Turbulent Jets And Plumes

Volcanic plumes, made up of material that has explosively erupted from a volcano, are of fundamental importance to volcanology because their deposits record the past activity of a volcano. They also pose a wide range of hazards to humans and can have significant environmental effects. This book integrates observation, theory, and experimental studies and contains recent research ideas and results.
Jets and plumes are shear flows produced by momentum and buoyancy forces. Examples include smokestack emissions, fires and volcano eruptions, deep sea vents, thermals, sewage discharges, thermal effluents from power stations, and ocean dumping of sludge. Knowledge of turbulent mixing by jets and plumes is important for environmental control, impact and risk assessment. Turbulent Jets and Plumes introduces the fundamental concepts and develops a Lagrangian approach to model these shear flows. This theme persists throughout the text, starting from simple cases and building towards the practically important case of a turbulent buoyant jet in a density-stratified crossflow. Basic ideas are illustrated by ample use of flow visualization using the laser-induced fluorescence technique. The text includes many illustrative worked examples, comparisons of model predictions with laboratory and field data, and classroom tested problems. An interactive PC-based virtual-reality modelling software (VISJET) is also provided. Engineering and science students, researchers and practitioners may use the book both as an introduction to the subject and as a reference in hydraulics and environmental fluid mechanics.
This book aims at fulfilling the need for a handbook at undergraduate and starting researcher level on fire and smoke dynamics in enclosures, giving fluid mechanics aspects a central role. Fluid mechanics are essential at the level of combustion, heat transfer and fire suppression, but they are described only cursorily in most of the existing fire
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.
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.
Turbulence Measurements in Plane Jets and Plumes in Crossflow
Turbulence
Fluid Mechanics Aspects of Fire and Smoke Dynamics in Enclosures
Prediction of Plane Turbulent Jets and Plumes Rising Algebraic Stress - Flux Models
International Series of Monographs on Aeronautical Sciences and Space Flight: Aerodynamics
A Review of Experimental Data
River and Lake Ice Engineering
Turbulence Modelling for the Prediction of Turbulent Jets, Wakes and Plumes
Atlas of Visualization
This book is an outgrowth of research contributions and teaching experiences by all the authors in applying modern fluid mechanics to problems of pollutant transport and mixing in the water environment. It should be suitable for use in first year graduate level courses for engineering and science students, although more material is contained than can reasonably be taught in a one-year course, and most instructors will probably wish to cover only selected potions. The book should also be useful as a reference for practicing hydraulic and environmental engineers, as well as anyone involved in engineering studies for disposal of wastes into the environment. The practicing consulting or design engineer will find a thorough explanation of the fundamental processes, as well as many references to the current technical literature, the student should gain a deep enough understanding of basics to be able to read with understanding the future technical literature evolving in this evolving field.
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 management are also discussed, and an up-to-date account of the mathematical modeling of pollution is also presented. Audience: Invaluable reading for senior undergraduates and beginning graduates, civil, environmental, and agricultural engineers, and geologists and climatologists.
Natural Aerodynamics focuses on the mathematics of any problem in air motion. This book discusses the general form of the law of fluid motion, relationship between pressure and wind, production of vortex filaments, and conduction of vorticity by viscosity. The flow at moderate Reynolds numbers, turbulence in a stably stratified fluid, natural exploitation of atmospheric thermals, and plumes in turbulent crosswinds are also elaborated. This text likewise considers the waves produced by thermals, transformation of thin layer clouds, method of small perturbations, and dangers of extra-polation. This publication is suitable for mathematicians and experimentalists in natural aerodynamical research, but is also valuable to aviators, engineers, geographers, and meteorologists.
Visualization is a novel interdisciplinary science for making any phenomenon clear by visualizing the invisible using computer techniques. The Atlas of Visualization presents the latest advances in visualization techniques, image processing, computer graphics, and visualization of measured and compound results. Focusing on both experimental and computer-aided visualization, this encyclopedic resource discusses all aspects of this new and evolving science. This volume includes cutting-edge information on turbulent flow, vortex, water spray, PIV, jet flames, thermal plume and numerical simulation, and heat and mass transfer. Encompasses all aspects of visualization! The Atlas of Visualization is concerned with all aspects of visualization, not just with engineering and physics applications, but with applications in disciplines such as the biomedical sciences, oceanography, agriculture, meteorology, and sports science. The aim of this book is to provide a medium for announcing the latest advances in visualization. Full color presentation! Books on visualization could not discuss complex phenomena without the use of color photographs. For this reason, the Atlas of Visualization is issued in full color. This allows the complex phenomena to be presented clearly, and combined phenomena are illustrated with quantitative results and detailed structure. Global perspective! The chapters and gravures in the Atlas are contributed by the world's top researchers, and provides both researchers and technicians with extremely useful information from the foremost innovators in the field of visualization. Computer scientists, mechanical engineers, physicists, applied and biological scientists, meteorologists, and sports scientists, as well as students of these disciplines, will find the Atlas of Visualization an essential source of all the latest knowledge in the field of visualization.
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.
A Lagrangian Approach
Turbulent Buoyant Jets and Plumes
Environmental Fluid Mechanics
Turbulent buoyant Jets and plumes
Volcanic Plumes
Atmospheric Dispersion of Heavy Gases and Small Particles
Environmental Hydrology
The Structure of Turbulent Shear Flow
Transport Phenomena in Fires

The present book contains the papers that have been presented at the IUTAM-Symposium on Atmospheric Dispersion of Heavy Gases and Small Particles, which was held from August 29th to September 2nd 1983 in Scheveningen in The Netherlands. Attendees from many countries were present; 4 review lectures and about 25 research papers were presented. The realization of the symposium was made possible by the support of Delft University of Technology Koninklijke/Shell-Laboratory Amsterdam Prins Maurits Laboratory/Institute for Chemical and Technological Research Royal Netherlands Meteorological Institute. The symposium organization was carried out by the local organi zing committee consisting of F.G.J. Absil - Delft University of Technology G.W. Colenbrander - Koninklijke/Shell-Laboratory Amsterdam G. Ooms - Delft University of Technology G. Opschoor - Prins Maurits Laboratory/Institute for Chemical and Technological Research H. Tennekes - Royal Netherlands Meteorological Institute A.P. van Ulden - Royal Netherlands Meteorological Institute. The work of the organizing committee was supported in many re spects by the sientific committee, which consisted of H. Fiedler - Technische Hochschule Karlsruhe, Fed. Rep. of Germany F.N. Frenkiel - Naval Ship Research and Development Center, Bethesda, Maryland, U.S.A. J.C.R. Hunt - University of Cambridge, England J. Kondo - National Institute for Environmetal Studies, Japan J.L. Lumley - Cornell University, Ithaca, New York, U.S.A."
Develops a physical theory from the mass of experimental results, with revisions to reflect advances of recent years.
Fundamental Non-Reactive Jets in Crossflow and Other Jet Systems; Background on Modeling, Dynamical Systems, and Control; Reactive Jets in Crossflow and Multiphase Jets; Controlled Jets in Crossflow and Control via Jet Systems;
This book constitutes the proceedings of the 5th Latin American Conference, CARLA 2018, held in Bucaramanga, Colombia, in September 2018. The 24 papers presented in this volume were carefully reviewed and selected from 38 submissions. They are organized in topical sections on: Artificial Intelligence; Accelerators; Applications; Performance Evaluation; Platforms and Infrastructures; Cloud Computing.
Turbulent Jets
Unsteady Turbulent Jets and Plumes
Manipulation and Control of Jets in Crossflow
High Performance Computing
Study of Vertical Plane Turbulent Jets and Plumes
Free-Surface Flow
Buoyant Turbulent Jets and Flames. Part 3. Round Turbulent Nonbuoyant Starting Jets and Puffs and Buoyant Starting Plumes and Thermals. Annual Report
Natural Aerodynamics
Prediction of Turbulent Jets and Plumes in Flowing Ambients
Handbook of Environmental Engineering

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.
Understanding the behaviour of particles suspended in a fluid has many important applications across a range of fields, including engineering and geophysics. Comprising two main parts, this book begins with the well-developed theory of particles in viscous fluids, i.e. microhydrodynamics, particularly for single- and pair-body dynamics. Part II considers many-body dynamics, covering shear flows and sedimentation, bulk flow properties and collective phenomena. An interlude between the two parts provides the basic statistical techniques needed to employ the results of the first (microscopic) in the second (macroscopic). The authors introduce theoretical, mathematical concepts through concrete examples, making the material accessible to non-mathematicians. They also include some of the many open questions in the field to encourage further study. Consequently, this is an ideal introduction for students and researchers from other disciplines who are approaching suspension dynamics for the first time.
Controlled fires are beneficial for the generation of heat and power while uncontrolled fires, like fire incidents and wildfires, are detrimental and can cause enormous material damage and human suffering. This edited book presents the state-of-the-art of modeling and numerical simulation of the important transport phenomena in fires. It describes how computational procedures can be used in analysis and design of fire protection and fire safety. Computational fluid dynamics, turbulence modeling, combustion, soot formation, thermal radiation modeling are demonstrated and applied to pool fires, flame spread, wildfires, fires in buildings and other examples.
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
This is the first book specifically designed to offer the student a smooth transitionary course between elementary fluid dynamics (which gives only last-minute attention to turbulence) and the professional literature on turbulent flow, where an advanced viewpoint is assumed. The subject of turbulence, the most forbidding in fluid dynamics, has usually proved treacherous to the beginner, caught in the whirls and eddies of its nonlinearities and statistical imponderables. This is the first book specifically designed to offer the student a smooth transitionary course between elementary fluid dynamics (which gives only last-minute attention to turbulence) and the professional literature on turbulent flow, where an advanced viewpoint is assumed. Moreover, the text has been developed for students, engineers, and scientists with different technical backgrounds and interests. Almost all flows, natural and man-made, are turbulent. Thus the subject is the concern of geophysical and environmental scientists (in dealing with atmospheric jet streams, ocean currents, and the flow of rivers, for example), of astrophysicists (in studying the photospheres of the sun and stars or mapping gaseous nebulae), and of engineers (in calculating pipe flows, jets, or wakes). Many such examples are discussed in the book. The approach taken avoids the difficulties of advanced mathematical development on the one side and the morass of experimental detail and empirical data on the other. As a result of following its midstream course, the text gives the student a physical understanding of the subject and deepens his intuitive insight into those problems that cannot now be rigorously solved. In particular, dimensional analysis is used extensively in dealing with those problems whose exact solution is mathematically elusive. Dimensional reasoning, scale arguments, and similarity rules are introduced at the beginning and are applied throughout. A discussion of Reynolds stress and the kinetic theory of gases provides the contrast needed to put mixing-length theory into proper perspective: the authors present a thorough comparison between the mixing-length models and

dimensional analysis of shear flows. This is followed by an extensive treatment of vorticity dynamics, including vortex stretching and vorticity budgets. Two chapters are devoted to boundary-free shear flows and well-bounded turbulent shear flows. The examples presented include wakes, jets, shear layers, thermal plumes, atmospheric boundary layers, pipe and channel flow, and boundary layers in pressure gradients. The spatial structure of turbulent flow has been the subject of analysis in the book up to this point, at which a compact but thorough introduction to statistical methods is given. This prepares the reader to understand the stochastic and spectral structure of turbulence. The remainder of the book consists of applications of the statistical approach to the study of turbulent transport (including diffusion and mixing) and turbulent spectra.

Recent Research Advances in the Fluid Mechanics of Turbulent Jets and Plumes

Iranian journal of science and technology

Environmental Hydraulics

5th Latin American Conference, CARLA 2018, Bucaramanga, Colombia, September 26-28, 2018, Revised Selected Papers

Overview and Fundamentals

Mixing in Inland and Coastal Waters

Buoyant Turbulent Jets and Flames. Part 1. Adiabatic Wall Plumes. Annual Report

Turbulent Jets and Plumes

Stratified Flows

The author's first monograph on turbulent jets, in 1936, dealt solely with a free submerged jet. Since that time, the theory of the turbulent jet has been developed in many published works both in the USSR and abroad: it has been enriched with a large amount of experimental material and has been applied in many new fields of engineering. In the last 10 years very substantial progress has been made, and it has now become possible to go beyond the free submerged jet and to solve the problem of a jet in a stream of fluid, to take into account the interaction between the jet and solid walls, to ascertain the relationship between the contour of the jet and the ratio of its density to the density of the surrounding medium, and to establish the characteristic features of a supersonic jet. This monograph contains the results of further research by the author and his colleagues, as well as a critical reappraisal of the more important theoretical and experimental data published by other investigators. The first section deals with the theory of a turbulent jet of incompressible fluid. It gives a systematic analysis of numerous experimental data on velocity profiles, temperature, and the impurity concentration, as well as the outlines of the turbulent mixing lone. The second section sets forth the theory of turbulent gas jets, including strongly preheated and supersonic jets. The theory of free turbulence in a gas, suitable in principle for any degree of compressibility, is revised, and the equations are derived for motion and heat exchange in the boundary layer of a jet at very high temperature. The third section solves several problems of the spreading of jets in finite and semifinite space, and the fourth section describes various applications of the theory of jets, many of which are reported for the first time or have been significantly revised.

This book covers the major problems of turbulence and turbulent processes, including physical phenomena, their modeling and their simulation. After a general introduction in Chapter 1 illustrating many aspects dealing with turbulent flows, averaged equations and kinetic energy budgets are provided in Chapter 2. The concept of turbulent viscosity as a closure of the Reynolds stress is also introduced. Wall-bounded flows are presented in Chapter 3 and aspects specific to boundary layers and channel or pipe flows are also pointed out. Free shear flows, namely free jets and wakes, are considered in Chapter 4. Chapter 5 deals with vortex dynamics. Homogeneous turbulence, isotropy and dynamics of isotropic turbulence are presented in Chapters 6 and 7. Turbulence is then described both in the physical space and in the wave number space. Time dependent numerical simulations are presented in Chapter 8, where an introduction to large eddy simulation is offered. The last three chapters of the book summarize remarkable digital techniques current and experimental. Many results are presented in a practical way, based on both experiments and numerical simulations. The book is written for a advanced engineering students as well as postgraduate engineers and researchers. For students, it contains the essential results as well as details and demonstrations whose oral transmission is often tedious. At a more advanced level, the text provides numerous references which allow readers to find quickly further study regarding their work and to acquire a deeper knowledge on topics of interest.

A note on entrainment in turbulent jets and plumes

HMT: The Science & Applications of Heat and Mass Transfer. Reports, Reviews & Computer Programs

The Theory of Turbulent Jets

Vertical Turbulent Buoyant Jets

A Physical Introduction to Suspension Dynamics

A First Course in Turbulence

Symposium, Delft, The Netherlands August 29 - September 2, 1983

Turbulent Jets

Handbook of Environmental Fluid Dynamics, Volume One