

Journal Of Environmental Fluid Dynamics

With major implications for applied physics, engineering, and the natural and social sciences, the rapidly growing area of environmental fluid dynamics focuses on the interactions of human activities, environment, and fluid motion. A landmark for the field, the two-volume Handbook of Environmental Fluid Dynamics presents the basic principles, fundamental flow processes, modeling techniques, and measurement methods used in the study of environmental motions. It also offers critical discussions of environmental sustainability related to engineering. The handbook features 81 chapters written by 135 renowned researchers from around the world. Covering environmental, policy, biological, and chemical aspects, it tackles important cross-disciplinary topics such as sustainability, ecology, pollution, micrometeorology, and limnology. Volume One: Overview and Fundamentals provides a comprehensive overview of the basic principles. It starts with general topics that emphasize the relevance of environmental fluid dynamics research in society, public policy, infrastructure, quality of life, security, and the law. It then discusses established and emerging focus areas. The volume also examines the sub-mesoscale flow processes and phenomena that form the building blocks of environmental motions, with emphasis on turbulent motions and their role in heat, momentum, and species transport. As communities face existential challenges posed by climate change, rapid urbanization, and scarcity of water and energy, the study of environmental fluid dynamics becomes increasingly relevant. This volume is a valuable resource for students, researchers, and policymakers working to better understand the fundamentals of environmental motions and how they affect and are influenced by anthropogenic activities. See also Handbook of Environmental Fluid Dynamics, Two-Volume Set and Volume Two: Systems, Pollution, Modeling, and Measurements.

Environmental Fluid Mechanics provides comprehensive coverage of a combination of basic fluid principles and their application in a number of different situations-exploring fluid motions on the earth's surface, underground, and in oceans-detailing the use of physical and numerical models and modern computational approaches for the analysis of environmental processes. Environmental Fluid Mechanics covers novel scaling methods for a variety of environmental issues; equations of motion for boundary layers; hydraulic characteristics of open channel flow; surface and internal wave theory; the advection diffusion equation; sediment and associated contaminant transport in lakes and streams; mixed layer modeling in lakes; remediation; transport processes at the air/water interface; and more.

This book introduces readers to the fundamentals of simulating and analyzing built and natural environments using the Computational Fluid Dynamics (CFD) method. CFD offers a powerful tool for dealing with various scientific and engineering problems and is widely used in diverse industries. This book focuses on the most important aspects of applying CFD to the study of urban, buildings, and indoor and outdoor environments. Following the logical procedure used to prepare a CFD simulation, the book covers e.g. the governing equations, boundary conditions, numerical methods, modeling of different fluid flows, and various turbulence models. Furthermore, it demonstrates how CFD can be applied to solve a range of engineering problems, providing detailed hands-on exercises on air and water flow, heat transfer, and pollution dispersion problems that typically arise in the study of buildings and environments. The book also includes practical guidance on analyzing and reporting CFD results, as well as writing CFD reports/papers.

This book gathers selected contributions presented at the Enzo Levi and XX Annual Meeting of the Fluid Dynamic Division of the Mexican Physical Society in 2014. The individual papers explore recent advances in experimental and theoretical fluid dynamics and are suitable for use in both teaching and research. The fluid dynamics applications covered include multiphase flows, convection, diffusion, heat transfer, rheology, granular materials, viscous flows, porous media flows, geophysics and astrophysics. The contributions, some of which are introductory and avoid the use of complicated mathematics, are suitable for fourth-year undergraduate and graduate students. Accordingly, the book is of immense benefit to these students, as well as to scientists in the fields of physics, chemistry and engineering with an interest in fluid dynamics from experimental and theoretical points of view. Paperback edition of text on fluid dynamics for graduate students and specialists alike.

Sponsored by the Fluids Committee of the Engineering Mechanics Division of ASCE. This report provides environmental engineers with a comprehensive survey of recent developments in the application of fluid mechanics theories to treat environmental problems. Chapters cover principles of fluid mechanics, as well as contemporary applications to environmental problems involving river, lake, coastal, and groundwater areas. Topics include: turbulent diffusion; mixing of a turbulent jet in crossflow -- the advected line puff; multi-phase plumes in uniform, stratified, and flowing environments; turbulent transport processes across natural streams; three-dimensional hydrodynamic and salinity transport modeling in estuaries; fluid flows and reactive chemical transport in variably saturated subsurface media; heat and mass transport in porous media; parameter identification of environmental systems; finite element analysis of stratified lake hydrodynamics; water quality modeling in reservoirs; and linear systems approach to river water quality analysis. In addition to providing valuable information to practitioners, this book also serves as a text for an advanced undergraduate or introductory graduate level course.

This book collects invited lectures and selected contributions presented at the Enzo Levi and XVIII Annual Meeting of the Fluid Dynamic Division of the Mexican Physical Society in 2012. It is intended for fourth-year undergraduate and graduate students, and for scientists in the fields of physics, engineering and chemistry with an interest in Fluid Dynamics from experimental, theoretical and computational points of view. The invited lectures are introductory in nature and avoid the use of complicated mathematics. The other selected contributions are also suitable for fourth-year undergraduate and graduate students. The Fluid Dynamics applications include oceanography, multiphase flows, convection, diffusion, heat transfer, rheology, granular materials, viscous flows, porous media flows and astrophysics. The material presented in the book includes recent advances in experimental and computational fluid dynamics and is well-suited to both teaching and research.

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particular emphasis on environmental pollution. The book covers the numerical methodologies that underpin research, predictive modeling, and cyber-infrastructure developments. It also addresses practical aspects of laboratory experiments and field observations that validate quantitative predictions and help identify new phenomena and processes. As communities face existential challenges posed by climate change, rapid urbanization, and scarcity of water and energy, the study of environmental fluid dynamics becomes increasingly relevant. This volume is a valuable resource for students, researchers, and policymakers working to better understand environmental motions and how they affect and are influenced by anthropogenic activities. See also Handbook of Environmental Fluid Dynamics, Two-Volume Set and Volume One: Overview and Fundamentals.

A comprehensive guide for both fundamentals and real-world applications of environmental engineering Written by noted experts, Handbook of Environmental Engineering offers a comprehensive guide to environmental engineers who desire to contribute to mitigating problems, such as flooding, caused by extreme weather events, protecting populations in coastal areas threatened by rising sea levels, reducing illnesses caused by polluted air, soil, and water from improperly regulated industrial and transportation activities, promoting the safety of the food supply. Contributors not only cover such timely environmental topics related to soils, water, and air, minimizing pollution created by industrial plants and processes, and managing wastewater, hazardous, solid, and other industrial wastes, but also treat such vital topics as porous pavement design, aerosol measurements, noise pollution control, and industrial waste auditing. This important handbook: Enables environmental engineers to treat problems in systematic ways Discusses climate issues in ways useful for environmental engineers Covers up-to-date measurement techniques important in environmental engineering Reviews current developments in environmental law for environmental engineers Includes information on water quality and wastewater engineering Informs environmental engineers about methods of dealing with industrial and municipal waste, including hazardous waste Designed for use by practitioners, students, and researchers, Handbook of Environmental Engineering contains the most recent information to enable a clear understanding of major environmental issues.

Uniquely outlines CFD theory in a manner relevant to environmental applications. This book addresses the basic topics in CFD modelling in a thematic manner to provided the necessary theoretical background, as well as providing global cases studies showing how CFD models can be used in practice demonstrating how good practice can be achieved , with reference to both established and new applications. First book to apply CFD to the environmental sciences Written at a level suitable for non-mathematicians

Environmental Fluid Mechanics (EFM) studies the motion of air and water at several different scales, the fate and transport of species carried along by these fluids, and the interactions among those flows and geological, biological, and engineered systems. EFM emerged some decades ago as a response to the need for tools to study problems of flow and transport in rivers, estuaries, lakes, groundwater and the atmosphere; it is a topic of increasing importance for decision makers, engineers, and researchers alike. The second edition of the successful textbook "Fluid Mechanics of Environmental Interfaces" is still aimed at providing a comprehensive overview of fluid mechanical processes occurring at the different interfaces existing in the realm of EFM, such as the air-water interface, the air-land interface, the water-sediment interface, the surface water-groundwater interface, the water-vegetation interface, and the water-biological systems interface. Across any of these interfaces mass, momentum, and heat are exchanged through different fluid mechanical processes over various spatial and temporal scales. In this second edition, the unique feature of this book, considering all the topics from the point of view of the concept of environmental interface, was maintained while the chapters were updated and five new chapters have been added to significantly enlarge the coverage of the subject area. The book starts with a chapter introducing the concept of EFM and its scope, scales, processes and systems. Then, the book is structured in three parts with fifteen chapters. Part one, which is composed of four chapters, covers the processes occurring at the interfaces between the atmosphere and the surface of the land and the seas, including the transport of dust and the dispersion of passive substances within the atmosphere. Part two deals in five chapters with the fluid mechanics at the air-water interface at small scales and sediment-water interface, including the advective diffusion of air bubbles, the hyporheic exchange and the tidal bores. Finally, part three discusses in six chapters the processes at the interfaces between fluids and biotic systems, such as transport processes in the soil-vegetation-lower atmosphere system, turbulence and wind above and within the forest canopy, flow and mass transport in vegetated open channels, transport processes to and from benthic plants and animals and coupling between interacting environmental interfaces. Each chapter has an educational part, which is structured in four sections: a synopsis of the chapter, a list of keywords that the reader should have encountered in the chapter, a list of questions and a list of unsolved problems related to the topics covered by the chapter. The book will be of interest to graduate students and researchers in environmental sciences, civil engineering and environmental engineering, (geo)physics, atmospheric science, meteorology, limnology, oceanography, and applied mathematics.

A broad cross-section of scientists working in aquatic environments will enjoy this treatment of environmental fluid dynamics, a foundation for elucidating the importance of hydrodynamics and hydrology in the regulation of energy. The primary reference for the modeling of hydrodynamics and water quality in rivers, lake, estuaries, coastal waters, and wetlands This comprehensive text perfectly illustrates the principles, basic processes, mathematical descriptions, case studies, and practical applications associated with surface waters. It focuses on solving practical problems in rivers, lakes, estuaries, coastal waters, and wetlands. Most of the theories and technical approaches presented within have been implemented in mathematical models and applied to solve practical problems. Throughout the book, case studies are presented to demonstrate how the basic theories and technical approaches are implemented into models, and how these models are applied to solve practical environmental/water resources problems. This new edition of Hydrodynamics and Water Quality: Modeling Rivers, Lakes, and Estuaries has been updated with more than 40% new information. It

features several new chapters, including one devoted to shallow water processes in wetlands as well as another focused on extreme value theory and environmental risk analysis. It is also supplemented with a new website that provides files needed for sample applications, such as source codes, executable codes, input files, output files, model manuals, reports, technical notes, and utility programs. This new edition of the book: Includes more than 120 new/updated figures and 450 references Covers state-of-the-art hydrodynamics, sediment transport, toxics fate and transport, and water quality in surface waters Provides essential and updated information on mathematical models Focuses on how to solve practical problems in surface waters—presenting basic theories and technical approaches so that mathematical models can be understood and applied to simulate processes in surface waters Hailed as “a great addition to any university library” by the Journal of the American Water Resources Association (July 2009), *Hydrodynamics and Water Quality, Second Edition* is an essential reference for practicing engineers, scientists, and water resource managers worldwide. For some time there has existed an extensive theoretical literature relating to tides on continental shelves and also to the behavior of estuaries. Much less attention was traditionally paid to the dynamics of longer term, larger scale motions (those which are usually described as 'circulation') over continental shelves or in enclosed shallow seas such as the North American Great Lakes. This is no longer the case: spurred on by other disciplines, notably biological oceanography, and by public concern with the environment, the physical science of the coastal ocean has made giant strides during the last two decades or so. Today, it is probably fair to say that coastal ocean physics has come of age as a deductive quantitative science. A well developed body of theoretical models exist, based on the equations of fluid motion, which have been related to observed currents, sea level variations, water properties, etc. Quantitative parameters required in using the models to predict e.g. the effects of wind or of freshwater influx on coastal currents can be estimated within reasonable bounds of error. While much remains to be learned, and many exciting discoveries presumably await us in the future, the time seems appropriate to summarize those aspects of coastal ocean dynamics relevant to 'circulation' or long term motion.

This book introduces the basic concepts of environmental fluid dynamics. It is intended for use by students, researchers, engineers, and specialists working not only in general fluid research but also in the atmospheric and oceanic research fields. The Earth is covered by atmosphere and oceans and is exposed to solar wind. Therefore, the knowledge of fluid dynamics is essential for tackling its environmental issues. Although many textbooks have treated fluid dynamics, practically no book has been published that clearly describes all essential ideas, from the fundamentals of fluid dynamics to advanced environmental sciences, with careful sequential explanations of the governing mathematics. This book has been developed to solve these educational problems and has actually been in use in lectures in the graduate school of Kyushu University for more than 15 years.

This book discusses the basic formulations of fluid mechanics and their computer modelling, as well as the relationship between experimental and analytical results. Containing papers from the Ninth International Conference on Advances in Fluid Mechanics, this book discusses the basic formulations of fluid mechanics and their computer modelling, as well as the relationship between experimental and analytical results. Scientists, engineers, and other professionals interested in the latest developments in theoretical and computational fluid mechanics will find the book a useful addition to the literature. The book covers a wide range of topics, with emphasis on new applications and research currently in progress, including: Computational Methods in Fluid Mechanics, Environmental Fluid Mechanics; Experimental Versus Simulation Methods; Multiphase Flow; Hydraulics and Hydrodynamics; Heat and Mass Transfer; Industrial Applications; Wave Studies; Biofluids; Fluid Structure Interaction.

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Seabed fluid flow involves the flow of gases and liquids through the seabed. Such fluids have been found to leak through the seabed into the marine environment in seas and oceans around the world - from the coasts to deep ocean trenches. This geological phenomenon has widespread implications for the sub-seabed, seabed, and marine environments. Seabed fluid flow affects seabed morphology, mineralization, and benthic ecology. Natural fluid emissions also have a significant impact on the composition of the oceans and atmosphere; and gas hydrates and hydrothermal minerals are potential future resources. This book describes seabed fluid flow features and processes, and demonstrates their importance to human activities and natural environments. It is targeted at research scientists and professionals with interests in the marine environment. Colour versions of many of the illustrations, and additional material - most notably feature location maps - can be found at www.cambridge.org/9780521819503.

The cooperation between plankton biologists and fluid dynamists has enhanced our knowledge of life within the plankton communities in ponds, lakes, and seas. This book assembled contributions on plankton–flow interactions, with an emphasis on syntheses and/or predictions. However, a wide range of novel insights, reasonable scenarios, and founded critiques are also considered in this book.

Applications of the science of fluid mechanics to the new and expanding fields of industrial safety and environmental protection are discussed in this volume. The material is organized in accordance with the chain-of-events in real accidents, starting with the loss of containment of hazardous fluids, going on to the spreading and mixing processes in water or air, and ending with the damage loads caused by explosions, fires or toxic content. To develop solutions relevant to the wide range of problems considered, it is necessary to draw on material from various branches of fluid mechanics, i.e. from the engineering fields (aero- and gas- and hydrodynamics, hydraulics, heat transfer and two-phase flows) as well as from geophysics (environmental flows, boundary-layer meteorology). The relevant solutions are developed from the fundamental equations, but are kept simple for transparency and understanding. To achieve this, the simplifications offered by scaling, similarity and entrainment concepts are used extensively. Many of the solutions are novel but have been confirmed by laboratory experiments. The material in the book has been used as a teaching text on Master's level, but the content will be useful also for practising engineers and scientists engaged in safety and environmental impact. The problems considered have been encountered in consultancy work for industry and government agencies. The coherent presentation and the fundamental basis for analytical developments, makes the material accessible also to readers not acquainted with the field.

This book provides an introduction, overview, and specific examples of computational fluid dynamics and their applications in the water, wastewater, and stormwater industry.

An introduction to CFD fundamentals and using commercial CFD software to solve engineering problems, designed for the wide variety of engineering students new to CFD, and for practicing engineers learning CFD for the first time. Combining an appropriate level of mathematical background, worked examples, computer screen shots, and step by step processes, this book walks the reader through modeling and computing, as well as interpreting CFD results. The first book in the field aimed at CFD users rather than developers. New to this edition: A more comprehensive coverage of CFD techniques including discretisation via finite element and spectral element as well as finite difference and finite volume methods and multigrid method. Coverage of different approaches to CFD grid generation in order to closely match how CFD meshing is being used in industry. Additional coverage of high-pressure fluid dynamics and meshless approach to provide a broader overview of the application areas where CFD can be used. 20% new content

Describes fluid flow, transport and contamination in rocks and sediments, for graduate students and professionals in hydrology, water resources, geochemistry.

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Non-Newtonian (non-linear) fluids are common in nature, for example, in mud and honey, but also in many chemical, biological, food, pharmaceutical, and personal care processing industries. This Special Issue of Fluids is dedicated to the recent advances in the mathematical and physical modeling of non-linear fluids with industrial applications, especially those concerned with CFD studies. These fluids include traditional non-Newtonian fluid models, electro- or magneto-rheological fluids, granular materials, slurries, drilling fluids, polymers, blood and other biofluids, mixtures of fluids and particles, etc.

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The field of fluid mechanics is vast and has numerous and diverse applications. As such, it covers a wide range of topics including basic formulations and their computer modelling as well as the relationship between experimental and analytical results. The 13th International Conference on Advances in Fluid Mechanics, from which this volume originates, had an emphasis on new applications and research currently in progress. The papers included cover such topics as Boundary elements and other mesh reduction methods; Fluid structure interaction; Multiphase heat transfer; Environmental fluid dynamics; Energy harvesting; Nano and micro fluids; Complex flows; Jets; Droplet and spray dynamics; Bubble dynamics; Multiphase fluid flow; Pumping and fluid transportation; Complex and non-Newtonian fluids; Chemical reaction flow; Hydroelectromagnetic flow; hypersonic flows; Wave theory; Acoustics of noise propagation; Nanotechnology applications in fluids and heat transfer; Bluff body aerodynamics; Aerodynamic shape optimization.

This book grew out of lectures on geophysical fluid dynamics delivered over many years at the Moscow Institute of Physics and Technology by the author (and, with regard to some parts of the book, by his colleagues). During these lectures the students were advised to read many books, and sometimes individual articles, in order to acquaint themselves with the necessary material, since there was no single book available which provided a sufficiently complete and systematic account (except, perhaps, the volumes on Hydrophysics of the Ocean, Hydrodynamics of the Ocean, and Geodynamics in the ten-volume Oceanology series published by Nauka Press in 1978-1979; these refer, however, specifically to the ocean, and anyway they are much too massive to be convenient for study by students). As far as we know, no text corresponding to our understanding of geophysical fluid dynamics has as yet been published outside the Soviet Union. The present book is designed to fill this gap. Since it is customary to write the preface after the entire book has been completed, the author has an opportunity there to raise some points of possible criticism by the reviewers and readers. First of all, note that this work presents the theoretical fundamentals of geophysical fluid dynamics, and that observational and experimental data (which in the natural sciences are always very copious) are referred to only rarely and briefly.

Environmental fluid mechanics (EFM) is the scientific study of transport, dispersion and transformation processes in natural fluid flows on our planet Earth, from the microscale to the planetary scale. This book brings together scientists and engineers working in research institutions, universities and academia, who engage in the study of theoretical, modeling, measuring and software aspects in environmental fluid mechanics. It provides a forum for the participants, and exchanges new ideas and expertise through the presentations of up-to-date and recent overall achievements in this field.

This book contains twelve chapters detailing significant advances and applications in fluid dynamics modeling with focus on biomedical, bioengineering, chemical, civil and environmental engineering, aeronautics, astronautics, and automotive. We hope this book can be a useful resource to scientists and engineers who are interested in fundamentals and applications of fluid dynamics.

Environmental Fluid Dynamics Flow Processes, Scaling, Equations of Motion, and Solutions to Environmental Flows Academic Press

Environmental Hydrology presents a unified approach to the role of hydrology in environmental planning and management, emphasizing the consideration of the hydrological continuum in determining the fate and migration of chemicals as well as micro-organisms in the environment, both below the ground as well as on it. The eco-hydrological consequences of environmental

