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| Nota di contenuto | Mathematical Models of Fluid Dynamics; Contents; Preface to the Second Edition; Preface to the First Edition; 1 Ideal Fluids; 1.1 Modeling by Euler's Equations; 1.2 Characteristics and Singularities; 1.3 Potential Flows and (Dynamic) Buoyancy; 1.4 Motionless Fluids and Sound Propagation; 2 Weak Solutions of Conservation Laws; 2.1 Generalization of What Will Be Called a Solution; 2.2 Traffic Flow Example with Loss of Uniqueness; 2.3 The Rankine-Hugoniot Condition; 3 Entropy Conditions; 3.1 Entropy in the Case of an Ideal Fluid; 3.2 Generalization of the Entropy Condition<br>3.3 Uniqueness of Entropy Solutions3.4 Kruzkov's Ansatz; 4 The Riemann Problem; 4.1 Numerical Importance of the Riemann Problem; 4.2 The Riemann Problem for Linear Systems; 4.3 The Aw-Rascle Traffic Flow Model; 5 Real Fluids; 5.1 The Navier-Stokes Equations Model; 5.2 Drag Force and the Hagen-Poiseuille Law; 5.3 Stokes Approximation and Artificial Time; 5.4 Foundations of the Boundary Layer Theory and Flow Separation; 5.5 Stability of Laminar Flows; 5.6 Heated Real Gas Flows; 5.7 Tunnel Fires; 6 Proving the Existence of Entropy Solutions by |

Discretization Procedures

6.1 Some Historical Remarks6.2 Reduction to Properties of Operator Sequences; 6.3 Convergence Theorems; 6.4 Example; 7 Types of Discretization Principles; 7.1 Some General Remarks; 7.2 Finite Difference Calculus; 7.3 The CFL Condition; 7.4 Lax-Richtmyer Theory; 7.5 The von Neumann Stability Criterion; 7.6 The Modified Equation; 7.7 Difference Schemes in Conservation Form; 7.8 The Finite Volume Method on Unstructured Grids; 7.9 Continuous Convergence of Relations; 8 A Closer Look at Discrete Models; 8.1 The Viscosity Form; 8.2 The Incremental Form; 8.3 Relations

8.4 Godunov Is Just Good Enough8.5 The Lax-Friedrichs Scheme; 8.6 A Glimpse of Gas Dynamics; 8.7 Elementary Waves; 8.8 The Complete Solution to the Riemann Problem; 8.9 The Godunov Scheme in Gas Dynamics; 9 Discrete Models on Curvilinear Grids; 9.1 Mappings; 9.2 Transformation Relations; 9.3 Metric Tensors; 9.4 Transforming Conservation Laws; 9.5 Good Practice; 9.6 Remarks Concerning Adaptation; 10 Finite Volume Models; 10.1 Difference Methods on Unstructured Grids; 10.2 Order of Accuracy and Basic Discretization; 10.3 Higher-Order Finite Volume Schemes; 10.4 Polynomial Recovery

10.5 Remarks Concerning Non-polynomial Recovery10.6 Remarks Concerning Grid Generation; Index; Suggested Reading

Sommario/riassunto

Without sacrificing scientific strictness, this introduction to the field guides readers through mathematical modeling, the theoretical treatment of the underlying physical laws and the construction and effective use of numerical procedures to describe the behavior of the dynamics of physical flow. The book is carefully divided into three main parts: - The design of mathematical models of physical fluid flow;- A theoretical treatment of the equations representing the model, as Navier-Stokes, Euler, and boundary layer equations, models of turbulence, in order to gain qualitative as