Books Environmental Fluid Mechanics And Thermodynamics

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.

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.

Environmental Fluid MechanicsTheories and ApplicationsASCE Publications

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.

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, funda

Modelling Fluid Flow presents invited lectures, workshop summaries and a selection of papers from a recent international conference CMFF '03 on fluid technology. The lectures follow the current evolution and the newest challenges of the computational methods and measuring techniques related to fluid flow. The workshop summaries reflect the recent trends, open questions and unsolved problems in the mutually inspiring fields of experimental and computational fluid mechanics. The papers cover a wide range of fluids engineering, including reactive flow, chemical and process engineering, environmental fluid dynamics, turbulence modelling, numerical methods, and fluid machinery.

This book systematically introduces engineering fluid mechanics in a simple and understandable way, focusing on the basic concepts, principles and methods. Engineering fluid mechanics is necessary for professionals and students in fields such as civil, environmental, mechanical, and petroleum engineering. Unlike most of the current textbooks and monographs, which are too complicated and include huge numbers of math formulas and equations, this book introduces essential concepts and flow rules in a clear and elementary way that can be used in further research. In addition, it provides numerous useful tables and diagrams that can be quickly and directly checked for industry applications. Furthermore, it highlights the connection between free flow and porous flow, which can aid advanced interdisciplinary research such as nanotech and environmental science. Last but not least, each chapter presents a variety of problems to offer readers a better understanding about the principles and applications of fluid mechanics.

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.

This book contains the written versions of invited lectures presented at the Gerhard H. Jirka Memorial Colloquium on Environmental Fluid Mechanics, held June 3-4, 2011, in Karlsruhe, Germany. Professor Jirka was widely known for his outstanding work in Environmental Fluid Mechanics, and 23 eminent world-leading experts in this field contributed to

The papers in this volume were written by his students and colleagues to honor Sidney Leibovich, Samuel B. Eckert Professor in the Sibley School of Mechanical and Aerospace Engineering at Cornell University, in commemoration of his 60th birthday, 2 April 1999. They were presented at a symposium held at Cornell, 23 and 24 August 1999. Sid obtained his Bachelor of Science degree with honors from The California Institute of Technology in 1961, graduating first in his class. He came to Cornell to work with Geoffrey Ludford on Magnetohydrodynamics, and obtained his Ph.D. in 1965 in the Department of Theoretical and Applied Mechanics. He spent a year at University College, London as a NATO Postdoctoral Fellow, and returned to Cornell as an Assistant Professor. He has been here ever since, and is currently Director of the Sibley School. Since returning to Cornell, Sid has concentrated on rotating fluids and n- linear waves, in various combinations and applications, producing some 3.2 - pers a year with an applied-mathematical bent. In particular this interest led to both Langmuir circulation and vortex breakdown, two areas in which Sid has had enormous influence, and both, of course, examples of rotating fluids interacting with waves. It was impossible to work in this area without being distracted by the study of the nonlinear dispersive and dissipative waves themselves,

and Sid has made substantial contributions in this area.
Data, Statistics, and Useful Numbers for Environmental Sustainability: Bringing the Numbers to Life is an accessible reference for researchers working in environmental and sustainability fields who need to communicate the latest data and statistics to reinforce their own research or message. The book compiles the most-needed numbers into one resource and covers a variety of relevant topics, including materials, energy, environment, city planning, electronics, and waste. This handbook is clearly indexed and full of comprehensive tables, making it easy to find answers. Researchers in environmental and sustainability-related fields will find it an invaluable resource. Collects and presents important environmental data in one accessible resource Provides key information needed for effectively communicating environmental and sustainability issues Offers a clear index Includes detailed tables throughout for ease of access
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
Fluids play an important role in environmental systems appearing as surface water in rivers, lakes, and coastal regions or in the subsurface as well as in the atmosphere. Mechanics of environmental fluids is concerned with fluid motion, associated mass and heat transport as well as deformation processes in subsurface systems. In this reference work the fundamental modelling approaches based on continuum mechanics for fluids in the environment are described, including porous media and turbulence. Numerical methods for solving the process governing equations as well as its object-oriented computer implementation are discussed and illustrated with examples. Finally, the application of computer models in civil and environmental engineering is demonstrated.
Inhaltsverzeichnis: I Fundamentals - 1: Introduction - 2: The Coriolis Force - 3: Equations of Fluid Motion - 4: Equations Governing Geophysical Flows - 5: Diffusive Processes - 6: Transport and FateII Rotation Effects - 7: Geostrophic Flows and Vorticity Dynamics - 8: Ekman layer - 9: Barotropic Waves - 10: Barotropic Instability - III Stratification Effects - 11: Stratification - 12: Layered Models - 13: Internal Waves - 14: Turbulence in Stratified Fluids - IV Combined Rotation and Stratification Effects - 15: Dynamics of Stratified Rotating Flows - 16: Quasi-Geostrophic Dynamics - 17: Instabilities of Rotating Stratified Flows - 18: Fronts, Jets and VorticesV Special Topics - 19: Atmospheric General Circulation - 20: Oceanic General Circulation - 21: Equatorial Dynamics - 22: Data Assimilation - VI Web-site information Appendix A: Elements of Fluid Mechanics - Appendix B: Wave KinematicsAppendix C: Recapitulation of Numerical SchemesReferencesCD-ROM
The book presents a collection of selected papers from the I Workshop of the Venezuelan Society of Fluid Mechanics held on Margarita Island, Venezuela from November 4 to 9, 2012. Written by experts in their respective fields, the contributions are organized into five parts: - Part I Invited Lectures, consisting of full-length technical papers on both computational and experimental fluid mechanics covering a wide range of topics from drops to multiphase and granular flows to astrophysical flows, - Part II Drops, Particles and Waves - Part III Multiphase and Multicomponent Flows - Part IV Atmospheric and Granular Flows - and Part V Turbulent and Astrophysical Flows. The book is intended for upper-level undergraduate and graduate students as well as for physicists, chemists and engineers teaching and working in the field of fluid mechanics and its applications. The contributions are the result of recent advances in theoretical and experimental research in fluid mechanics, encompassing both fundamentals as well as applications to fluid engineering design, including pipelines, turbines, flow separators, hydraulic systems and biological fluid elements, and to granular, environmental and astrophysical flows.
Fluid Mechanics and Thermodynamics of Our Environment ...
This book comprises select proceedings of the 63rd Congress of the Indian Society of Theoretical and Applied Mechanics (ISTAM) held in Bangalore, in December 2018. Latest research in computational, experimental, and applied mechanics is presented in the book. The chapters are broadly classified into two sections - (i) fluid mechanics and (ii) solid mechanics. Each section covers computational and experimental studies on various contemporary topics such as aerospace dynamics and propulsion, atmospheric sciences, boundary layers, compressible flow, environmental fluid dynamics, control structures, fracture and crack, viscoelasticity, and mechanics of composites. The contents of this book will serve as a useful reference to students, researchers, and practitioners interested in the broad field of mechanics.
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.

This volume is the proceedings of the Fifth International Conference on Fluid Mechanics (ICFM-V), the primary forum for the presentation of technological advances and research results in the fields of theoretical, experimental, and computational Fluid Mechanics. Topics include: flow instability and turbulence, aerodynamics and gas dynamics, industrial and environmental fluid mechanics, biofluid mechanics, geophysical fluid mechanics, plasma and magneto-hydrodynamics, and others.

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.

An environmental interface is defined as a surface between two abiotic or biotic systems, in relative motion and exchanging mass, heat and momentum through biophysical and/or chemical processes. These processes fluctuate temporally and spatially. The book first treats exchange processes occurring at the interfaces between atmosphere and the surface of the sea, and atmosphere and land surface. These exchanges include the effect of vegetation, transport of dust and dispersion of passive substances within the atmosphere. Processes at the environmental interfaces of freshwater, such as gas-transfer at free-surfaces of rivers, advective diffusion of air bubbles in turbulent water flows and boundary-layers phenomena in vegetated open channels are also described. Finally, the book deals with the phenomena that affect transport of material to and from the surface of an organism, including molecular and turbulent diffusion. The relevant issues related to mass transfer to and from benthic plants and animals are further considered in detail. The book will be of interest to graduate students and researchers in environmental sciences, civil engineering and environmental engineering, (geo)physics and applied mathematics.

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.

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.

Randomness is ubiquitous in nature. Random drivers are generally considered a source of disorder in environmental systems. However, the interaction between noise and nonlinear dynamics may lead to the emergence of a number of ordered behaviors (in time and space) that would not exist in the absence of noise. This counterintuitive effect of randomness may play a crucial role in environmental processes. For example, seemingly 'random' background events in the atmosphere can grow into larger instabilities that have great effects on weather patterns. This book presents the basics of the theory of stochastic calculus and its application to the study of noise-induced phenomena in environmental systems. It will be an invaluable reference text for ecologists, geoscientists and environmental engineers interested in the study of stochastic environmental dynamics.

This collection of over 200 detailed worked exercises adds to and complements the textbook "Fluid Mechanics" by the same author, and, at the same time, illustrates the teaching material via examples. The exercises revolve around applying the fundamental concepts of "Fluid Mechanics" to obtain solutions to diverse concrete problems, and, in so doing, the students' skill in the mathematical modelling of practical problems is developed. In addition, 30 challenging questions WITHOUT detailed solutions have been included. While lecturers will find these questions suitable for examinations and tests, students themselves can use them to check their understanding of the subject.

This volume provides an overview of the fluid aspects of the climate system, focusing on basic aspects as well as recent research developments. It will bring together contributions from diverse fields of the physical, mathematical and engineering sciences. The volume will be useful to doctorate students, postdocs and researchers working on different aspects of atmospheric, oceanic and environmental fluid dynamics. It will also be of interest to researchers interested in quantitatively understanding how fluid dynamics can be applied to the climate system, and to climate scientists willing to gain a deeper insight into the fluid mechanics underlying climate processes.

The phenomenon of evaporation in the natural environment is of interest in various diverse disciplines. This book is an attempt to present a coherent and organized introduction to theoretical concepts and relationships useful in analyzing this phe nomenon, and to give an outline of their history and their application. The main objective is to provide a better understanding of evaporation, and to connect some of the approaches and paradigms, that have been developed in different disciplines concerned with this phenomenon. The book is intended for professional scientists and engineers, who are active in hydrology, meteorology, agronomy, oceanography, climatology and related environ mental fields, and who wish to study prevailing concepts on evaporation. At the same time, I hope that the book will be useful to workers in fluid dynamics, who want to become acquainted with applications to an important and interesting natural phenomenon. As suggested in its subtitle, the book consists of three major parts. The first, consisting of Chapters I and 2, gives a general ouline of the problem and a history of the theories of evaporation from ancient times through the end of the nineteenth century. This history is far from exhaustive, but it sket~hes the background and the ideas that led directly to the scientific revolution in Europe and, ultimately, to our present-day knowledge.

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.