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Waves and Mean Flows On Three-dimensional Internal Wavepackets, Beams, and Mean Flows in a Stratified Fluid Waves and Mean Flows Estimates of Flow Duration, Mean Flow, and Peak-discharge Frequency Values for Kansas Stream Locations Wave Interactions and Fluid Flows Estimates of flow duration, mean flow, and peak-discharge frequency values for Kansas stream locations Statistical Theory and Modeling for Turbulent Flows Estimates of Flow Duration, Mean Flow, and Peak-discharge Frequency Values for Kansas Stream Locations An Introduction to Turbulent Flow Flow Visualization Compressibility, Turbulence and High Speed Flow Surface Water Year, Ireland, 1977 The Structure of Turbulent Shear Flow Lecture Notes on Mean Curvature Flow River Dynamics Internal Flow Analytical and Experimental Study of Mean Flow and Turbulence Characteristics Inside the Passages of an Axial Flow Inducer Viscous Fluid Flow Direct Measurement of the Mean Flow Velocity Vector Mean-flow Measurements of the Flow Field Diffusing Bend Developments in Non-Newtonian Flows, 1993

Free-Surface Flow Measurement of Mean-flow-velocity in Shear Flow Regularity Theory for Mean Curvature Flow Mean Flow Integral Model for Shoaling and Surf Zone Waves Traveltimes of Flood Waves on the New River Between Hinton and Hawks Nest, West Virginia Measurements of Mean Flow and Acoustic Power for a Subsonic Jet Impinging Normal to a Large Rigid Surface River Mechanics Free-Surface Flow: Lectures on Mean Curvature Flows Rotating Flow Lectures on Mean Curvature Flows Annual Cycle for Large-scale Transient Eddy and Mean Flow Interactions in the Northern Hemisphere Turbulent Flows Flow Control Engineering Experiment Station Circular On the Dynamics of Measure Flows and Multi-agent and Mean-field Financial Games Estimates of Streamflow Characteristics for Selected Small Streams, Baker River Basin, Washington Fluid Dynamics Mean-flow Scaling of Turbulent Pipe Flow

The long-time evolution and eventual dissipation mechanisms of internal waves in a stratified fluid are of fundamental geophysical importance. While much progress in recent years has been made on two-dimensional nonlinear internal wave evolution, the effects of three-dimensional variations are still poorly understood. In this thesis, we propose asymptotic models for the weakly nonlinear three-dimensional evolution of three types of internal wave disturbances: beam-like wavepackets, equally modulated wavepackets, and thin beams. Our models assess the combined effects of nonlinearity, three-dimensional modulations, viscosity, and background rotation to determine the roles that they play in wave evolution and instability. Our results indicate that internal waves with three-dimensional variations behave in very different ways than their two-dimensional counterparts. Most notably, in all three types of waves we consider, three-dimensional variations are necessary in triggering the nonlinear transfer of energy from waves to a large-scale time-mean flow via the action of Reynolds stresses. Furthermore, we show that two distinct mechanisms of mean flow generation exist, and each may result in wave breakdown. The first is an inviscid purely modulation-induced mean flow which can trigger the so-called modulational instability. The second is a combined viscosity and modulation-driven mean flow that establishes a resonant wave-mean flow interaction known as streaming. The relative importance of these two mean flow mechanisms and associated instabilities thus depends on the specific nature of the modulations and the importance of viscous dissipation. For instance, we show that beam-like waves, where modulations are weaker in the direction along constant phase lines, exhibit the coexistence of both types of mean flow. The robust nature of the induced mean flow indicates that three-dimensional variations may be of utmost importance in determining the fate of internal waves, both in the field and in the laboratory. "Mean curvature flow" is a term that is used to describe the evolution of a hypersurface whose normal velocity is given by the mean curvature. In the simplest case of a convex closed curve on the plane, the properties of the mean curvature flow are described by Gage-Hamilton's theorem. This theorem states that under the mean curvature flow, the curve collapses to a point, and if the flow is diluted so that the enclosed area equals \pi, the curve tends to the unit circle. In this book, the author gives a comprehensive account of fundamental results on singularities and the asymptotic behavior o.

Providing a comprehensive grounding in the subject of turbulence, Statistical Theory and Modeling for Turbulent Flows develops both the physical insight and the mathematical framework needed to understand turbulent flow. Its scope enables the reader to become a knowledgeable user of turbulence models; it develops analytical tools for developers of predictive tools. Thoroughly revised and updated, this second edition includes a new fourth section covering DNS (direct numerical simulation), LES (large eddy simulation), DES (detached eddy simulation) and numerical aspects of eddy resolving simulation. In addition to its role as a guide for students, Statistical Theory and Modeling for Turbulent Flows also is a valuable reference for practicing engineers and scientists in computational and experimental fluid dynamics, who would like to broaden their understanding of fundamental issues in turbulence and how they relate to turbulence model implementation. Provides an excellent foundation to the fundamental theoretical concepts in turbulence. Features new and heavily revised material, including an entire new section on eddy resolving simulation. Includes new material on modeling laminar to turbulent transition. Written for students and practitioners in aeronautical and mechanical engineering, applied mathematics and the physical sciences. Accompanied by a website housing solutions to the problems within the book. Develops a physical theory from the mass of experimental results, with revisions to reflect advances of recent years. Free-Surface Flow: Shallow-Water Dynamics presents a novel approach to this phenomenon. It bridges the gap between traditional books on open-channel flow and analytical fluid mechanics. Shallow-water theory is established by formal integration of the Navier-Stokes equations, and boundary resistance is developed by a rigorous construction of turbulent flow models for channel flow. In addition, the book presents a comprehensive description of shallow-water waves by mathematical analysis. These methods form the foundation for understanding flood routing, sudden water releases, dam and levee break, sluice gate dynamics and wave-current interaction. Bridges the gap between traditional books on open-channel flow and wave mechanics. Presents a comprehensive description of shallow-water waves by characteristic and bicharacteristic analysis. Presents techniques for wave control and active flood mitigation. A thorough treatment of the basics of flow control and flow control practices. ``Mean curvature flow'' is a term that is used to describe the evolution of a hypersurface whose normal velocity is given by the mean curvature. In the simplest case of a convex closed curve on the plane, the properties of the mean curvature flow are described by Gage-Hamilton's theorem. This theorem states that under the mean curvature flow, the curve collapses to a point, and if the flow is diluted so that the enclosed area equals π, the curve tends to the unit circle. In thisbook, the author gives a comprehensive account of fundamental results on singularities and the asymptotic behavior of mean curvature flows in higher dimensions. Among other topics, he considers in detail Huisken's theorem (a generalization of Gage-Hamilton's theorem to higher dimension), evolutionof non-convex curves and hypersurfaces, and the classification of singularities of the mean curvature flow. Because of the importance of the mean curvature flow and its numerous applications in differential geometry and partial differential equations, as well as in engineering, chemistry, and biology, this book can be useful to graduate students and researchers working in these areas. The book would also make a nice supplementary text for an advanced course in differential geometry.Prerequisites include basic differential geometry, partial differential equations, and related applications. Rotating flow is critically important across a wide range of scientific, engineering and product applications, providing design and modeling capability for diverse products such as jet engines, pumps and vacuum cleaners, as well as geophysical flows. Developed over the course of 20 years' research into rotating fluids and associated heat transfer at the University of Sussex Thermo-Fluid Mechanics Research Centre (TFMRC), Rotating Flow is an indispensable reference and resource for all those working within the gas turbine and rotating machinery industries. Traditional fluid and flow dynamics titles offer the essential background but generally include very sparse coverage of rotating flows—which is where this book comes in. Beginning with an accessible introduction to rotating flow, recognized expert Peter Childs takes you through fundamental equations, vorticity and vortices, rotating disc flow, flow around rotating cylinders and flow in rotating cavities, with an introduction to atmospheric and oceanic circulations included to help deepen understanding. Whilst competing resources are weighed down with complex mathematics, this book focuses on the essential equations and provides full workings to take readers step-by-step through the theory so they can concentrate on the practical applications. A detailed yet accessible introduction to rotating flows, illustrating the differences between flows where rotation is significant and highlighting the non-intuitive nature of rotating flow fields Written by world-leading authority on rotating flow, Peter Childs, making this a unique and authoritative work Covers the essential theory behind engineering applications such as rotating discs, cylinders, and cavities, with natural phenomena such as atmospheric and oceanic flows used to explain underlying principles Provides a rigorous, fully worked mathematical account of rotating flows whilst also including numerous practical examples in daily life to highlight the relevance and prevalence of different flow types Concise summaries of the results of important research and lists of references included to direct readers to significant further resources Most natural and industrial flows are turbulent. The atmosphere and oceans, automobile and aircraft engines, all provide examples of this ubiquitous phenomenon. In recent years, turbulence has become a very lively area of scientific research and application, attracting many newcomers who need a basic introduction to the subject. An Introduction to Turbulent Flow, first published in 2000, offers a solid grounding in the subject of turbulence, developing both physical insight and the mathematical framework needed to express the theory. It begins with a review of the physical nature of turbulence, statistical tools, and space and time scales of turbulence. Basic theory is presented next, illustrated by examples of simple turbulent flows and developed through classical models of jets, wakes, and boundary layers. A deeper understanding of turbulence dynamics is provided by spectral analysis and its applications. The final chapter introduces the numerical simulation of turbulent flows. This well-balanced text will interest graduate students in engineering, applied mathematics, and the physical sciences. This book is an introduction to the subject of mean curvature flow of hypersurfaces with special emphasis on the analysis of singularities. This flow occurs in the description of the evolution of numerous physical models where the energy is given by the area of the interfaces. These notes provide a detailed discussion of the classical parametric approach (mainly developed by R. Hamilton and G. Huisken). They are well suited for a course at PhD/PostDoc level and can be useful for any researcher interested in a solid introduction to the technical issues of the field. All the proofs are carefully written, often simplified, and contain several comments. Moreover, the author revisited and organized a large amount of material scattered around in literature in the last 25 years. Interactions between waves and mean flows play a crucial role in understanding the long-term aspects of atmospheric and oceanographic modelling. Indeed, our ability to predict climate change hinges on our ability to model waves accurately. This book gives a modern account of the nonlinear interactions between waves and mean flows such as shear flows and vortices. A detailed account of the theory of linear dispersive waves in moving media is followed by a thorough introduction to classical wave–mean interaction theory. The author then extends the scope of the classical theory and lifts its restriction to zonally symmetric mean flows. The book is a fundamental reference for graduate students and researchers in fluid mechanics, and can be used as a text for advanced courses; it will also be appreciated by geophysicists and physicists who need an introduction to this important area in fundamental fluid dynamics and atmosphere-ocean science. Compressibility, Turbulence and High Speed Flow introduces the reader to the field of compressible turbulence and compressible turbulent flows across a broad speed range, through a unique complimentary treatment of both the theoretical foundations and the measurement and analysis tools currently used. The book provides the reader with the necessary background and current trends in the theoretical and experimental aspects of compressible turbulent flows and compressible turbulence. Detailed derivations of the pertinent equations describing the motion of such turbulent flows is provided and an extensive discussion of the various approaches used in predicting both free shear and wall bounded flows is presented. Experimental measurement techniques common to the compressible flow regime are introduced with particular emphasis on the unique challenges presented by high speed flows. Both experimental and numerical simulation work is supplied throughout to provide the reader with an overall perspective of current trends. An introduction to current techniques in compressible turbulent flow analysis An approach that enables engineers to identify and solve complex compressible flow challenges Prediction methodologies, including the Reynolds-averaged Navier Stokes (RANS) method, scale filtered methods and direct numerical simulation (DNS) Current strategies focusing on compressible flow control This is a graduate text on turbulent flows, an important topic in fluid dynamics. It is up-to-date, comprehensive, designed for teaching, and is based on a course taught by the author at Cornell University for a number of years. The book consists of two parts followed by a number of appendices. Part I provides a general introduction to turbulent flows, how they behave, how they can be described quantitatively, and the fundamental physical processes involved. Part II is concerned with different approaches for modelling or simulating turbulent flows. The necessary mathematical techniques are presented in the appendices. This book is primarily intended as a graduate level text in turbulent flows for engineering students, but it may also be valuable to students in applied mathematics, physics, oceanography and atmospheric sciences, as well as researchers and practising engineers. This book describes the analysis and behaviour of internal flows encountered in propulsion systems, fluid machinery (compressors, turbines and pumps) and ducts (diffusers, nozzles and combustion chambers). The focus is on phenomena that are important in setting the performance of a broad range of fluid devices. The authors show that even for complex processes one can learn a great deal about the behaviour of such devices from a clear understanding and rigorous use of basic principles. Throughout the book they illustrate theoretical principles by reference to technological applications. The strong emphasis on fundamentals, however, means that the ideas presented can be applied beyond internal flow to other types of fluid motion. The book equips students and practising engineers with a range of new analytical tools. These tools offer enhanced interpretation and application of both experimental measurements and the computational procedures that characterize modern fluids engineering. Rivers are important agents of change that shape the Earth's surface and evolve through time in response to fluctuations in climate and other environmental conditions. They are fundamental in landscape development, and essential for water supply, irrigation, and transportation. This book provides a comprehensive overview of the geomorphological processes that shape rivers and that produce change in the form of rivers. It explores how the dynamics of rivers are being affected by anthropogenic change, including climate change, dam construction, and modification of rivers for flood control and land drainage. It discusses how concern about environmental degradation of rivers has led to the emergence of management strategies to restore and naturalize these systems, and how river management techniques work best when coordinated with the natural dynamics of rivers. This textbook provides an excellent resource for students, researchers, and professionals in fluvial geomorphology, hydrology, river science, and environmental policy. Many introductions to fluid dynamics offer an illustrative approach that demonstrates some aspects of fluid behavior, but often leave you without the tools necessary to confront new problems. For more than a decade, Fluid Dynamics: Theoretical and Computational Approaches has supplied these missing tools with a constructive approach that made the book a bestseller. Now in its third edition, it supplies even more computational skills in addition to a solid foundation in theory. After laying the groundwork in theoretical fluid dynamics, independent of any particular coordinate system in order to allow coordinate transformation of the equations, the author turns to the technique of writing Navier–Stokes and Euler's equations, flow of inviscid fluids, laminar viscous flow, and turbulent flow. He also includes requisite mathematics in several "Mathematical Expositions" at the end of the book and provides abundant end-of-chapter problems. What's New in the Third Edition? New section on free surface flow New section on instability of flows through Chaos and nonlinear dissipative systems New section on formulation of the large eddy simulation (LES) problem New example problems and exercises that reflect new and important topics of current interest By integrating a strong theoretical foundation with practical computational tools, Fluid Dynamics: Theoretical and Computational Approaches, Third Edition is an indispensable guide to the methods needed to solve new and unfamiliar problems in fluid dynamics. This up-to-date and comprehensive account of theory and experiment on wave-interaction phenomena covers fluids both at rest and in their shear flows. It includes, on the one hand, water waves, internal waves, and their evolution, interaction, and associated wave-driven means flow and, on the other hand, phenomena on nonlinear hydrodynamic stability, especially those leading to the onset of turbulence. This study provide a particularly valuable bridge between these two similar, yet different, classes of phenomena. It will be of value to oceanographers, meteorologists, and those working in fluid mechanics, atmospheric and planetary physics, plasma physics, aeronautics, and geophysical and astrophysical fluid dynamics. * Devoted to the motion of surfaces for which the normal velocity at every point is given by the mean curvature at that point; this geometric heat flow process is called mean curvature flow. * Mean curvature flow and related geometric evolution equations are important tools in mathematics and mathematical physics. "With the appearance and fast evolution of high performance materials, mechanical, chemical and process engineers cannot perform effectively without fluid processing knowledge. The purpose of this book is to explore the systematic application of basic engineering principles to fluid flows that may occur in fluid processing and related activities. In Viscous Fluid Flow, the authors develop and rationalize the mathematics behind the study of fluid mechanics and examine the flows of Newtonian fluids. Although the material deals with Newtonian fluids, the concepts can be easily generalized to non-Newtonian fluid mechanics. The book contains many examples. Each chapter is accompanied by problems where the chapter theory can be applied to produce characteristic results. Fluid mechanics is a fundamental and essential element of advanced research, even for those working in different areas, because the principles, the equations, the analytical, computational and experimental means, and the purpose are common. Completely updated and with three new chapters, this analysis of river dynamics is invaluable for advanced students, researchers and practitioners. A fundamental reference for graduate students and researchers in fluid mechanics. Now revised throughout, it also includes exercises. Free Surface Flow: Environmental Fluid Mechanics introduces a wide range of environmental fluid flows, such as water waves, land runoff, channel flow, and effluent discharge. The book provides systematic analysis tools and basic skills for study fluid mechanics in natural and constructed environmental flows. As the prediction of changes in free surfaces in rivers, lakes, estuaries and in the ocean directly affects the design of structures that control surface waters, and because planning for the allocation of fresh-water resources in a sustainable manner is an essential goal, this book provides the necessary background and research. Helps users determine the transfer of solute mass through the air-water interface Presents tactics on the impact of free shear flow in the environment and how to quantify mixing mechanisms in turbulent jets and wakes Gives users tactics to predict the fate and transport of contaminants in stratified lakes and estuaries Flow Visualization, Second Edition focuses on developments, applications, and results in the field of flow visualization. Organized into four chapters, this book begins with the principles of flow visualization and image processing. Subsequent chapters describe the methods of flow visualization, particularly the addition of foreign material to the flowing fluid that might be gaseous or liquid; certain optical methods that are sensitive to changes of the index of refraction; and flow field marking by heat and energy addition.

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