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Theory of Concentrated Vortices

AN INTRODUCTION



Springer

Theory Of Concentrated Vortices An Introduction

Kam Tim Chau



Theory Of Concentrated Vortices An Introduction:

Theory of Concentrated Vortices S. V. Alekseenko, P. A. Kuibin, V. L. Okulov, 2007-08-29 Vortex motion is one of the basic states of a flowing continuum. Interestingly, in many cases vorticity is space localized, generating concentrated vortices. Vortex filaments having extremely diverse dynamics are the most characteristic examples of such vortices. Notable examples in particular include such phenomena as self-induced motion, various instabilities, wave generation, and vortex breakdown. These effects are typically manifested as a spiral or helical configuration of a vortex axis. Many publications in the field of hydrodynamics are focused on vortex motion and vortex effects. Only a few books are devoted entirely to vortices, and even fewer to concentrated vortices. This work aims to highlight the key problems of vortex formation and behavior. The experimental observations of the authors, the impressive visualizations of concentrated vortices, including helical and spiral, and pictures of vortex breakdown, primarily motivated the authors to begin this work. Later, the approach based on the helical symmetry of swirl flows was developed, allowing the authors to deduce simplified mathematical models and to describe many vortex phenomena. The major portion of this book consists of theoretical studies of vortex dynamics. The final chapter presents detailed results of experimentally observed concentrated vortices that provide the basis for analysis and stimulate development of vortex theory. The mathematical description of the dynamics of concentrated vortices is hindered by the requirement to consider three-dimensional and nonlinear effects, singularity, and various instabilities. For each particular problem, very different coordinate frames and equation systems must be used.

Introduction to the Theory of Flow Machines Albert Betz, 2014-05-16 Introduction to the Theory of Flow Machines details the fundamental processes and the relations that have a significant influence in the operating mechanism of flow machines. The book first covers the general consideration in flow machines such as pressure, stress, and cavitation. In the second chapter, the text deals with ducts; this chapter discusses the general remarks, types of flow, and mixing process. Next, the book tackles the types of cascades along with its concerns. The closing chapter covers the flow machine and its components such as turbine wheels, engines, and propellers. The text will be of great use to mechanical engineers and technicians.

Wind Turbine Aerodynamics and Vorticity-Based Methods Emmanuel Branlard, 2017-04-05 The book introduces the fundamentals of fluid mechanics, momentum theories, vortex theories, and vortex methods necessary for the study of rotors, aerodynamics, and wind turbines. Aerodynamics, in particular, rotor theories are presented in a great level of details at the beginning of the book. These theories include the blade element theory, the Kutta-Joukowski theory, the momentum theory, and the blade element momentum method. A part of the book is dedicated to the description and implementation of vortex methods. The remaining of the book focuses on the study of wind turbine aerodynamics using vortex theory analyses or vortex methods. Examples of vortex theory applications are optimal rotor design, tip loss corrections, yaw models, and dynamic inflow models. Historical derivations and recent extensions of the models are presented. The cylindrical vortex model is another example of a simple analytical vortex

model presented in this book This model leads to the development of different BEM models and it is also used to provide the analytical velocity field upstream of a turbine or a wind farm under aligned or yawed conditions Different applications of numerical vortex methods are presented Numerical methods are used for instance to investigate the influence of a wind turbine on the incoming turbulence Sheared inflows and aero elastic simulations are investigated using vortex methods for the first time Many analytical flows are derived in details vortex rings vortex cylinders Hill s vortex vortex blobs etc They are used throughout the book to devise simple rotor models or to validate the implementation of numerical methods Several Matlab programs are provided to ease some of the most complex implementations

Transfer of Substance in Vortex and Wave Flows in One-Component and Multi-component Environment Tatiana Chaplina,2023-06-02 The study of vortex and wave flows is one of the traditional problems of fluid mechanics the practical importance of which has grown significantly in recent years Consideration of the processes of substance transfer in such complex systems as natural water bodies is fraught with many difficulties of a methodological and fundamental nature the extreme complexity of conducting a full scale experiment the complexity and variability of hydrophysical fields of the ocean and hydrometeorological conditions during research and also in some cases the complexity and the variability of the properties of the transferred substance In this connection it is of particular interest to study the transfer of markers in stationary vortex and wave flows which can form in laboratory facilities with constant external conditions In this case it is possible to avoid problems associated with the spatial and temporal variability of natural sources of vortex formations and directly trace the dependence of the characteristic flow parameters or the characteristics of the movement of solid or other objects placed during This book presents the results of experimental and theoretical studies of the dynamics and structure of multiphase vortex flows and the nature of the transfer of three types of markers solid state ice plastic immiscible with water oil oil diesel and soluble aniline dyes uranyl The results will be important first of all for a better understanding of the behavior of various impurities in the circulation flows and more accurate prediction of their distribution in natural conditions in a stratified hydrosphere and atmosphere

An Introduction to the Theory of Aeroelasticity Y C Fung,2008-10-17 Geared toward advanced undergraduates and graduate students this outstanding text surveys aeroelastic problems their historical background basic physical concepts and the principles of analysis

Applications of Differential Equations in Engineering and Mechanics Kam Tim Chau,2019-01-08 This second of two comprehensive reference texts on differential equations continues coverage of the essential material students they are likely to encounter in solving engineering and mechanics problems across the field alongside a preliminary volume on theory This book covers a very broad range of problems including beams and columns plates shells structural dynamics catenary and cable suspension bridge nonlinear buckling transports and waves in fluids geophysical fluid flows nonlinear waves and solitons Maxwell equations Schrodinger equations celestial mechanics and fracture mechanics and dynamics The focus is on the mathematical technique for solving the differential equations involved

All readers who are concerned with and interested in engineering mechanics problems climate change and nanotechnology will find topics covered in this book providing valuable information and mathematics background for their multi disciplinary research and education

Progress in Material Science and Engineering Igor V. Minin, Sergey Uchaikin, Alexander Rogachev, Oldřich Starý, 2021-04-05 This book presents recent developments and new directions in advanced control systems together with new theoretical findings industrial applications and case studies on complex engineering systems sensors materials science medicine non destructive testing and quality assurance With a breakthrough in technology the modern world is on the verge of new industrial revolution at the stage of digital transformation when innovations from various industries collaborate and change each other Innovations are the basis of the developed products and technologies They are used to create new developments and advances as well as improve the state of the art processes However the digital transformation both opens new opportunities and introduces additional risks The successful industrial modernization is characterized by the combination of stable manufacturing regulatory structure with the new technological approaches of the Fourth Industrial Revolution Developments and advances of School of Non Destructive Testing relate to technological trends in the areas of systems decision making and control in the fields of aerospace systems robotics and automation power systems and sensor networks

Processes in GeoMedia—Volume IV Tatiana Chaplina, 2021-11-15 This book corresponds to the fourth volume of the series focused on Processes in GeoMedia and their research on the dynamic of natural systems geosphere hydrosphere atmosphere and their interactions the human contribution to naturally occurring processes are among the most urgent and essential scientific problems The widespread introduction of computer technology has allowed calculating complex phenomena previously unavailable for analysis The creation and improvement of a new generation of geophysical instruments remote observing systems based on the ship aircraft and satellite allow obtaining a large amount of data to reflect the broad picture of the processes objectively The articles included in this book also reflect a critical position in laboratory modeling of research in geo environments and testing

Proceedings of the 5th International Conference on Jets, Wakes and Separated Flows (ICJWSF2015) Antonio Segalini, 2016-07-18 This volume collects various contributions from the 5th International Conference on Jets Wakes and Separated Flows ICJWSF2015 that took place in Stockholm during June 2015 Researchers from all around the world presented their latest results concerning fundamental and applied aspects of fluid dynamics With its general character the conference embraced many aspects of fluid dynamics such as shear flows multiphase flows and vortex flows for instance The structure of the present book reflects the variety of topics treated within the conference i e Jets Wakes Separated flows Vehicle aerodynamics Wall bounded and confined flows Noise Turbomachinery flows Multiphase and reacting flows Vortex dynamics Energy related flows and a section dedicated to Numerical analyses

International Scientific Conference Energy Management of Municipal Facilities and Sustainable Energy Technologies EMMFT 2018 Vera Murgul, Marco Pasetti, 2019-05-27 This book presents a collection of the latest studies on

and applications for the sustainable development of urban energy systems Based on the 20th International Scientific Conference on Energy Management of Municipal Facilities and Sustainable Energy Technologies held in Voronezh and Samara Russia from 10 to 13 December 2018 it addresses a range of aspects including energy modelling materials and applications in buildings heating ventilation and air conditioning systems renewable energy technologies photovoltaic biomass and wind energy electrical energy storage energy management and life cycle assessment in urban systems and transportation The book is intended for a broad readership from policymakers tasked with evaluating and promoting key enabling technologies efficiency policies and sustainable energy practices to researchers and engineers involved in the design and analysis of complex systems Physical and Mathematical Modeling of Earth and Environment Processes (2018) V. I. Karev, Dmitry Klimov, Konstantin Pokazeev, 2019-03-24 This book entitled Physical and Mathematical Modeling of Earth and Environment Processes is the result of a collaborative work after the 4th international scientific youth forum held at the IPMech RAS on November 13 2018 The book includes theoretical and experimental studies of processes in the atmosphere oceans the lithosphere and their interaction environmental issues problems of human impact on the environment methods of geophysical research A special focus is given to the extraction of hydrocarbon resources including unconventional sources This book also focuses on new approaches to the development of hydrocarbon fields very important in today's geopolitical conditions The book presents new results of the experimental and theoretical modeling of deformation fracture and filtration processes in the rocks in connection with issues of creating scientific fundamentals for new hydrocarbon production technologies **An Introduction to Theoretical and Computational Aerodynamics** Jack Moran, 2013-04-22 Concise text discusses properties of wings and airfoils in incompressible and primarily inviscid flow viscous flows panel methods finite difference methods and computation of transonic flows past thin airfoils 1984 edition *High Angle of Attack Aerodynamics* Josef Rom, 2012-12-06 The aerodynamics of aircraft at high angles of attack is a subject which is being pursued diligently because the modern agile fighter aircraft and many of the current generation of missiles must perform well at very high incidence near and beyond stall However a comprehensive presentation of the methods and results applicable to the studies of the complex aerodynamics at high angle of attack has not been covered in monographs or textbooks This book is not the usual textbook in that it goes beyond just presenting the basic theoretical and experimental know how since it contains reference material to practical calculation methods and technical and experimental results which can be useful to the practicing aerospace engineers and scientists It can certainly be used as a text and reference book for graduate courses on subjects related to high angles of attack aerodynamics and for topics related to three dimensional separation in viscous flow courses In addition the book is addressed to the aerodynamicist interested in a comprehensive reference to methods of analysis and computations of high angle of attack flow phenomena and is written for the aerospace scientist and engineer who is familiar with the basic concepts of viscous and inviscid flows and with computational methods used in fluid dynamics

High Angle of Attack Aerodynamics Mr. Rohit Manglik, 2024-07-12 EduGorilla Publication is a trusted name in the education sector committed to empowering learners with high quality study materials and resources Specializing in competitive exams and academic support EduGorilla provides comprehensive and well structured content tailored to meet the needs of students across various streams and levels Introduction to Vortex Dynamics, 1986 Thermophysics and Aeromechanics, 2007 Theoretical and Computational Aerodynamics Tapan K. Sengupta, 2014-11-17 Aerodynamics has seen many developments due to the growth of scientific computing which has caused the design cycle time of aerospace vehicles to be heavily reduced Today computational aerodynamics appears in the preliminary step of a new design relegating costly time consuming wind tunnel testing to the final stages of design Theoretical and Computational Aerodynamics is aimed to be a comprehensive textbook covering classical aerodynamic theories and recent applications made possible by computational aerodynamics It starts with a discussion on lift and drag from an overall dynamical approach and after stating the governing Navier Stokes equation covers potential flows and panel method Low aspect ratio and delta wings including vortex breakdown are also discussed in detail and after introducing boundary layer theory computational aerodynamics is covered for DNS and LES Other topics covered are on flow transition to analyse NLF airfoils bypass transition streamwise and cross flow instability over swept wings viscous transonic flow over airfoils low Reynolds number aerodynamics high lift devices and flow control Key features Blends classical theories of incompressible aerodynamics to panel methods Covers lifting surface theories and low aspect ratio wing and wing body aerodynamics Presents computational aerodynamics from first principles for incompressible and compressible flows Covers unsteady and low Reynolds number aerodynamics Includes an up to date account of DNS of airfoil aerodynamics including flow transition for NLF airfoils Contains chapter problems and illustrative examples Accompanied by a website hosting problems and a solution manual Theoretical and Computational Aerodynamics is an ideal textbook for undergraduate and graduate students and is also aimed to be a useful resource book on aerodynamics for researchers and practitioners in the research labs and the industry **Vortical Flows** Jie-Zhi Wu, Hui-Yang Ma, Ming-De Zhou, 2015-06-23 This book is a comprehensive and intensive book for graduate students in fluid dynamics as well as scientists engineers and applied mathematicians Offering a systematic introduction to the physical theory of vortical flows at graduate level it considers the theory of vortical flows as a branch of fluid dynamics focusing on shearing process in fluid motion measured by vorticity It studies vortical flows according to their natural evolution stages from being generated to dissipated As preparation the first three chapters of the book provide background knowledge for entering vortical flows The rest of the book deals with vortices and vortical flows following their natural evolution stages Of various vortices the primary form is layer like vortices or shear layers and secondary but stronger form is axial vortices mainly formed by the rolling up of shear layers Problems are given at the end of each chapter and Appendix some for helping understanding the basic theories and some involving specific applications but the emphasis of both is always on physical

thinking *Aircraft Wake Turbulence and Its Detection* John Olsen, 2012-12-06 The combination of increasing airport congestion and the advent of large transports has caused increased interest in aircraft wake turbulence. A quantitative understanding of the interaction between an aircraft and the vortex wake of a preceding aircraft is necessary for planning future high density air traffic patterns and control systems. The nature of the interaction depends on both the characteristics of the following aircraft and the characteristics of the wake. Some of the questions to be answered are: What determines the full characteristics of the vortex wake? What properties of the following aircraft are important? What is the role of pilot response? How are the wake characteristics related to the generating aircraft parameters? How does the wake disintegrate and where? Many of these questions were addressed at this first Aircraft Wake Turbulence Symposium sponsored by the Air Force Office of Scientific Research and The Boeing Company. Workers engaged in aerodynamic research, airport operations and instrument development came from several countries to present their results and exchange information. The new results from the meeting provide a current picture of the state of the knowledge on vortex wakes and their interactions with other aircraft. Phenomena previously regarded as mere curiosities have emerged as important tools for understanding or controlling vortex wakes. The new types of instability occurring within the wake may one day be used for promoting early disintegration of the hazardous twin vortex structure. **Studies of Vortex Dominated Flows** M.Y. Hussaini, M.D.

Salas, 2013-06-29 From the astrophysical scale of a swirling spiral galaxy through the geophysical scale of a hurricane down to the subatomic scale of elementary particles, vortical motion and vortex dynamics have played a profound role in our understanding of the physical world. Kuchemann referred to vortex dynamics as the sinews and muscles of fluid motion. In order to update our understanding of vortex dominated flows, NASA Langley Research Center and the Institute for Computer Applications in Science and Engineering (ICASE) conducted a workshop during July 9-11, 1985. The subject was broadly divided into five overlapping topics: vortex dynamics, vortex breakdown, massive separation, vortex shedding from sharp leading edges and conically separated flows. Some of the experts in each of these areas were invited to provide an overview of the subject. This volume is the proceedings of the workshop and contains the latest theoretical, numerical and experimental work in the above mentioned areas. Leibovich, Widnall, Moore and Sirovich discussed topics on the fundamentals of vortex dynamics, while Keller and Hafez treated the problem of vortex breakdown phenomena. The contributions of Smith, Davis and LeBalleur were in the area of massive separation and inviscid viscous interactions, while those of Cheng, Hoeijmakers and Munnan dealt with sharp leading edge vortex flows, and Fiddes and Marconi represented the category of conical separated flows.

Theory Of Concentrated Vortices An Introduction Book Review: Unveiling the Magic of Language

In an electronic digital era where connections and knowledge reign supreme, the enchanting power of language has are more apparent than ever. Its power to stir emotions, provoke thought, and instigate transformation is really remarkable. This extraordinary book, aptly titled "**Theory Of Concentrated Vortices An Introduction**," published by a highly acclaimed author, immerses readers in a captivating exploration of the significance of language and its profound effect on our existence. Throughout this critique, we will delve into the book is central themes, evaluate its unique writing style, and assess its overall influence on its readership.

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