A. V. Boiko · G. R. Grek
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# The Origin of Turbulence in Near-Wall Flows

Springer

# Origin Of Turbulence In Nearwall Flows

Andrey V. Boiko,Alexander V. Dovgal,Genrih R. Grek,Victor V. Kozlov

**Origin Of Turbulence In Nearwall Flows:**

**The Origin of Turbulence in Near-Wall Flows** A.V. Boiko,2002-01-22 This book presents a comprehensive survey of the origin of turbulence in near wall shear layer flows Instead of going too far into details modern approaches to the problem are discussed in a conceptual treatment The transition from laminar to turbulent flows in shear layers is described including the generation of flow perturbations their amplification and development the breakdown of the initial laminar state and transformation to a turbulent regime This book also presents new approaches to boundary layer transitions with strong external flow perturbations and to the prediction and control of the presented near wall transitions to turbulence This book is addressed to researchers lecturers and students in engineering physics and mathematics Near-wall Turbulent Flows Ronald M. C. So,Charles G. Speziale,Brian Edward Launder,1993 Knowledge of near wall turbulence from experimental theoretical and numerical sources is accumulating at an ever increasing rate An overview of the latest important developments is reported and discussed in depth in this volume with the goal of stimulating closer dialogue between researchers in all areas of near wall turbulence The full text of 95 contributed papers cover a broad range of topics in near wall turbulent flows that includes boundary layers coherent structures drag reduction experimental methods high speed flows numerical simulations transition and turbulent modeling The innovativeness of the contributions demonstrates that near wall turbulence remains a vital and dynamically evolving field with important technological consequences for the future

**Physics of Transitional Shear Flows** Andrey V. Boiko,Alexander V. Dovgal,Genrih R. Grek,Victor V. Kozlov,2011-09-15 Starting from fundamentals of classical stability theory an overview is given of the transition phenomena in subsonic wall bounded shear flows At first the consideration focuses on elementary small amplitude velocity perturbations of laminar shear layers i e instability waves in the simplest canonical configurations of a plane channel flow and a flat plate boundary layer Then the linear stability problem is expanded to include the effects of pressure gradients flow curvature boundary layer separation wall compliance etc related to applications Beyond the amplification of instability waves is the non modal growth of local stationary and non stationary shear flow perturbations which are discussed as well The volume continues with the key aspect of the transition process that is receptivity of convectively unstable shear layers to external perturbations summarizing main paths of the excitation of laminar flow disturbances The remainder of the book addresses the instability phenomena found at late stages of transition These include secondary instabilities and nonlinear features of boundary layer perturbations that lead to the final breakdown to turbulence Thus the reader is provided with a step by step approach that covers the milestones and recent advances in the laminar turbulent transition Special aspects of instability and transition are discussed through the book and are intended for research scientists while the main target of the book is the student in the fundamentals of fluid mechanics Computational guides recommended exercises and PowerPoint multimedia notes based on results of real scientific experiments supplement the monograph These are especially helpful for the neophyte to obtain a

solid foundation in hydrodynamic stability To access the supplementary material go to extras springer com and type in the ISBN for this volume IUTAM Symposium on Simulation and Identification of Organized Structures in Flows J.N. Sørensen,E.J. Hopfinger,N. Aubry,2012-12-06 The dynamics of transitional and turbulent flows is often dominated by organized structures with a life time much longer than a characteristic time scale of the surrounding small scale turbulence Organized structures may appear as secondary flows as a result of an instability but they persist in turbulent flows They manifest themselves as eddies or localized vortices and play an important role in e g mixing and transport processes Al though the existence of organized structures has been revealed by many experiments and by numerical simulations they are somewhat elusive as there is no consensus on how to define them and technically how to detect them In recent years several identification tools for analysing complex flows have been developed These tools include various versions of the Proper Orthog onal Decomposition POD technique wavelet transforms pattern recogni tion etc At the same time improvements in experimental techniques have made available data that further necessitate efficient detection methods A prominent example is the Particle Image Velocimetry PIV technique from which complex spatio temporal flow data can be obtained An interesting feature of some of the identification techniques is that they form the basis for reduced models by which dynamical processes can be studied in details From studies of dissipative dynamical systems it has been revealed that in phase space transitional and turbulent flows can be identified by their low dimensional behaviour Thus employing data from experiments or nu merical simulations to form modes residing on finite dimensional attractors may dramatically reduce computing costs

**Closure Strategies for Turbulent and Transitional Flows** Brian Edward Launder,N. D. Sandham,2002-02-21 Publisher Description **IUTAM Symposium on Dynamics of Slender Vortices** Egon Krause,K. Gersten,2012-12-06 The decision of the General Assembly of the International Union of Theoretical and Applied Mechanics to organize a Symposium on Dynamics of Slender Vortices was greeted with great enthusiasm The acceptance of the proposal forwarded by the Deutsches Komitee fiir Mechanik DEKOMECH signalized that there was a need for discussing the topic chosen in the frame the IUTAM Symposia offer Also the location of the symposium was suitably chosen It was decided to hold the symposium at the RWTH Aachen where years ago Theodore von Karman had worked on problems related to those to be discussed now anew It was clear from the beginning of the planning that the symposium could only be held in the von Karman Auditorium ofthe Rheinisch Westfalische Technische Hochschule Aachen a building named after him The symposium was jointly organized by the editors of this volume strongly supported by the local organizing committee The invitations of the scientific committee brought together scientists actively engaged in research on the dynamics of slender vortices It was the aim of the committee to have the state of the art summarized and also to have the latest results of specific problems investigated communicated to the participants of the symposium The topics chosen were asymptotic theories numerical methods vor tices in shear layers interaction of vortices vortex breakdown vortex sound and aircraft and helicopter vortices **Turbulent**

**Flow** Peter S. Bernard,James M. Wallace,2002-10-31 Diese Einf hrung in die Theorie der turbulenten Str mungen wendet sich in erster Linie an fortgeschrittene Studenten Ingenieure in der Praxis werden den Band aber auch gern als Nachschlagewerk benutzen Physikalische Grundlagen Analysenverfahren Simulationen Messmethoden und nicht zuletzt einschl gige Vorhersagealgorithmen werden so erkl rt dass der Leser lernt selbst geeignete Methoden f r den praktischen Einsatz auszuw hlen Unter anderem finden Sie Ausf hrungen zu neuen Wirbelmethoden mit denen man turbulente Str mungen berechnen und auswerten kann sowie zur Steuerung der Turbulenz in verschiedenen realen Situationen

**Handbook of Fluid Dynamics** Richard W. Johnson,2016-04-06 Handbook of Fluid Dynamics offers balanced coverage of the three traditional areas of fluid dynamics theoretical computational and experimental complete with valuable appendices presenting the mathematics of fluid dynamics tables of dimensionless numbers and tables of the properties of gases and vapors Each chapter introduces a different fluid dynamics topic discusses the pertinent issues outlines proven techniques for addressing those issues and supplies useful references for further research Covering all major aspects of classical and modern fluid dynamics this fully updated Second Edition Reflects the latest fluid dynamics research and engineering applications Includes new sections on emerging fields most notably micro and nanofluidics Surveys the range of numerical and computational methods used in fluid dynamics analysis and design Expands the scope of a number of contemporary topics by incorporating new experimental methods more numerical approaches and additional areas for the application of fluid dynamics Handbook of Fluid Dynamics Second Edition provides an indispensable resource for professionals entering the field of fluid dynamics The book also enables experts specialized in areas outside fluid dynamics to become familiar with the field IUTAM Symposium on Mechanics of Passive and Active Flow Control G.E.A. Meier,P.R. Viswanath,2012-12-06 The call for papers for the rUTAM Symposium on Mechanics of Passive and Active Flow Control brought an overwhelming response of applications for contributions Fi nally 12 invited lectures 48 papers and 23 posters were selected by thc Scientific Com mittee to be presented in the conference 58 papers are published in this volume Due to the limited number of pages available poster presentations could not be considered for publication The editors would like to thank all the members of the Scientific Committee for their very valuable assistance The papers presented at the rUT AM Symposium were classified under three groups de voted to Passive Control Methods Active Control Methods and Control Concepts This was done to contrast at first between the passive techniques where the control power is mainly supplied by the flow itself and the active techniques where the power is pro vided by external sources the third group was devoted to control concepts for presenting methods of control theory and new techniques of flow control **Proceedings of the Cambridge Unsteady Flow Symposium 2024** James C. Tyacke,Nagabhushana Rao Vadlamani,2024-12-02 This book contains the proceedings of the Cambridge Unsteady Flow Symposium held on 4 5 March 2024 at the University of Cambridge The book brings together internationally leading experts in computational fluid dynamics CFD and promotes discussions on numerical methods for

unsteady flows The book covers a wide range of topics related to CFD including but not limited to large eddy simulations unsteady flows in aerospace high order methods and mesh generation **Fluid-Structure-Sound Interactions and Control** Yu Zhou,A.D. Lucey,Yang Liu,Lixi Huang,2015-12-17 These proceedings primarily focus on advances in the theory experiments and numerical simulations of turbulence in the contexts of flow induced vibration and noise as well as their control Fluid related structural vibration and noise problems are often encountered in many engineering fields increasingly making them a cause for concern The FSSIC conference held on 5 9 July 2015 in Perth featured prominent keynote speakers such as John Kim Nigel Peake Song Fu and Colin Hansen as well as talks on a broad range of topics turbulence fluid structure interaction fluid related noise and the control management aspects of these research areas many of which are clearly interdisciplinary in nature It provided a forum for academics scientists and engineers working in all branches of Fluid Structure Sound Interactions and Control FSSIC to exchange and share the latest developments ideas and advances bringing them together researchers from East and West to push forward the frontiers of FSSIC ensuring that the proceedings will be of interest to a broad engineering community *Fluid Flow Phenomena* Paolo Orlandi,2012-12-06 This book deals with the simulation of the incompressible Navier Stokes equations for laminar and turbulent flows The book is limited to explaining and employing the finite difference method It furnishes a large number of source codes which permit to play with the Navier Stokes equations and to understand the complex physics related to fluid mechanics Numerical simulations are useful tools to understand the complexity of the flows which often is difficult to derive from laboratory experiments This book then can be very useful to scholars doing laboratory experiments since they often do not have extra time to study the large variety of numerical methods furthermore they cannot spend more time in transferring one of the methods into a computer language By means of numerical simulations for example insights into the vorticity field can be obtained which are difficult to obtain by measurements This book can be used by graduate as well as undergraduate students while reading books on theoretical fluid mechanics it teaches how to simulate the dynamics of flow fields on personal computers This will provide a better way of understanding the theory Two chapters on Large Eddy Simulations have been included since this is a methodology that in the near future will allow more universal turbulence models for practical applications The direct simulation of the Navier Stokes equations DNS is simple by finite differences that are satisfactory to reproduce the dynamics of turbulent flows A large part of the book is devoted to the study of homogeneous and wall turbulent flows In the second chapter the elementary concept of finite difference is given to solve parabolic and elliptical partial differential equations In successive chapters the 1D 2D and 3D Navier Stokes equations are solved in Cartesian and cylindrical coordinates Finally Large Eddy Simulations are performed to check the importance of the subgrid scale models Results for turbulent and laminar flows are discussed with particular emphasis on vortex dynamics This volume will be of interest to graduate students and researchers wanting to compare experiments and numerical simulations and to workers in the mechanical and aeronautic industries **Applied**

**Mechanics Reviews** ,1986 CFD Applications in Nuclear Engineering Wenxi Tian,Victor Petrov,Yixiang Liao,Mingjun Wang,Nejdet Erkan,2023-08-21 High fidelity nuclear reactor thermal hydraulic simulations are a hot research topic in the development of nuclear engineering technology The three dimensional Computational Fluid Dynamics CFD and Computational Multi phase Fluid Dynamics CMFD methods have attracted significant attention in predicting single phase and multi phase flows under steady state or transient scenarios in the field of nuclear reactor engineering Compared with three dimensional thermal hydraulic methods the traditional one dimensional system analysis method contains inherent defects in the required accuracy and spatial resolution for a number of important nuclear reactor thermal hydraulic phenomena At present the CFD method has been widely adopted in the nuclear industry across both light water reactors and liquid metal cooled fast reactors providing an effective solution for complex issues of thermal hydraulic analysis However the CFD method employs empirical models for turbulence simulation heat transfer multi phase interaction and chemical reactions Such models must be validated before they can be used with confidence in nuclear reactor applications In addition user practice guidelines play a critical role in achieving reliable results from CFD simulations **Scientific and Technical Aerospace Reports** ,1994 Particles in Wall-Bounded Turbulent Flows: Deposition, Re-Suspension and Agglomeration Jean-Pierre Minier,Jacek Pozorski,2016-07-26 The book presents an up to date review of turbulent two phase flows with the dispersed phase with an emphasis on the dynamics in the near wall region New insights to the flow physics are provided by direct numerical simuation and by fine experimental techniques Also included are models of particle dynamics in wall bounded turbulent flows and a description of particle surface interactions including muti layer deposition and re suspension Physics of Granular Suspensions Marco Mazzuoli,Laurent Lacaze,2024-05-31 This book provides graduate students and scientists with fundamental knowledge on the mechanics of granular suspensions as well as on the mathematical and numerical techniques that can be adopted to investigate geophysical flows To this end three formidably complex problems sediment transport flow like landslide inception and gravity currents are considered The reader will find a thorough combination of elements of fluid and solid mechanics rheology geotechnics geomorphology civil and coastal engineering The first part of the book introduces the problem of granular suspensions from the mathematical viewpoint focusing on issues that characterise geophysical flows such as turbulence the effects of inter particle contacts and strong velocity gradients In the second part different models that were successfully used to investigate the mechanics of granular suspensions in environmental flows are presented *Multiphase Flow Handbook, Second Edition* Efstathios Michaelides,Clayton T. Crowe,John D. Schwarzkopf,2016-10-26 The Multiphase Flow Handbook Second Edition is a thoroughly updated and reorganized revision of the late Clayton Crowe s work and provides a detailed look at the basic concepts and the wide range of applications in this important area of thermal fluids engineering Revised by the new editors Efstathios E Stathis Michaelides and John D Schwarzkopf the new Second Edition begins with two chapters covering fundamental concepts and

methods that pertain to all the types and applications of multiphase flow The remaining chapters cover the applications and engineering systems that are relevant to all the types of multiphase flow and heat transfer The twenty one chapters and several sections of the book include the basic science as well as the contemporary engineering and technological applications of multiphase flow in a comprehensive way that is easy to follow and be understood The editors created a common set of nomenclature that is used throughout the book allowing readers to easily compare fundamental theory with currently developing concepts and applications With contributed chapters from sixty two leading experts around the world the Multiphase Flow Handbook Second Edition is an essential reference for all researchers academics and engineers working with complex thermal and fluid systems **Turbulent Flows** G. Biswas,V. Eswaran,2002 This book allows readers to tackle the challenges of turbulent flow problems with confidence It covers the fundamentals of turbulence various modeling approaches and experimental studies The fundamentals section includes isotropic turbulence and anistropic turbulence turbulent flow dynamics free shear layers turbulent boundary layers and plumes The modeling section focuses on topics such as eddy viscosity models standard K E Models Direct Numerical Stimulation Large Eddy Simulation and their applications The measurement of turbulent fluctuations experiments in isothermal and stratified turbulent flows are explored in the experimental methods section Special topics include modeling of near wall turbulent flows compressible turbulent flows and more **Energy Research Abstracts** ,1990

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## Origin Of Turbulence In Nearwall Flows Introduction

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