamics Eleuterio F. Toro, 2009-04-21 High resolution upwind and centered methods are a mature generation of computational techniques They are applicable to a wide range of engineering and scientific disciplines Computational Fluid Dynamics CFD being the most prominent up to now This textbook gives a comprehensive coherent and practical presentation of this class of techniques For its third edition the book has been thoroughly revised to contain new material **Progress in Industrial Mathematics at ECMI 2014** Giovanni

Russo, Vincenzo Capasso, Giuseppe Nicosia, Vittorio Romano, 2017-09-04 This book presents a collection of papers emphasizing applications of mathematical models and methods to real world problems of relevance for industry life science environment finance and so on The biannual Conference of ECMI the European Consortium of Mathematics in Industry held in 2014 focused on various aspects of industrial and applied mathematics The five main topics addressed at the conference were mathematical models in life science material science and semiconductors mathematical methods in the environment design automation and industrial applications and computational finance Several other topics have been treated such as among others optimization and inverse problems education numerical methods for stiff pdes model reduction imaging processing multi physics simulation mathematical models in textile industry The conference which brought together applied mathematicians and experts from industry provided a unique opportunity to exchange ideas problems and methodologies bridging the gap between mathematics and industry and contributing to the advancement of science and technology The conference has included a presentation of EU Maths In European Network of Mathematics for Industry and Innovation a recent joint initiative of ECMI and EMS The proceedings from this conference represent a snapshot of the current activity in industrial mathematics in Europe and are highly relevant to anybody interested in the latest applications of mathematics to industrial problems **Shallow Water Hydraulics** Oscar Castro-Orgaz, Willi H. Hager, 2019-11-08 This book presents the

theory and computation of open channel flows using detailed analytical numerical and experimental results The fundamental equations of open channel flows are derived by means of a rigorous vertical integration of the RANS equations for turbulent flow In turn the hydrostatic pressure hypothesis which forms the core of many shallow water hydraulic models is scrutinized by analyzing its underlying assumptions The book s main focus is on one dimensional models including detailed treatments of

unsteady and steady flows The use of modern shock capturing finite difference and finite volume methods is described in detail and the quality of solutions is carefully assessed on the basis of analytical and experimental results The book's unique features include Rigorous derivation of the hydrostatic based shallow water hydraulic models Detailed treatment of steady open channel flows including the computation of transcritical flow profiles General analysis of gate maneuvers as the solution of a Riemann problem Presents modern shock capturing finite volume methods for the computation of unsteady free surface flows Introduces readers to movable bed and sediment transport in shallow water models Includes numerical solutions of shallow water hydraulic models for non hydrostatic steady and unsteady free surface flows This book is suitable for both undergraduate and graduate level students given that the theory and numerical methods are progressively introduced starting with the basics As supporting material a collection of source codes written in Visual Basic and inserted as macros in Microsoft Excel is available The theory is implemented step by step in the codes and the resulting programs are used throughout the book to produce the respective solutions

Applied Wave Mathematics Ewald Quak,Tarmo

Soomere,2009-08-29 This edited volume consists of twelve contributions related to the EU Marie Curie Transfer of Knowledge Project Cooperation of Estonian and Norwegian Scientific Centres within Mathematics and its Applications CENS CMA 2005 2009 der contract MTKD CT 2004 013909 which financed exchange visits to and from CENS the Centre for Nonlinear Studies at the Institute of Cybernetics of Tallinn University of Technology in Estonia Seven contributions describe research highlights of CENS members two the work of members of CMA the Centre of Mathematics for Applications University of Oslo Norway as the partner institution of CENS in the Marie Curie project and three the field of work of foreign research fellows who visited CENS as part of the project The structure of the book reflects the distribution of the topics addressed Part I Waves in Solids Part II Mesoscopic Theory Part III Exploiting the Dissipation Inequality Part IV Waves in Fluids Part V Mathematical Methods The papers are written in a tutorial style intended for non specialist researchers and students where the authors communicate their own experiences in tackling a problem that is currently of interest in the scientific community The goal was to produce a book which highlights the importance of applied mathematics and which can be used for educational purposes such as material for a course or a seminar To ensure the scientific quality of the contributions each paper was carefully viewed by two international experts Special thanks go to all authors and referees without whom making this book would not have been possible

Numerical Modelling of Hydrodynamics for Water Resources Pilar Garcia

Navarro,Enrique Playan,2007-09-17 The presentations collected in this volume have a problem oriented perspective and focus on canal and river flow riparian areas and aquifers Numerical Modelling of Hydrodynamics for Water Resources is highly relevant to those working in hydrology civil engineering and environmental and agricultural sectors

Advances in Spatio-Temporal Analysis Xinming Tang,Yaolin Liu,Jixian Zhang,Wolfgang Kainz,2007-08-23

Developments in Geographic Information Technology have raised the expectations of users A static map is no longer enough there is now demand for a

dynamic representation Time is of great importance when operating on real world geographical phenomena especially when these are dynamic Researchers in the field of Temporal Geographical Information Systems TGIS have been developing methods of incorporating time into geographical information systems Spatio temporal analysis embodies spatial modelling spatio temporal modelling and spatial reasoning and data mining Advances in Spatio Temporal Analysis contributes to the field of spatio temporal analysis presenting innovative ideas and examples that reflect current progress and achievements

Computational Methods in Multiphase Flow V Andrea Alberto Mammoli, C. A. Brebbia, 2009 Together with turbulence multiphase flow remains one of the most challenging areas of computational mechanics and experimental methods and numerous problems remain unsolved to date Multiphase flows are found in all areas of technology at all length scales and flow regimes The fluids involved can be compressible or incompressible linear or nonlinear Because of the complexity of the problems it is often essential to utilize advanced computational and experimental methods to solve the complex equations that describe them Challenges in these simulations include modelling and tracking interfaces dealing with multiple length scales modelling nonlinear fluids treating drop breakup and coalescence characterizing phase structures and many others Experimental techniques although expensive and difficult to perform are essential to validate models This book contains papers presented at the Fifth International Conference on Computational Methods in Multiphase Flow which are grouped into the following topics Multiphase Flow Simulation Interaction of Gas Liquids and Solids Turbulent Flow Environmental Multiphase Flow Bubble and Drop Dynamics Flow in Porous Media Heat Transfer Image Processing Interfacial Behaviour

Numerical Simulation of Waves and Fronts in Inhomogeneous Solids Arkadi Berezovski, J ri Engelbrecht, G rard A. Maugin, 2008 This book shows the advanced methods of numerical simulation of waves and fronts propagation in inhomogeneous solids and introduces related important ideas associated with the application of numerical methods for these problems Great care has been taken throughout the book to seek a balance between the thermomechanical analysis and numerical techniques It is suitable for advanced undergraduate and graduate courses in continuum mechanics and engineering Necessary prerequisites for this text are basic continuum mechanics and thermodynamics Some elementary knowledge of numerical methods for partial differential equations is also preferable *Computational Hydraulics* Ioana Popescu, 2014-08-14 Computational Hydraulics introduces the concept of modeling and the contribution of numerical methods and numerical analysis to modeling It provides a concise and comprehensive description of the basic hydraulic principles and the problems addressed by these principles in the aquatic environment Flow equations numerical and analytical solutions are included The necessary steps for building and applying numerical methods in hydraulics comprise the core of the book and this is followed by a report of different example applications of computational hydraulics river training effects on flood propagation water quality modelling of lakes and coastal applications The theory and exercises included in the book promote learning of concepts within academic environments Sample codes are made available online for purchasers

of the book Computational Hydraulics is intended for under graduate and graduate students researchers members of governmental and non governmental agencies and professionals involved in management of the water related problems
Author Ioana Popescu Hydroinformatics group UNESCO IHE Institute for Water Education Delft The Netherlands

Encyclopedia of Hydrological Sciences M. G. Anderson, 2005 Written and edited by leading worldwide authorities in the field and comprising nearly 200 substantial articles the Encyclopedia provides detailed informed coverage of the subject

Hydraulic Modelling: An Introduction Pavel Novak, Vincent Guinot, Alan Jeffrey, Dominic E. Reeve, 2018-10-24
Modelling forms a vital part of all engineering design yet many hydraulic engineers are not fully aware of the assumptions they make These assumptions can have important consequences when choosing the best model to inform design decisions Considering the advantages and limitations of both physical and mathematical methods this book will help you identify the most appropriate form of analysis for the hydraulic engineering application in question All models require the knowledge of their background good data and careful interpretation and so this book also provides guidance on the range of accuracy to be expected of the model simulations and how they should be related to the prototype Applications to models include open channel systems closed conduit flows storm drainage systems estuaries coastal and nearshore structures hydraulic structures This an invaluable guide for students and professionals
Numerical Time-Dependent Partial Differential Equations for Scientists and Engineers Moysey Brio, Gary M. Webb, Aramais R. Zakharian, 2010-09-21 It is the first text that in addition to standard convergence theory treats other necessary ingredients for successful numerical simulations of physical systems encountered by every practitioner The book is aimed at users with interests ranging from application modeling to numerical analysis and scientific software development It is strongly influenced by the authors research in in space physics electrical and optical engineering applied mathematics numerical analysis and professional software development The material is based on a year long graduate course taught at the University of Arizona since 1989 The book covers the first two semesters of a three semester series The second semester is based on a semester long project while the third semester requirement consists of a particular methods course in specific disciplines like computational fluid dynamics finite element method in mechanical engineering computational physics biology chemistry photonics etc The first three chapters focus on basic properties of partial differential equations including analysis of the dispersion relation symmetries particular solutions and instabilities of the PDEs methods of discretization and convergence theory for initial value problems The goal is to progress from observations of simple numerical artifacts like diffusion damping dispersion and anisotropies to their analysis and management technique as it is not always possible to completely eliminate them In the second part of the book we cover topics for which there are only sporadic theoretical results while they are an integral part and often the most important part for successful numerical simulation We adopt a more heuristic and practical approach using numerical methods of investigation and validation The aim is teach students subtle key issues in order to separate physics from numerics The

following topics are addressed Implementation of transparent and absorbing boundary conditions Practical stability analysis in the presence of the boundaries and interfaces Treatment of problems with different temporal spatial scales either explicit or implicit preservation of symmetries and additional constraints physical regularization of singularities resolution enhancement using adaptive mesh refinement and moving meshes Self contained presentation of key issues in successful numerical simulation Accessible to scientists and engineers with diverse background Provides analysis of the dispersion relation symmetries particular solutions and instabilities of the partial differential equations *The British National Bibliography* Arthur James Wells,2003 **100 Volumes of 'Notes on Numerical Fluid Mechanics'** Ernst Heinrich Hirschel,Egon Krause,2009-05-19 In a book that will be required reading for engineers physicists and computer scientists the editors have collated a number of articles on fluid mechanics written by some of the world s leading researchers and practitioners in this important subject area Proceedings of the Institution of Civil Engineers ,2005

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