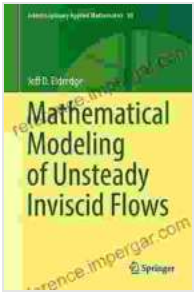
Mathematical Modeling of Unsteady Inviscid Flows: Interdisciplinary Applied Approaches

Unsteady inviscid flows are a common occurrence in many engineering and scientific applications. These flows are characterized by their high speeds and the absence of viscosity. The mathematical modeling of unsteady inviscid flows is a challenging task, but it is essential for understanding the behavior of these flows and for designing systems that interact with them.

This book provides a comprehensive to the mathematical modeling of unsteady inviscid flows. The book covers a wide range of topics, including the governing equations of inviscid flow, the method of characteristics, and the solution of unsteady inviscid flows using numerical methods. The book also includes a number of case studies that illustrate the application of unsteady inviscid flow modeling to a variety of real-world problems.



Mathematical Modeling of Unsteady Inviscid Flows (Interdisciplinary Applied Mathematics Book 50)

★★★★★ 5 out of 5

Governing Equations of Inviscid Flow

The governing equations of inviscid flow are the conservation of mass, momentum, and energy. These equations can be derived from the fundamental laws of physics and are valid for inviscid flows. The conservation of mass equation states that the mass of a fluid element remains constant as it moves. The conservation of momentum equation states that the momentum of a fluid element changes at a rate equal to the sum of the forces acting on the element. The conservation of energy equation states that the total energy of a fluid element remains constant as it moves.

Method of Characteristics

The method of characteristics is a powerful technique for solving unsteady inviscid flows. The method of characteristics is based on the fact that the governing equations of inviscid flow are hyperbolic. Hyperbolic equations have the property that they can be solved by constructing a set of characteristic lines. These characteristic lines are curves along which the governing equations can be reduced to a set of ordinary differential equations.

Numerical Methods

The method of characteristics can be used to solve unsteady inviscid flows in a variety of geometries. However, for complex geometries, it is often necessary to use numerical methods. Numerical methods are also used to solve unsteady inviscid flows in three dimensions.

There are a variety of numerical methods that can be used to solve unsteady inviscid flows. These methods include the finite difference

method, the finite element method, and the spectral method. The choice of numerical method depends on the specific problem being solved.

Case Studies

The book includes a number of case studies that illustrate the application of unsteady inviscid flow modeling to a variety of real-world problems. These case studies include:

* The design of a supersonic aircraft * The analysis of the flow around a wind turbine * The simulation of the flow in a combustion engine

These case studies demonstrate the power of unsteady inviscid flow modeling and its importance in a variety of engineering and scientific applications.

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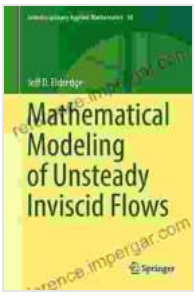
This book is an essential resource for engineers and scientists who work with unsteady inviscid flows. The book provides a solid foundation in the mathematical modeling of these flows and demonstrates how to apply this knowledge to solve real-world problems.



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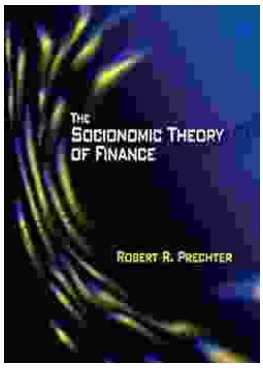

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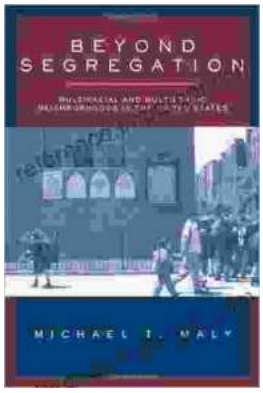

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