Theory And Computation Of Hydrodynamic Stability

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the study of hydrodynamic stability is fundamental to many subjects ranging from geophysics and meteorology through to engineering design this treatise covers both classical and modern aspects of the subject systematically developing it from the simplest physical problems then progressing chapter by chapter to the most complex considering linear and nonlinear situations and analysing temporal and spatial stability the authors examine each problem both analytically and

numerically many chapters end with an appendix outlining relevant numerical techniques all relevant fluid flows are treated including those where the fluid may be compressible or those from geophysics or those that require salient geometries for description details of initial value problems are explored equally with those of stability as a result the early transient period as well as the asymptotic fate for perturbations for a flow can be assessed the text is enriched with many exercises copious illustrations and an extensive bibliography and the result is a book that can be used with courses on hydrodynamic stability or as an authoritative reference for researchers

publisher description

the instability of fluid flows is a key topic in classical fluid mechanics because it has huge repercussions for applied disciplines such as chemical engineering hydraulics aeronautics and geophysics this modern introduction is written for any student researcher or practitioner working in the area for whom an understanding of hydrodynamic instabilities is essential based on a decade s experience of teaching postgraduate students in fluid dynamics this book brings the subject to life by emphasizing the physical mechanisms involved the theory of dynamical systems provides the basic structure of the exposition together with asymptotic methods wherever possible charru discusses the phenomena in terms of characteristic scales and dimensional analysis the book includes numerous experimental studies with references to videos and multimedia material as well as over 150 exercises which introduce the reader to new problems

hydrodynamic stability is of fundamental importance in fluid mechanics and is concerned with the problem of transition from laminar to turbulent flow drazin and reid emphasise throughout the ideas involved the physical mechanisms the methods used and the results obtained and wherever possible relate the theory to both experimental and numerical results a distinctive feature of the book is the large number of problems it contains these problems not only provide exercises for students but also provide many additional results in a concise form this new edition of this celebrated introduction differs principally by the inclusion of detailed solutions for those exercises and by the addition of a foreword by professor j w miles

the great number of varied approaches to hydrodynamic stability theory appear as a bulk of results whose classification and discussion are well known in the literature several books deal with one aspect of this theory alone e g the linear case the influence of temperature and magnetic field large classes of globally stable fluid motions etc the aim of this book is to provide a complete mathe matical treatment of hydrodynamic stability theory by combining the early results of engineers and applied mathematicians with the recent achievements of pure mathematicians in order to ensure a more operational frame to this theory i have briefly outlined the main results concerning the stability of the simplest types of flow i have attempted several definitions of the stability of fluid flows with due

consideration of the connections between them on the other hand as the large number of initial and boundary value problems in hydrodynamic stability theory requires appropriate treat ments most of this book is devoted to the main concepts and methods used in hydrodynamic stability theory open problems are expressed in both mathematical and physical terms

this book is a complete revision of the part of monin yaglom s famous two volume work statistical fluid mechanics mechanics of turbulence that deals with the theory of laminar flow instability and transition to turbulence it includes the considerable advances in the subject that have been made in the last 15 years or so it is intended as a textbook for advanced graduate courses and as a reference for research students and professional research workers the first two chapters are an introduction to the mathematics and the experimental results for the instability of laminar or inviscid flows to infinitesimal in practice small disturbances the third chapter develops this linear theory in more detail and describes its application to particular problems chapters 4 and 5 deal with instability to finite amplitude disturbances much of the material has previously been available only in research papers

this work has been selected by scholars as being culturally important and is part of the knowledge base of civilization as we know it this work is in the public domain in the united states of america and possibly other nations within the united states you may freely copy and distribute this work as no entity individual or corporate has a copyright on the body of the work scholars believe and we concur that this work is important enough to be preserved reproduced and made generally available to the public to ensure a quality reading experience this work has been proofread and republished using a format that seamlessly blends the original graphical elements with text in an easy to read typeface we appreciate your support of the preservation process and thank you for being an important part of keeping this knowledge alive and relevant

offers modern and numerical techniques for the stability of fluid flow with illustrations an extensive bibliography and exercises with solutions

hydrodynamic stability is of fundamental importance in the mechanics of fluids and is mainly concerned with the problem of the transition to turbulence this book is devoted to publication of original research papers research expository and survey articles with an emphasis on unsolved problems and open questions in the mathematical modeling and computational aspects of hydrodynamic stability review chapters on the mathematical modeling and numerical simulation aspects of hydrodynamic stability the physical background and the limitations of the modeling and simulation procedures due to particular mathematical or computational methods used are included this book will be appropriate for use in research and in research related courses on the subject it includes chapters on bifurcations in fluid systems flow patterns channel flows non parallel shear flows thin film flows strong viscous shear flows gortler vortices bifurcations in

convection wavy film flows and boundary layers

this is part 4 of a book series on fluid dynamics which is devoted to hydrodynamic stability theory this theory aims at predicting the conditions under which a flow which is smooth and regular a so called laminar flow undergoes a transition to a more complicated and apparently erratic state known as turbulence

a detailed look at some of the more modern issues of hydrodynamic stability including transient growth eigenvalue spectra secondary instability it presents analytical results and numerical simulations linear and selected nonlinear stability methods by including classical results as well as recent developments in the field of hydrodynamic stability and transition the book can be used as a textbook for an introductory graduate level course in stability theory or for a special topics fluids course it is equally of value as a reference for researchers in the field of hydrodynamic stability theory or with an interest in recent developments in fluid dynamics stability theory has seen a rapid development over the past decade this book includes such new developments as direct numerical simulations of transition to turbulence and linear analysis based on the initial value problem

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