Buoyancy Effects In Fluids

Supercritical fluids have been utilized for numerous scientific advancements and industrial innovations. As the concern for environmental sustainability grows, these fluids have been increasingly used for energy efficiency purposes. Advanced Applications of Supercritical Fluids in Energy Systems is a pivotal reference source for the latest academic material on the integration of supercritical fluids into contemporary energy-related applications. Highlighting innovative discussions on topics such as renewable energy, fluid dynamics, and heat and mass transfer, this book is ideally designed for researchers, academics, professionals, graduate students, and practitioners interested in the latest trends in energy conversion.

This book highlights some recent advances in interfacial research in the fields of fluid mechanics and materials science at the beginning of the twenty-first century. It is an extension of the presentations made during the conference “Interfaces for the 21st Century,” held on August 16-18, 1999, in Monterey, California. It includes papers by sixteen renowned experts in the field of interfacial mechanics, abstracts contributed by research scientists, and a summary of a panel discussion on future research directions. The book covers experimental and theoretical approaches, with the unifying philosophy being the investigation of new techniques for modeling the dynamics of interfaces. A number of new and exciting solution methods and experimental studies, as well as the physical problems that initiated them, are presented.

This book has been written with the idea of providing the fundamentals for those who are interested in the field of heat transfer to non-Newtonian fluids. It is well recognized that non-

Newtonian fluids are encountered in a number of transport processes and estimation of the heat transfer characteristics in the presence of these fluids requires analysis of equations that are far more complex than those encountered for Newtonian fluids. A deliberate effort has been made to demonstrate the methods of simplification of the complex equations and to put forth analytical expressions for the various heat transfer situations in as vivid a manner as possible. The book covers a broad range of topics from forced, natural and mixed convection without and with porous media. Laminar as well as turbulent flow heat transfer to non-Newtonian fluids have been treated and the criterion for transition from laminar to turbulent flow for natural convection has been established. The heat transfer characteristics of non-Newtonian fluids from inelastic power-law fluids to viscoelastic second-order fluids and mildly elastic drag reducing fluids are covered. This book can serve the needs of undergraduates, graduates and industry personnel from the fields of chemical engineering, material science and engineering, mechanical engineering and polymer engineering.

The phenomena treated in this book all depend on the action of gravity on small density differences in a non-rotating fluid. The author gives a connected account of the various motions which can be driven or influenced by buoyancy forces in a stratified fluid, including internal waves, turbulent shear flows and buoyant convection. This excellent introduction to a rapidly developing field, first published in 1973, can be used as the basis of graduate courses in university departments of meteorology, oceanography and various branches of engineering. This edition is reprinted with corrections, and extra references have been added to allow readers to bring themselves up to date on specific topics. Professor Turner is a physicist with a special interest in laboratory modelling of small-scale geophysical processes. An important feature is the superb illustration of the text with many fine photographs of laboratory experiments and natural phenomena.

Spatial inhomogeneity of heating of fluids in the gravity field is the cause of all motions in nature: in the atmosphere and the oceans on Earth, in astrophysical and planetary objects. All natural objects rotate and convective motions in rotating fluids are of interest in many geophysical and astrophysical phenomena. In many industrial applications, too (crystal growth, semiconductor manufacturing), heating and rotation are the main mechanisms defining the structure and quality of the material. Depending on the geometry of the systems and the mutual orientation of temperature and gravity field, a variety of phenomena will arise in rotating fluids, such as regular and oscillating waves, intensive solitary vortices and regular vortex grids, interacting vortices and turbulent mixing. In this book the authors elucidate the physical essence of these phenomena, determining and classifying flow regimes in the space of similarity numbers. The theoretical and computational results are presented only when the results help to explain basic qualitative motion characteristics. The book will be of interest to researchers and graduate students in fluid mechanics, meteorology, oceanography and astrophysics, crystallography, heat and mass transfer.

This monograph, entirely devoted to “Convection in Fluids”, presents a unified rational approach of various convective phenomena in fluids (mainly considered as a thermally perfect gas or an expansible liquid), where the main driving mechanism is the buoyancy force (Archimedean thrust) or temperature-dependent surface tension in homogeneities (Marangoni effect). Also, the general mathematical formulation (for instance, in the Bénard problem - heated from below) and the effect of free surface deformation are taken into account. In the case of atmospheric thermal convection, the Coriolis force and stratification effects are also considered. This volume gives a rational and analytical analysis of the above mentioned physical effects on the basis of the full unsteady Navier-Stokes and Fourier (NS-F) equations - for a Newtonian compressible viscous and heat-conducting fluid - coupled with the associated initials (at initial time), boundary (lower-at the solid plane) and free surface (upper-in contact with ambiant air) conditions. This, obviously, is not an easy but a necessary task if we have in mind a rational modelling process, and work within a numerically coherent simulation on a high speed computer.

This book introduces a number of selected advanced topics in mass transfer phenomenon and covers its theoretical, numerical, modeling and experimental aspects. The 26 chapters of this book are divided into five parts. The first is devoted to the study of some problems of mass transfer in microchannels, turbulence, waves and plasma, while chapters regarding mass transfer with hydro-, magnetohydro- and electro- dynamics are collected in the second part. The third part deals with mass transfer in food, such as rice, cheese, fruits and vegetables, and the fourth focuses on mass transfer in some large-scale applications such as geomorphologic studies. The last part introduces several issues of combined heat and mass transfer phenomena. The book can be considered as a rich reference for researchers and engineers working in the field of mass transfer and its related topics.

Triggerd primarily byill effects of polluted air, soil and water resources on living species, public concern for environmental quality has been growing during the past four decades or so. One manifestation of this concern is found in occurrence of public debates as well as in the demand for full environmental impact assessment before a water-resources project is approved. Engineering soundness and economic feasibility are no longer sufficient criteria for construction of hydraulic works. As a result, environmental considerations have become very much a part of hydraulic analyses. In response to growing environmental concerns, the field of hydraulics has expanded and a new branch, called Environmental Hydraulics, has emerged. The focus of this branch is on hydraulic analyses of those environmental issues that are important for protection, restoration, and managementof environmental quality. The motivation for this book grew out of the desire to provide a hydraulic discussion of some of the key environmental issues.It is hoped that the book would serve to stimulate others to write more comprehensive texts on this subject of growing importance.

This volume is a selection of the material presented at the 7th European Mixing Congress. It is concerned exclusively with mixing in circular section vessels, using centrally mounted paddles or similar impellers. The contents are arranged under three classifications: Modelling of Mixing Processes, Mixing Operations and Experimental Techniques. The classifications result in the original material appearing in a different order to that of the Congress. This arrangement is intended to assist the reader in identifying the topic area by function or application, rather than by technology. In this book the section on Modelling contains papers which focus on the representation of the mixing process, whether by equation, scale-up criteria, or fluid dynamic simulation. Similarly, Mixing Operations are concerned with the application or function of the mixing process, such as mass transfer, heat transfer or mixing time. Experimental Techniques addresses the tools the researcher needs to use at the data gathering experimental stage. It collects together advances made in the various methods used by some of the foremost researchers, and indicates those areas still in need of additional instrumentation or methods of data reduction. The book is intended for researchers, designers and users of mixing equipment, and for those planning research and development programmes and who wish to keep up to date with advances in the basic technology and its applications.

Buoyancy Effects in FluidsCambridge University Press

An up-to-date summary of our understanding of the dynamics and thermodynamics of moist atmospheric convection, with a strong focus on recent developments in the field. The book also reviews ways in which moist convection may be parameterised in large-scale numerical models - a field in which there is still some controversy - and discusses the implications of convection for large-scale flow. Audience: The book is aimed at the graduate level and research meteorologists as well as scientists in other disciplines who need to know more about moist convection and its representation in numerical models.

This scholarly text provides an introduction to the numerical methods used to model partial differential equations, with focus on atmospheric and oceanic flows. The book covers both the essentials of building a numerical model and the more sophisticated techniques that are now available. Finite difference methods, spectral methods, finite element method, flux-corrected methods and TVC schemes are all discussed. Throughout, the author keeps to a middle ground between the theorem-proof formalism of a mathematical text and the highly empirical approach found in some engineering publications. The book establishes a concrete link between theory and practice using an extensive range of test problems to illustrate the theoretically derived properties of various methods. From the reviews: "...the books unquestionable advantage is the clarity and simplicity in presenting virtually all basic ideas and methods of numerical analysis currently actively used in geophysical fluid dynamics." Physics of Atmosphere and Ocean

This monograph covers many different aspects of materials science and in particular: inorganic (semiconductors and metal alloys) and organic (protein crystals) materials as well as the case of living biological tissues. In particular, attention is mainly devoted to the most useful and/or promising aspects of the new illuminating knowledge provided by microgravity experimentation. When microgravity conditions are attained, materials and fluids do "incredible" things. This environment (provided by space platforms or properly simulated on the ground by microscale experimentation) is instrumental in unravelling processes that are otherwise interwoven or overshadowed in "normal" gravity. It becomes possible to test fundamental theories of three-dimensional laminar, oscillatory and turbulent flow generated by various other forces; all of which are of substantial theoretical as well as practical interest on Earth. Critical knowledge gained from these experiments is accelerating the current trend towards predictable and reproducible phenomena, and enabling the development of new manufacturing methods. Within this context, this book develops and refines working engineering models, that can be easily used within practical applications, while providing a rigorous mathematical and numerical framework for deeper understanding and effective treatment of a number of macrophysical and microphysical phenomena still poorly known or ignored by most of specialists in the field of materials science. Furthermore, some unexpected theoretical kinships existing among the different subjects explored within the text (inorganic, organic, biological, etc.) are elucidated and emphasized (for instance, those dealing with the presence of moving and/or interacting interfaces). Along these lines, many problems are treated within the common framework of Volume of Fluid and Level-Set numerical methods and other similar multiphase Eulerian or Lagrangian techniques. Large amount of information is transmitted from one field to another in terms of models and numerical strategies. Such a philosophy succeeds in building a common source for the scientific community, with the intention to establish an ongoing, mutually beneficial dialogue among a variety of fields.

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.

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
Accompanying DVD-ROM contains ... "all chapters of the Springer Handbook."--Page 3 of cover.
This book describes in depth the fundamental effects of buoyancy, a key force in driving air and transporting heat and pollutants around the interior of a building. This book is essential reading for anyone involved in the design and operation of modern sustainable, energy-efficient buildings, whether a student, researcher, or practitioner. The book presents new principles in natural ventilation design and addresses surprising, little-known natural ventilation phenomena that are seldom taught in architecture or engineering schools. Despite its scientific and applied mathematics subject, the book is written in simple language and contains no demanding mathematics, while still covering both qualitative and quantitative aspects of ventilation flow analysis. It is, therefore, suitable to both non-expert readers who just want to develop intuition of natural ventilation design and control (e.g., architects and students) and to those possessing more expertise whose work involves quantifying flows (e.g., engineers and building scientists).
Basic fluid dynamic theory and applications in a single, authoritative reference The growing capabilities of computational fluid dynamics and the development of laser velocimeters and other new instrumentation have made a thorough understanding of classic fluid theory and laws more critical today than ever before. Fundamentals of Fluid Mechanics is a vital repository of essential information on this crucial subject. It brings together the contributions of

recognized experts from around the world to cover all of the concepts of classical fluid mechanics-from the basic properties of liquids through thermodynamics, flow theory, and gas dynamics. With answers for the practicing engineer and real-world insights for the student, it includes applications from the mechanical, civil, aerospace, chemical, and other fields. Whether used as a refresher or for first-time learning, Fundamentals of Fluid Mechanics is an important new asset for engineers and students in many different disciplines.
Advanced Transport Phenomena is ideal as a graduate textbook. It contains a detailed discussion of modern analytic methods for the solution of fluid mechanics and heat and mass transfer problems, focusing on approximations based on scaling and asymptotic methods, beginning with the derivation of basic equations and boundary conditions and concluding with linear stability theory. Also covered are unidirectional flows, lubrication and thin-film theory, creeping flows, boundary layer theory, and convective heat and mass transport at high and low Reynolds numbers. The emphasis is on basic physics, scaling and nondimensionalization, and approximations that can be used to obtain solutions that are due either to geometric simplifications, or large or small values of dimensionless parameters. The author emphasizes setting up problems and extracting as much information as possible short of obtaining detailed solutions of differential equations. The book also focuses on the solutions of representative problems. This reflects the book's goal of teaching readers to think about the solution of transport problems.
NOTE: The Binder-ready, Loose-leaf version of this text contains the same content as the Bound, Paperback version. Fundamentals of Fluid Mechanic, 8th Edition offers comprehensive topical coverage, with varied examples and problems, application of visual component of fluid mechanics,

and strong focus on effective learning. The text enables the gradual development of confidence in problem solving. The authors have designed their presentation to enable the gradual development of reader confidence in problem solving. Each important concept is introduced in easy-to-understand terms before more complicated examples are discussed. Continuing this book's tradition of extensive real-world applications, the 8th edition includes more Fluid in the News case study boxes in each chapter, new problem types, an increased number of real-world photos, and additional videos to augment the text material and help generate student interest in the topic. Example problems have been updated and numerous new photographs, figures, and graphs have been included. In addition, there are more videos designed to aid and enhance comprehension, support visualization skill building and engage students more deeply with the material and concepts.

Covering a wide range of techniques, this book describes methods for the solution of partial differential equations which govern wave propagation and are used in modeling atmospheric and oceanic flows. The presentation establishes a concrete link between theory and practice.

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.
' The role of high performance computing in current research on transitional and turbulent flows is undoubtedly very important. This review volume provides a good platform for leading experts and researchers in various fields of fluid mechanics dealing with transitional and turbulent flows to synergistically exchange ideas and present the state of the art in the fields. Contributed by eminent researchers, the book chapters feature keynote lectures, panel discussions and the best invited contributed papers. Contents:Keynote Speakers:Large-Eddy Simulation of the Navier-Stokes Equations: Deconvolution, Particle Methods, and Super-Resolution (A Leonard)Convective Transport in the Sun (S M Hanasoge, L Gizon, K R Sreenivasan)Rapidly-Rotating Turbulence and its Role in Planetary Dynamos (P A Davidson)Low-Order Models for Control of Fluids: Balanced Models and the Koopman Operator(C W Rowley)Contributed Papers:Different Routes of Transition by Spatio-Temporal Wave-Front (S Bhaumik, T K Sengupta, V Mudkavi)Bypass Transitional Flow Past an Aerofoil With and Without Surface Roughness Elements (Y G Bhumkar, T W H Sheu, T K Sengupta)Global Stability and Transition to Intermittent Chaos in the Cubical Lid-Driven Cavity Flow Problem (J-Ch Loiseau, J-Ch Robinet, E Leriche)Spatio-Temporal

Wave Front — Essential Element of Flow Transition for Low Amplitude Excitations (A Mulloth, P Suchandra, T K Sengupta)Simulations Using Transition Models within the Framework of RANS (Y C Manu, A Rajesh, M B Subrahmanya, D S Kulkarni, B N Rajan)DNS of Incompressible Square Duct Flow and Its Receptivity to Free Stream Turbulence (P M Bagade, N Sawant, M Sriramkrishnan, T K Sengupta)Evolution of RANS Modelling of High Speed Mixing Layers using LES (A S Iyer, N K S Rajan, D Chakraborthy)Numerical Investigation of Centrifugal Instability Around a Circular Cylinder Rotated Impulsively (A M Prabhu, R K Shukla, J H Arakeri)Direct Numerical Simulations of Riblets in a Fully-Developed Turbulent Channel Flow: Effects of Geometry (J H Ng, R K Jaiman, T T Lim)Computational Studies on Flow Separation Controls at Relatively Low Reynolds Number Regime (K Fujii)Frequency Dependent Capacitance SDBD Plasma Model for Flow Control (P M Bagade, T K Sengupta, S Sengupta, H D Vo)Effects of Uniform Blowing or Suction on the Amplitude Modulation in Spatially Developing Turbulent Boundary Layers (Y Kametani, R Örlü, P Schlatter, K Fukagata)Turbulent Drag Reduction in Channel Flow Using Weak-Pressure Forcing (B A Khan, M F Baig)Drifting of Internal Gravity Wave in a Non-Boussinesq Stably Stratified Turbulent Channel Flow (S M Yahya, S Sanghi, S F Anwer)Numerical Study of Sink Flow Turbulent Boundary Layers (S S Patwardhan, O N Ramesh)Coherent Structure in Oil Body Embedded in Compound Vortex (T O Chaplina, Yu D Chashechkin)Quantitative Characterization of Single Orifice Hydraulic Flat Spray Nozzle (D M Sharma, W T Lai)Shell Model for Buoyancy-Driven Turbulent Flows (A Kumar, M K Verma)Numerical Simulations in Low–Prandtl Number Convection (J D Scheel, J Schumacher)Effect of Buoyancy on Turbulent Mixed Convection Flow Through Vertical and Horizontal Channels (N Satish, K Venkatasubbaiah, R Harish)Computation of Boundary Layer Flow over Porous Laminated Flat Plate (K A Nair, A Sameen, S A Lal)Boundary Condition Development for an Adverse Pressure Gradient Turbulent Boundary Layer at the Verge of Separation (V Kitsios, C Atkinson, J A Sillero, G Borrell, A G Gungor, J Jiménez, J Soria)Some Interesting Features of Flow Past Slotted Circular Cylinder at Re = 3500 (G K Suryanarayana, V Y Mudkavi, R Kurade, K M Naveen)A High-Resolution Compressible DNS Study of Flow Past a Low-Pressure Gas Turbine Blade (R Ranjan, S M Deshpande, R Narasimha)Numerical Simulation of Impulsive Supersonic Flow from an Open End of a Shock Tube: A Comparative Study (T Murugan, S De, V Thiagarajan)Green''s Function Analysis of Pressure-Strain Correlations in a Supersonic Pipe, Nozzle and Diffuser (S Ghosh, R

Friedrich)The Structure of Turbulence in Poiseuille and Couette Flow at Computationally High Reynolds Number (S Pirozzoli, M Bernardini, P Orlandi)A New Reynolds Stress Damping Function for Hybrid RANS/LES with an Evolved Functional Form (J Weatheritt, R D Sandberg)Direct Numerical and Large Eddy Simulations of Helicity-Induced Stably Stratified Turbulent Flows (A Rahimi, A J Chandy)Comparison of RANS and DNS for Transitional Flow Over WTEA-TE1 Airfoil (P M Bagade, É Laurendeau, A Bhole, N Sharma, T K Sengupta)Extracting Coherent Structures to Explore the Minimum Jet Noise (Z Fu, A Agarwal, A V G Cavalieri, P Jordan)Synchronized Large-Eddy Simulations for Sound Generation Analysis (S Unnikrishnan, D V Gaitonde)DNS of a Turbulent Jet Issuing from an Acoustically Lined Pipe (R D Sandberg, B J Tester)Decomposition of Radiating and Non-Radiating Linear Fluctuating Components in Compressible Flows (P Stegeman, A Ooi, J Soria)Toward Control of Compressible Shear Flows: Investigation of Possible Flow Mechanisms (G Kumar, R Bertsch, V Venugopal, S S Girimaji)Damping Numerical Oscillations in Hybrid Solvers through Detection of Gibbs Phenomenon (V K Chakravarthy, D Chakraborty)Forward and Inverse 3D Fourier Transforms of a DNS Wavepacket Evolving in a Blasius Boundary Layer (K-L Kang, K S Yeo)Reduced Order Modeling by POD of

Supercritical Flow Past Circular Cylinder (M K Parvathi, S Ijlal, G Pallavi, T K Sengupta)Proper Orthogonal Decomposition vs. Fourier Analysis for Extraction of Large-Scale Structures of Thermal Convection (S Paul, M K Verma)Energy Spectrum and Flux of Buoyancy-Driven Turbulence (M K Verma, A Kumar, A G Chatterjee)DNS of a Buoyant Turbulent Cloud under Rapid Rotation (A Ranjan, P A Davidson)Numerical Simulation of Shock-Bubble Interaction using High Order Upwind Schemes (A Kundu, S De)Rayleigh-Taylor Instability of a Miscible Fluid at the Interface: Direct Numerical Simulation (A Bhole, S Sengupta, A Sengupta, K S Shruti, N Sharma)A High Resolution Differential Filter for Large Eddy Simulation on Unstructured Grids for High-Order Methods (M Najafiyazdi, S Nadarajah, L Mongeau)A Critical Assessment of Simulations for Transitional and Turbulent Flows (T K Sengupta)Panel Discussion Readership: Researchers, professionals, academics, graduate and senior undergraduates in aerospace engineering, mechanical engineering, engineering mechanics, geophysics and fluid mechanics. Keywords:HPC;Transition;Turbulence;Flow Control;Turbulence Modelling'

Fluid mechanics, the study of how fluids behave and interact under various forces and in various applied situations-whether in the liquid or gaseous state or both-is introduced and comprehensively covered in

this widely adopted text. Revised and updated by Dr. David Dowling, Fluid Mechanics, Fifth Edition is suitable for both a first or second course in fluid mechanics at the graduate or advanced undergraduate level. The leading advanced general text on fluid mechanics, Fluid Mechanics, 5e includes a free copy of the DVD "Multimedia Fluid Mechanics," second edition. With the inclusion of the DVD, students can gain additional insight about fluid flows through nearly 1,000 fluids video clips, can conduct flow simulations in any of more than 20 virtual labs and simulations, and can view dozens of other new interactive demonstrations and animations, thereby enhancing their fluid mechanics learning experience. Text has been reorganized to provide a better flow from topic to topic and to consolidate portions that belong together. Changes made to the book's pedagogy accommodate the needs of students who have completed minimal prior study of fluid mechanics. More than 200 new or revised end-of-chapter problems illustrate fluid mechanical principles and draw on phenomena that can be observed in everyday life. Includes free Multimedia Fluid Mechanics 2e DVD
Double-diffusive convection is a mixing process driven by the interaction of two fluid components which diffuse at different rates. Leading expert Timour Radko presents the first systematic overview of the classical theory of double-diffusive convection

in a coherent narrative, bringing together the disparate literature in this developing field. The book begins by exploring idealized dynamical models and illustrating key principles by examples of oceanic phenomena. Building on the theory, it then explains the dynamics of structures resulting from double-diffusive instabilities, such as the little-understood phenomenon of thermohaline staircases. The book also surveys non-oceanographic applications, such as industrial, astrophysical and geological manifestations, and discusses the climatic and biological consequences of double-diffusive convection. Providing a balanced blend of fundamental theory and real-world examples, this is an indispensable resource for academic researchers, professionals and graduate students in physical oceanography, fluid dynamics, applied mathematics, astrophysics, geophysics and climatology.

Advances in Heat Transfer

CD-ROM contains: an interactive PC-based virtual-reality modelling software (VISJET 2.0 limited version).

The Science & Applications of Heat and Mass Transfer: Reports, Reviews, & Computer Programs, Volume 6: Turbulent Buoyant Jets and Plumes focuses on the formation, properties, characteristics, and reactions of turbulent jets and plumes. The selection first offers information on the mechanics of turbulent buoyant jets and plumes and turbulent buoyant jets in shallow fluid layers. Discussions focus on submerged buoyant jets into shallow fluid, horizontal surface or interface jets into shallow layers, fundamental considerations, and turbulent buoyant jets (forced plumes). The manuscript then examines a turbulence model for buoyant flows and its application to vertical buoyant jets, including mathematical model, calculation of vertical buoyant jets, and explanation of velocity and temperature spreading in pure jets and pure plumes. The publication is a dependable reference for scientists and readers interested in turbulent buoyant jets and plumes.

Challenging problems involvrllg jet and plume phenomena are common to many areas of fundamental and applied scientific research, and an understanding of plume and jet behaviour is essential in many geophysical and industrial contexts. For example, in the field of meteorology, where pollutant dispersal takes place by means of atmospheric jets and plumes formed either naturally under conditions of convectively-driven flow in the atmospheric boundary layer, or anthropogenically by the release of pollutants from tall chimneys. In other fields of geophysics, buoyant plumes and jets are known to play important roles in oceanic mixing processes, both at the relatively large scale (as in deep water formation by convective sinking) and at the relatively small scale (as with plume formation beneath ice leads, for example). In the industrial context, the performances of many engineering systems are determined primarily by the behaviour of buoyant plumes and jets. For example, (i) in sea outfalls, where either sewage or thermal effluents are discharged into marine and/or freshwater environments, (ii) in solar ponds, where buoyant jets are released under density interfaces, (iii) in buildings, where thermally-generated plumes affect the air quality and ventilation properties of architectural environments, (iv) in rotating machinery where fluid jet~ are used for cooling purposes, and (v) in long road and rail tunnels, where safety and ventilation prcedures rely upon an understanding of the behaviour of buoyant jets. In many other engineering and oceanographic contexts, the properties of jets and plumes are of great importance. The dissertation focuses on a comparison between momentumless (self-propelled) and net-momentum (towed) wakes with an emphasis on the elucidation of buoyancy effects. It is difficult to realize truly momentumless wakes in the laboratory and DNS offer a viable, accurate alternative because the initial value of net momentum can be controlled and the evolution of the net momentum can be closely monitored. DNS of axisymmetric wakes with and without net momentum are performed at Re=50,000 on a grid with approximately 2 billion grid points. The development of the wake is characterized by the evolution of maxima, area integrals and spatial distributions of mean and turbulence statistics. The mean velocity in the self-propelled, momentumless wake decays more rapidly than the towed case due to higher shear and consequently a faster rate of energy transfer to turbulence. Buoyancy allows a wake to survive longer in a stratified fluid by reducing the u1'u3' correlation responsible for the mean-to-turbulence energy transfer in the vertical direction. This buoyancy effect is especially important in the self-propelled case because it allows regions of positive and negative momentum to become decoupled in the vertical direction and decay with different rates. The vertical wake thickness is found to be larger in self-propelled wakes. The role of internal waves in the energetics is determined and it is found that they are responsible for sustaining turbulence at the wake periphery long after the shear production has subsided. The non-equilibrium region of the Re=50,000 wake is found to exhibit a time span when, although the turbulence is strongly stratified as indicated by small Froude number, the turbulent dissipation rate exhibits inertial scaling. The multiply inflected mean velocity profile, inherent to the self-propelled wake, results in four bands of vorticity, compared to the two bands observed in the towed case. Vortex pairs of opposite sign form vortex dipoles which interact with other dipoles to cause a more disordered appearance of the late wake vorticity when compared to the towed case.

This book investigates the unique hydrodynamics and heat transfer problems that are encountered in the vicinity of the critical point of fluids. Emphasis is given on weightlessness conditions, gravity effects and thermovibrational phenomena. Near their critical point, fluids indeed obey universal behavior and become very compressible and expandable. Their comportment, when gravity effects are suppressed, becomes quite unusual.

The problems that are treated in this book are of interest to students and researchers interested in the original behavior of near-critical fluids as well as to engineers that have to manage supercritical fluids. A special chapter is dedicated to the present knowledge of critical point phenomena. Specific data for many fluids are provided, ranging from cryogenics (hydrogen) to high temperature (water). Basic information in statistical mechanics, mathematics and measurement techniques is also included. The basic concepts of fluid mechanics are given for the non-specialists to be able to read the parts he is interested in. Asymptotic theory of heat transfer by thermoacoustic processes is provided with enough details for PhD students or researchers and engineers to begin in the field. Key spaces are described in details, with many comparisons between theory and experiments to illustrate the topics.

Studies of convection in geophysical flows constitute an advanced and rapidly developing area of research that is relevant to problems of the natural environment. During the last decade, significant progress has been achieved in the field as a result of both experimental studies and numerical modelling. This led to the principal revision of the widely held view on buoyancy-driven turbulent flows comprising an organised mean component with superimposed chaotic turbulence. An intermediate type of motion, represented by coherent structures, has been found to play a key role in geophysical boundary layers and in larger scale atmospheric and hydrospheric circulations driven by buoyant forcing. New aspects of the interaction between convective motions and rotation have recently been discovered and investigated. Extensive experimental data have also been collected on the role of convection in cloud dynamics and microphysics. New theoretical concepts and approaches have been outlined regarding scaling and parameterization of physical processes in buoyancy-driven geophysical flows. The book summarizes interdisciplinary studies of buoyancy effects in different media (atmosphere and hydrosphere) over a wide range of scales (small scale phenomena in unstably stratified and convectively mixed layers to deep convection in the atmosphere and ocean), by different research methods (field measurements, laboratory simulations, numerical modelling), and within a variety of application areas (dispersion of pollutants, weather forecasting, hazardous phenomena associated with buoyant forcing).