obtained are still severely limited to low Reynolds numbers (about only one decade better than direct numerical simulations), and the interpretation of such calculations for complex, curved geometries is still unclear. It is evident that a lot of work (and a very significant increase in available computing power) is required before such methods can be adopted in daily's engineering practice. I hope to cover on all these topics in a near future. The book is divided into six chapters, each chapter in subchapters, sections and subsections. The first part is introduced by Chapter 1 which summarizes the equations of fluid mechanics, it is developed in Chapters 2 to 4 devoted to the construction of turbulence models. What has been called "engineering methods" is considered in Chapter 2 where the Reynolds averaged equations are established and the closure problem studied (§1-3). A first detailed study of homogeneous turbulent flows follows (§4). It includes a review of available experimental data and their modeling. The eddy viscosity concept is analyzed in §5 with the resulting transport equation models such as the famous K-e model. Reynolds st res models (Chapter 4) require a preliminary consideration of two-point turbulence concepts which are developed in Chapter 3 devoted to homogeneous turbulence. We review the two-point moments of velocity fields and their spectral transforms (§ 1), their general dynamics (§2) with the particular case of homogeneous, isotropic turbulence (§3) where the so-called Kolmogorov's assumptions are discussed at length. This textbook presents numerical solution techniques for incompressible turbulent flows that occur in a variety of scientific and engineering settings including aerodynamics of ground-based vehicles and low-speed aircraft, fluid flows in
energy systems, atmospheric flows, and biological flows. This book encompasses fluid mechanics, partial differential equations, numerical methods, and turbulence models, and emphasizes the foundation on how the governing partial differential equations for incompressible fluid flow can be solved numerically in an accurate and efficient manner. Extensive discussions on incompressible flow solvers and turbulence modeling are also offered. This text is an ideal instructional resource and reference for students, research scientists, and professional engineers interested in analyzing fluid flows using numerical simulations for fundamental research and industrial applications.

Compressibility, Turbulence and High Speed Flow introduces the reader to the field of compressible turbulence and compressible turbulent flows across a broad speed range, through a unique complimentary treatment of both the theoretical foundations and the measurement and analysis tools currently used. The book provides the reader with the necessary background and current trends in the theoretical and experimental aspects of compressible turbulent flows and compressible turbulence. Detailed derivations of the pertinent equations describing the motion of such turbulent flows is provided and an extensive discussion of the various approaches used in predicting both free shear and wall bounded flows is presented. Experimental measurement techniques common to the compressible flow regime are introduced with particular emphasis on the unique challenges presented by high speed flows. Both experimental and numerical simulation work is supplied throughout to provide the reader with an overall perspective of current trends. An introduction to current techniques in compressible turbulent flow analysis An approach that enables engineers to identify and solve complex compressible flow challenges Prediction methodologies, including the Reynolds-averaged Navier
Stokes (RANS) method, scale filtered methods and direct numerical simulation (DNS) Current strategies focusing on compressible flow control

An Introduction to Turbulent Flow

Cambridge University Press

This is an advanced textbook on the subject of turbulence, and is suitable for engineers, physical scientists and applied mathematicians. The aim of the book is to bridge the gap between the elementary accounts of turbulence found in undergraduate texts, and the more rigorous monographs on the subject. Throughout, the book combines the maximum of physical insight with the minimum of mathematical detail. Chapters 1 to 5 may be appropriate as background material for an advanced undergraduate or introductory postgraduate course on turbulence, while chapters 6 to 10 may be suitable as background material for an advanced postgraduate course on turbulence, or act as a reference source for professional researchers. This second edition covers a decade of advancement in the field, streamlining the original content while updating the sections where the subject has moved on. The expanded content includes large-scale dynamics, stratified & rotating turbulence, the increased power of direct numerical simulation, two-dimensional turbulence, Magnetohydrodynamics, and turbulence in the core of the Earth

TUrbulence modeling encounters mixed evaluation concerning its importance. In engineering flow, the Reynolds number is often very high, and the direct numerical simulation (DNS) based on the resolution of all spatial scales in a flow is beyond the capability of a computer available at present and in the foreseeable near future. The spatial scale of energetic parts of a turbulent flow is much larger than the energy dissipative counterpart, and they have large influence on the transport processes of momentum, heat, matters, etc. The primary subject of turbulence modeling is the proper es timate
of these transport processes on the basis of a bold approximation to the energy-dissipation one. In the engineering community, the turbulence modeling is highly evaluated as a mathematical tool indispensable for the analysis of real-world turbulent flow. In the physics community, attention is paid to the study of small-scale components of turbulent flow linked with the energy-dissipation process, and much less interest is shown in the foregoing transport processes in real-world flow. This research tendency is closely related to the general belief that universal properties of turbulence can be found in small-scale phenomena. Such a study has really contributed much to the construction of statistical theoretical approaches to turbulence. The estrangement between the physics community and the turbulence modeling is further enhanced by the fact that the latter is founded on a weak theoretical basis, compared with the study of small-scale turbulence. Provides physical intuition and key entries to the body of literature. This book includes historical perspective of the theories.

This book highlights by careful documentation of developments what led to tracking the growth of deterministic disturbances inside the shear layer from receptivity to fully developed turbulent flow stages. Associated theoretical and numerical developments are addressed from basic level so that an uninitiated reader can also follow the materials which lead to the solution of a long-standing problem. Solving Navier-Stokes equation by direct numerical simulation (DNS) from the first principle has been considered as one of the most challenging problems of understanding what causes transition to turbulence. Therefore, this book is a very useful addition to advanced CFD and advanced fluid mechanics courses.

Part of the excitement in boundary-layer meteorology is the
Online Library An Introduction To Turbulent Flow

challenge associated with turbulent flow - one of the unsolved problems in classical physics. An additional attraction of the field is the rich diversity of topics and research methods that are collected under the umbrella-term of boundary-layer meteorology. The flavor of the challenges and the excitement associated with the study of the atmospheric boundary layer are captured in this textbook. Fundamental concepts and mathematics are presented prior to their use, physical interpretations of the terms in equations are given, sample data are shown, examples are solved, and exercises are included. The work should also be considered as a major reference and as a review of the literature, since it includes tables of parameterizations, procedures, filed experiments, useful constants, and graphs of various phenomena under a variety of conditions. It is assumed that the work will be used at the beginning graduate level for students with an undergraduate background in meteorology, but the author envisions, and has catered for, a heterogeneity in the background and experience of his readers.

Theory and Modeling of Dispersed Multiphase Turbulent Reacting Flows gives a systematic account of the fundamentals of multiphase flows, turbulent flows and combustion theory. It presents the latest advances of models and theories in the field of dispersed multiphase turbulent reacting flow, covering basic equations of multiphase turbulent reacting flows, modeling of turbulent flows, modeling of multiphase turbulent flows, modeling of turbulent combusting flows, and numerical methods for simulation of multiphase turbulent reacting flows, etc. The book is ideal for graduated students, researchers and engineers in many disciplines in power and mechanical engineering. Provides a combination of multiphase fluid dynamics, turbulence theory and combustion theory Covers physical phenomena, numerical modeling theory and methods, and their
applications Presents applications in a wide range of engineering facilities, such as utility and industrial furnaces, gas-turbine and rocket engines, internal combustion engines, chemical reactors, and cyclone separators, etc. A good understanding of turbulent compressible flows is essential to the design and operation of high-speed vehicles. Such flows occur, for example, in the external flow over the surfaces of supersonic aircraft, and in the internal flow through the engines. Our ability to predict the aerodynamic lift, drag, propulsion and maneuverability of high-speed vehicles is crucially dependent on our knowledge of turbulent shear layers, and our understanding of their behavior in the presence of shock waves and regions of changing pressure. Turbulent Shear Layers in Supersonic Flow provides a comprehensive introduction to the field, and helps provide a basis for future work in this area. Wherever possible we use the available experimental work, and the results from numerical simulations to illustrate and develop a physical understanding of turbulent compressible flows. This book provides students and researchers in fluid engineering with an up-to-date overview of turbulent flow research in the areas of simulation and modeling. A key element of the book is the systematic, rational development of turbulence closure models and related aspects of modern turbulent flow theory and prediction. Starting with a review of the spectral dynamics of homogenous and inhomogeneous turbulent flows, succeeding chapters deal with numerical simulation techniques, renormalization group methods and turbulent closure modeling. Each chapter is authored by recognized leaders in their respective fields, and each provides a thorough and cohesive treatment of the subject. Addressing classical material as well as new perspectives, Instabilities of Flows and Transition to Turbulence presents a concise, up-to-date treatment of theory and applications of
viscous flow instability. It covers materials from classical instability to contemporary research areas including bluff body flow instability, mixed convection flows, and application areas of aerospace and other branches of engineering. Transforms and perturbation techniques are used to link linear instability with receptivity of flows, as developed by the author. The book: Provides complete coverage of transition concepts, including receptivity and flow instability. Introduces linear receptivity using bi-lateral Fourier-Laplace transform techniques. Presents natural laminar flow (NLF) airfoil analysis and design as a practical application of classical and bypass transition. Distinguishes strictly between instability and receptivity, which leads to identification of wall- and free stream-modes. Describes energy-based receptivity theory for the description of bypass transitions. Instabilities of Flows and Transition to Turbulence has evolved into an account of the personal research interests of the author over the years. A conscious effort has been made to keep the treatment at an elementary level requiring rudimentary knowledge of calculus, the Fourier-Laplace transform, and complex analysis. The book is equally amenable to undergraduate students, as well as researchers in the field.

An introduction to the Large-Eddy-Simulation (LES) method, geared primarily toward hydraulic and environmental engineers, the book covers special features of flows in water bodies and summarizes the experience gained with LES for calculating such flows. It can also be a valuable entry to the subject of LES for researchers and students in all fields of fluids engineering, and the applications part will be useful to researchers interested in the physics of flows governed by the dynamics of coherent structures. First concise textbook on Large-Eddy Simulation, a very important method in scientific computing and engineering. From the foreword to the third edition written by Charles
Meneveau: "... this meticulously assembled and significantly enlarged description of the many aspects of LES will be a most welcome addition to the bookshelves of scientists and engineers in fluid mechanics, LES practitioners, and students of turbulence in general."

This book provides a general introduction to the topic of turbulent flows. Apart from classical topics in turbulence, attention is also paid to modern topics. After studying this work, the reader will have the basic knowledge to follow current topics on turbulence in scientific literature. The theory is illustrated with a number of examples of applications, such as closure models, numerical simulations and turbulent diffusion, and experimental findings. The work also contains a number of illustrative exercises.

Review from the Textbook & Academic Authors Association that awarded the book with the 2017 Most Promising New Textbook Award: “Compared to other books in this subject, we find this one to be very up-to-date and effective at explaining this complicated subject. We certainly would highly recommend it as a text for students and practicing professionals who wish to expand their understanding of modern fluid mechanics.”

Multiphase Particulate Systems in Turbulent Flows: Fluid-Liquid and Solid-Liquid Dispersions provides methods necessary to analyze complex particulate systems and related phenomena including physical, chemical and mathematical description of fundamental processes influencing crystal size and shape, suspension rheology, interfacial area of drops and bubbles in extractors and bubble columns. Examples of mathematical model formulation for different processes taking place in such systems is shown. Discussing connections between turbulent mixing mechanisms and precipitation, it discusses influence of fine-scale structure of turbulence,
including its intermittent character, on breakage of drops, bubbles, cells, plant cell aggregates. An important aspect of the mathematical modeling presented in the book is multi-fractal, taking into account the influence of internal intermittency on different phenomena. Key Features

Provides detailed descriptions of dispersion processes in turbulent flow, interactions between dispersed entities, and continuous phase in a single volume Includes simulation models and validation experiments for liquid-liquid, gas-liquid, and solid-liquid dispersions in turbulent flows Helps reader learn formulation of mathematical models of breakage or aggregation processes using multifractal theory Explains how to solve different forms of population balance equations Presents a combination of theoretical and engineering approaches to particulate systems along with discussion of related diversity, with exercises and case studies

Modelling and Computation of Turbulent Flows has been written by one of the most prolific authors in the field of CFD. Professor of aerodynamics at SUPAERO and director of DMAE at ONERA, the author calls on both his academic and industrial experience when presenting this work. The field of CFD is strongly represented by the following corporate companies; Boeing; Airbus; Thales; United Technologies and General Electric, government bodies and academic institutions also have a strong interest in this exciting field. Each chapter has also been specifically constructed to constitute as an advanced textbook for PhD candidates working in the field of CFD, making this book essential reading for researchers, practitioners in industry and MSc and MEng students. * A
broad overview of the development and application of Computational Fluid Dynamics (CFD), with real applications to industry * A Free CD-Rom which contains computer program’s suitable for solving non-linear equations which arise in modeling turbulent flows * Professor Cebeci has published over 200 technical papers and 14 books, a world authority in the field of CFD

First published in 2000, this book provides the physical and mathematical framework necessary to understand turbulent flow.

Nowadays mathematical modeling and numerical simulations play an important role in life and natural science. Numerous researchers are working in developing different methods and techniques to help understand the behavior of very complex systems, from the brain activity with real importance in medicine to the turbulent flows with important applications in physics and engineering. This book presents an overview of some models, methods, and numerical computations that are useful for the applied research scientists and mathematicians, fluid tech engineers, and postgraduate students.

An Introduction to Turbulence and Its Measurement is an introductory text on turbulence and its measurement. It combines the physics of turbulence with measurement techniques and covers topics ranging from measurable quantities and their physical significance to the analysis of fluctuating signals, temperature and concentration measurements, and the hot-wire anemometer. Examples of turbulent flows are presented. This book is comprised
of eight chapters and begins with an overview of the physics of turbulence, paying particular attention to Newton's second law of motion, the Newtonian viscous fluid, and equations of motion. After a chapter devoted to measurable quantities, the discussion turns to some examples of turbulent flows, including turbulence behind a grid of bars, Couette flow, atmospheric and oceanic turbulence, and heat and mass transfer. The next chapter describes measurement techniques using hot wires, films, and thermistors, as well as Doppler-shift anemometers; glow-discharge or corona-discharge anemometers; pulsed-wire anemometer; and steady-flow techniques for fluctuation measurement. This monograph is intended for post-graduate students of aeronautics and fluid mechanics, but should also be readily understandable to those with a good general background in engineering fluid dynamics.

Publisher Description

Provides unique coverage of the prediction and experimentation necessary for making predictions. * Covers computational fluid dynamics and its relationship to direct numerical simulation used throughout the industry. * Covers vortex methods developed to calculate and evaluate turbulent flows. * Includes chapters on the state-of-the-art applications of research such as control of turbulence.

Providing a comprehensive grounding in the subject of turbulence, Statistical Theory and Modeling for Turbulent Flows develops both the physical insight and the mathematical framework needed to understand turbulent flow. Its scope enables the reader to become a
knowledgeable user of turbulence models; it develops analytical tools for developers of predictive tools. Thoroughly revised and updated, this second edition includes a new fourth section covering DNS (direct numerical simulation), LES (large eddy simulation), DES (detached eddy simulation) and numerical aspects of eddy resolving simulation. In addition to its role as a guide for students, Statistical Theory and Modeling for Turbulent Flows also is a valuable reference for practicing engineers and scientists in computational and experimental fluid dynamics, who would like to broaden their understanding of fundamental issues in turbulence and how they relate to turbulence model implementation. Provides an excellent foundation to the fundamental theoretical concepts in turbulence. Features new and heavily revised material, including an entire new section on eddy resolving simulation. Includes new material on modeling laminar to turbulent transition. Written for students and practitioners in aeronautical and mechanical engineering, applied mathematics and the physical sciences. Accompanied by a website housing solutions to the problems within the book.

A review of open channel turbulence, focusing especially on certain features stemming from the presence of the free surface and the bed of a river. Part one presents the statistical theory of turbulence; Part two addresses the coherent structures in open-channel flows and boundary layers.
The Fourth International Symposium on Turbulent Shear Flows took place at Karlsruhe University in
Germany. The papers presented at this Symposium encompassed a similar range to that of the previous meetings, with greater emphasis placed on experimental work, and continued a trend towards the examination of complex flows. Once again, three dimensional, recirculating and reacting flows featured strongly in the programme and were complemented by consideration of two-phase flows and discussions of both numerical and experimental techniques. The Symposium brought together some 300 participants from all over the world, and it was evident that there is a need for Turbulent Shear Flows Symposia, in order to obtain and communicate new information useful to researchers in the field of turbulent flows and of interest to engineers who design flow equipment. This volume contains 27 papers selected from more than 100 presentations at the Symposium which have been reviewed and edited before publication. Together they provide an indication of the status of current knowledge on the subjects represented at the Symposium. They are grouped into four sections, namely: • Fundamentals • Free Flows • Boundary Layers • Reacting Flows As in previous volumes in this series, each section begins with an introductory article considering the papers which follow in the broader context of available literature and current research.

A guide to the essential information needed to model
and compute turbulent flows and interpret experiments and numerical simulations Turbulent Fluid Flow offers an authoritative resource to the theories and models encountered in the field of turbulent flow. In this book, the author – a noted expert on the subject – creates a complete picture of the essential information needed for engineers and scientists to carry out turbulent flow studies. This important guide puts the focus on the essential aspects of the subject – including modeling, simulation and the interpretation of experimental data - that fit into the basic needs of engineers that work with turbulent flows in technological design and innovation. Turbulent Fluid Flow offers the basic information that underpins the most recent models and techniques that are currently used to solve turbulent flow challenges. The book provides careful explanations, many supporting figures and detailed mathematical calculations that enable the reader to derive a clear understanding of turbulent fluid flow. This vital resource: • Offers a clear explanation to the models and techniques currently used to solve turbulent flow problems • Provides an up-to-date account of recent experimental and numerical studies probing the physics of canonical turbulent flows • Gives a self-contained treatment of the essential topics in the field of turbulence • Puts the focus on the connection between the subject matter and the goals of fluids engineering • Comes with a
detailed syllabus and a solutions manual containing MATLAB codes, available on a password-protected companion website Written for fluids engineers, physicists, applied mathematicians and graduate students in mechanical, aerospace and civil engineering, Turbulent Fluid Flow contains an authoritative resource to the information needed to interpret experiments and carry out turbulent flow studies.

Table of contents

Most natural and industrial flows are turbulent. The atmosphere and oceans, automobile and aircraft engines, all provide examples of this ubiquitous phenomenon. In recent years, turbulence has become a very lively area of scientific research and application, and this work offers a grounding in the subject of turbulence, developing both the physical insight and the mathematical framework needed to express the theory. Providing a solid foundation in the key topics in turbulence, this valuable reference resource enables the reader to become a knowledgeable developer of predictive tools. This central and broad ranging topic would be of interest to graduate students in a broad range of subjects, including aeronautical and mechanical engineering, applied mathematics and the physical sciences. The accompanying solutions manual to the text also makes this a valuable teaching tool for lecturers and for practising engineers and scientists in
computational and experimental and experimental fluid dynamics.

Interdisciplinary and Advanced Topics in Science and Engineering, Volume 3: Separation of Flow presents the problem of the separation of fluid flow. This book provides information covering the fields of basic physical processes, analyses, and experiments concerning flow separation. Organized into 12 chapters, this volume begins with an overview of the flow separation on the body surface as discusses in various classical examples. This text then examines the analytical and experimental results of the laminar boundary layer of steady, two-dimensional flows in the subsonic speed range. Other chapters consider the study of flow separation on the two-dimensional body, flow separation on three-dimensional body shape and particularly on bodies of revolution. This book discusses as well the analytical solutions of the unsteady flow separation. The final chapter deals with the purpose of separation flow control to raise efficiency or to enhance the performance of vehicles and fluid machineries involving various engineering applications. This book is a valuable resource for engineers.

Beginning with a description of turbulence, its various manifestations, and a brief history of study, this text also incorporates modern perspectives on turbulence. The text also covers such topics as
intermittency and the resultant conditional sampling and averaging of turbulent flows, the role of large scale computation of the fundamental equations of fluid mechanics in providing information on variables, and asymptotic methods which are used to expose important features of turbulent flows. Meaningful exercises are included in every section.

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.

Analysis of Turbulent Boundary Layers focuses on turbulent flows meeting the requirements for the boundary-layer or thin-shear-layer approximations. Its approach is devising relatively fundamental, and often subtle, empirical engineering correlations, which are then introduced into various forms of describing equations for final solution. After introducing the topic on turbulence, the book examines the conservation equations for compressible turbulent flows, boundary-layer equations, and general behavior of turbulent boundary layers. The latter chapters describe the CS method for calculating two-dimensional and axisymmetric laminar and turbulent boundary layers. This book will be useful to readers who have advanced knowledge in fluid mechanics, especially to engineers who study the important problems of design.

Reissue of Batchelor's classic text on the theory of turbulent motion, first published by CUP in 1953. Out of print for many years, it continues to be widely referred to in the professional literature of fluid mechanics.

By presenting current theory on flow prediction, this book addresses the needs of experienced practitioners and researchers in fluid dynamics.

Basics of Engineering Turbulence introduces flow turbulence
to engineers and engineering students who have a fluid dynamics background, but do not have advanced knowledge on the subject. It covers the basic characteristics of flow turbulence in terms of its many scales. The author uses a pedagogical approach to help readers better understand the fundamentals of turbulence scales, especially how they are derived through the order of magnitude analysis. This book is intended for those who have an interest in flowing fluids. It provides some background, though of limited scope, on everyday flow turbulence, especially in engineering applications. The book begins with the ‘basics’ of turbulence which is necessary for any reader being introduced to the subject, followed by several examples of turbulence in engineering applications. This overall approach gives readers all they need to grasp both the fundamentals of turbulence and its applications in practical instances. Focuses on the basics of turbulence for applications in engineering and industrial settings Provides an understanding of concepts that are often challenging, such as energy distribution among the turbulent structures, the effective diffusivity, and the theory behind turbulence scales Offers a user-friendly approach with clear-and-concise explanations and illustrations, as well as end-of-chapter problems

The simulation of technological and environmental flows is very important for many industrial developments. A major challenge related to their modeling is to involve the characteristic turbulence that appears in most of these flows. The traditional way to tackle this question is to use deterministic equations where the effects of turbulence are directly parametrized, i. e. , assumed as functions of the variables considered. However, this approach often becomes problematic, in particular if reacting flows have to be simulated. In many cases, it turns out that appropriate approximations for the closure of deterministic equations are
simply unavailable. The alternative to the traditional way of modeling turbulence is to construct stochastic models which explain the random nature of turbulence. The application of such models is very attractive: one can overcome the closure problems that are inherent to deterministic methods on the basis of relatively simple and physically consistent models. Thus, from a general point of view, the use of stochastic methods for turbulence simulations seems to be the optimal way to solve most of the problems related to industrial flow simulations. However, it turns out that this is not as simple as it looks at first glance. The first question concerns the numerical solution of stochastic equations for flows of environmental and technological interest. To calculate industrial flows, one often has to consider a number of grid cells that is of the order of 100.
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