Theory And Computation Of Hydrodynamic Stability

Theory and Computation of Hydrodynamic StabilityCambridge University Press

This book covers the basics of the hydrodynamics and vibration of structures subjected to environmental loads. It describes the interaction of hydrodynamics with the associated vibration of structures, giving simple explanations. Emphasis is placed on the applications of the theory to practical problems. Several case studies are provided to show how the theory outlined in the book is applied in the design of structures. Background material needed for understanding fluid-induced vibrations of structures is given to make the book reasonably self-sufficient. Examples are taken mainly from the novel structures that are of interest today, including ocean and offshore structures and components.Besides being a text for undergraduates, this book can serve as a handy reference for design engineers and consultants involved in the design of structures subjected to dynamics and vibration.

Instability of flows and their transition to turbulence are widespread phenomena in engineering and the natural environment, and are important in applied mathematics, astrophysics, biology, geophysics, meteorology, oceanography and physics as well as engineering. This is a textbook to introduce these phenomena at a level suitable for a graduate course, by modelling them mathematically, and describing numerical simulations and laboratory experiments. The visualization of instabilities is emphasized, with many figures, and in references to more still and moving pictures. The relation of chaos to transition is discussed at length. Many worked examples and exercises for students illustrate the ideas of the text. Readers are assumed to be fluent in linear algebra, advanced calculus, elementary theory of ordinary differential equations, complex variables and the elements of fluid mechanics. The book is aimed at graduate students but will also be very useful for specialists in other fields.

This report presents a method of the propeller camber calculations for the case of uniform chordwise load distribution employing the lifting-surface theory. This is essentially a refinement of Pien's published work on propeller lifting-surface theory. Mathematical development pertinent to the numerical computation is reviewed. Details of the computational procedure and method are outlined, and results of sample calculations are included. A detailed instruction for preparation of input data for the computer, samples of the computer input data and output, and the FORTRAN listing of the computer program are also given.

Theory and Computation of Hydrodynamic Stability

Handbook of Marine Craft Hydrodynamics and Motion Control

contributions to the theory of hydrodynamic stability

Computation of Nonlinear Hydrodynamic Loads on Floating Wind Turbines Using Fluid-Impulse Theory

Recent Advances in Differential Equations and Control Theory

The Aeronautical Journal

Wind energy is one of the more viable sources of renewable energy and offshore wind turbines represent a promising technology for the cost effective harvesting of this abundant source of energy. To capture wind energy offshore, horizontal-axis wind turbines can be installed on offshore platforms and the study of hydrodynamic loads on these offshore platforms becomes a critical issue for the design of offshore wind turbine systems. A versatile and efficient hydrodynamics module was developed to evaluate the linear and nonlinear loads on floating wind turbines using a new fluid-impulse formulation - the Fluid Impulse Theory(FIT). The new formulation allows linear and nonlinear loads on floating bodies to be computed in the time domain, and avoids the computationally intensive evaluation of temporal and spatial gradients of the velocity potential in the Bernoulli equation and the discretization of the nonlinear free surface. The module computes linear and nonlinear loads - including hydrostatic, Froude-Krylov, radiation and diffraction, as well as nonlinear effects known to cause ringing, springing and slow-drift loads - directly in the time domain and a stochastic seastate. The accurate evaluation of nonlinear loads by FIT provides an excellent alternative to existing methods for the safe and cost-effective design of offshore floating wind turbines. The time-domain Green function is used to solve the linear and nonlinear free-surface problems and efficient methods are derived for its computation. The body instantaneous wetted surface is approximated by a panel mesh and the discretization of the free surface is circumvented by using the Green function. The evaluation of the nonlinear loads is based on explicit expressions derived by the fluid-impulse theory, which can be computed efficiently.

This book discusses the fundamental principles and equations governing the motion of incompressible Newtonian fluids, and simultaneously introduces numerical methods for solving a broad range of problems. Appendices provide a wealth of information that establishes the necessary mathematical and computational framework.

To honor Professor Marshall P. Tulin on his 65th birthday (March 14, 1991), fluid mechanicians and applied mathematicians who have had close association and collaborated with Tulin during his career contribute papers in various areas related to his main interest naval hydrodynamics. No index. Annota

This book describes the motions resulting from heating a fluid layer from below.

Mechanics: From Theory to Computation
Proceedings of the Chicago Workshop on Adaptive Mesh Refinement Methods, Sept. 3-5, 2003
Computation of Nonlinear Hydrodynamic Loads on Floating Wind Turbines Using Fluid-impulse Theory
A Diffusion Hydrodynamic Model
Proceedings of the 6th International Conference on Hydrodynamics, Perth, Western Australia, 24-26 November 2004
From Theory to Computation : Essays in Honor of Juan Carlos Simo : Papers Invited

The Diffusion Hydrodynamic Model (DHM), as presented in the 1987 USGS publication, was one of the first computational fluid dynamics computational programs based on the groundwater program MODFLOW, which evolved into the control volume modeling approach. Over the following decades, others developed similar computational programs that either used the methodology and approaches presented in the DHM directly or were its extensions that included additional components and capacities. Our goal is to demonstrate that the DHM, which was developed in an age preceding computer graphics/visualization tools, is as robust as any of the popular models that are currently used. We thank the USGS for their approval and permission to use the content from the earlier USGS report.

Practical Ship Hydrodynamics provides a comprehensive overview of hydrodynamic experimental and numerical methods for ship resistance and propulsion, maneuvering, seakeeping and vibration. Beginning with an overview of problems and approaches, including the basics of modeling and full scale testing, expert author Volker Bertram introduces the marine applications of computational fluid dynamics and boundary element methods. Expanded and updated, this new edition includes: Otherwise disparate information on the factors affecting ship hydrodynamics, combined to provide one practical, go-to resource. Full coverage of new developments in computational methods and model testing techniques relating to marine design and development. New chapters on hydrodynamic aspects of ship vibrations and hydrodynamic options for fuel efficiency, and increased coverage of simple design estimates of hydrodynamic quantities such as resistance and wake fraction. With a strong focus on essential background for real-life modeling, this book is an ideal reference for practicing naval architects and graduate students.

This volume gathers the latest advances, innovations, and applications in the field of wind engineering, as presented by leading international researchers and engineers at the XV Conference of the Italian Association for Wind Engineering (IN-VENTO 2018), held in Naples, Italy on September 9-12, 2018. It covers highly diverse topics, including aeroelasticity, bluff-body aerodynamics, boundary layer wind tunnel testing, computational wind engineering, structural dynamics and reliability, wind-structure interaction, flow-induced vibrations, wind modeling and forecast, wind disaster mitigation, and wind climate assessment. The contributions, which were selected by means of a rigorous international peer-review process, highlight numerous exciting ideas that will spur novel research directions and foster multidisciplinary collaboration among different specialists.

Handbook of MARINE CRAFT HYDRODYNAMICS AND MOTION CONTROL The latest tools for analysis and design of advanced GNC systems Handbook of Marine Craft Hydrodynamics and Motion Control is an extensive study of the latest research in hydrodynamics, guidance, navigation, and control systems for marine craft. The text establishes how the implementation of mathematical models and modern control theory can be used for simulation and verification of control systems, decision-support systems, and situational awareness systems. Coverage includes hydrodynamic models for marine craft, models for wind, waves and ocean currents, dynamics and stability of marine craft, advanced guidance principles, sensor fusion, and inertial navigation. This important book includes the latest tools for analysis and design of advanced GNC systems and presents new material on unmanned underwater vehicles, surface craft, and autonomous vehicles. References and examples are included to enable engineers to analyze existing projects before making their own designs, as well as MATLAB scripts for hands-on software development and testing. Highlights of this Second Edition include: Topical case studies and worked examples demonstrating how you can apply modeling and control design techniques to your own designs A Github repository with MATLAB scripts (MSS toolbox) compatible with the latest software releases from Mathworks New content on mathematical modeling, including models for ships and underwater vehicles, hydrostatics, and control forces and moments New methods for guidance and navigation, including line-of-sight (LOS) guidance laws for path following, sensory systems, model-based navigation systems, and inertial navigation systems This fully revised Second Edition includes innovative research in hydrodynamics and GNC systems for marine craft, from ships to autonomous vehicles operating on the surface and under water. Handbook of Marine Craft Hydrodynamics and Motion Control is a must-have for students and engineers working with unmanned systems, field robots, autonomous vehicles, and ships. MSS toolbox: https://github.com/cybergalactic/mss Lecture notes: https://www.fossen.biz/wiley Author’s home page: https://www.fossen.biz

Theory and Computation in Hydrodynamic Stability
IN-VENTO 2018
Stability and Suppression of Turbulence in Relaxing Molecular Gas Flows
Fluid Dynamics
Practical Ship Hydrodynamics
Encyclopedia of Fluid Mechanics: Dynamics of single-fluid flows and mixing

This report is part of a series of reports that summarize this regular event. The report discusses research developments in ship design, construction, and operation in a forum that encouraged both formal and informal discussion of presented papers.

The subject of hydrodynamics applied to offshore structures is vast. The topics covered in this book aim to help the reader understand basic principles while at the same time giving the designer enough information for particular designs. Thus, results are given with derivations, and applications are discussed with the aid of examples, with an overview of the advantages and limitations of the method involved. This makes the book suitable as a text for undergraduate and graduate students specializing in offshore and ocean engineering.

The International Conference on Hydrodynamics is an increasingly important event at which academics, researchers and practitioners can exchange new ideas and their research findings. This volume contains papers from the 2004 conference covering a wide range of subjects within hydrodynamics, including traditional engineering, architectural and mechanical issues as well as significant new technologies and methodologies such as bio-fluid mechanics and computational fluid mechanics.

This book serves as an introduction to the continuum mechanics and mathematical modeling of complex fluids in living systems. The form and function of living systems are intimately tied to the nature of surrounding fluid environments, which commonly exhibit nonlinear and history dependent responses to forces and displacements. With ever-increasing capabilities in the visualization and manipulation of biological systems, research on the fundamental phenomena, models, measurements, and analysis of complex fluids has taken a number of exciting directions. In this book, many of the world's foremost experts explore key topics such as: Macro- and micro-rheological techniques for measuring the material properties of complex biofluids and the subtleties of data interpretation Experimental observations and rheology of complex biological materials, including mucus, cell membranes, the cytoskeleton, and blood The motility of microorganisms in complex fluids and the dynamics of active suspensions Challenges and solutions in the numerical simulation of biologically relevant complex fluid flows This volume will be accessible to advanced undergraduate and beginning graduate students in engineering, mathematics, biology, and the physical sciences, but will appeal to anyone interested in the intricate and beautiful nature of complex fluids in the context of living systems.

Theory and Model

Adaptive Mesh Refinement - Theory and Applications

Experiment, Theory, and Computation

Preprint

Complex Fluids in Biological Systems

HYDRODYNAMIC ASPECT OF PROPELLER DESIGN BASED ON LIFTING-SURFACE THEORY. PART 1. UNIFORM CHORDWISE LOAD DISTRIBUTION.

HYDRODYNAMIC PROPULSION AND ITS OPTIMIZATION ANALYTIC THEORY Hydrodynamic propulsion has been of major interest ever since craft took to the water. In the course of time, many attempts have been made to invent, develop, or to improve hydrodynamic propulsion devices. Remarkable achievements in this field were made essentially by experienced individuals, who were in need of reliable propulsion units such as paddle wheels, sculling devices, screw propellers, and of course, sails. The problem of minimizing the amount of input energy for a prescribed effective output was first investigated seriously at the beginning of this century. In 1919, BETZ presented a paper on air-screw propellers with minimum consumption of energy which could be applied to ship-screw propellers also. Next, attempts were made to optimize hydrodynamic propulsion units. Ensuing investigations concerned the optimization of the hydrodynamic system: ship-propeller. The first simple theory of ship propulsion which was presented considered more or less only thrust augmentation, wake processing and modification of propeller characteristics when operating behind the ships hull. This theory has been little improved meanwhile and is still useful, particularly with regard to practical ship design and for evaluating results of ship model tests. However, this theory is not adequate for optimization procedures necessary for high-technology propulsion, particularly for ship propellers utilizing propulsion improving devices such as tip end plates or tip fins at the propeller blades, spoilers in front of the propeller, asymmetrical stern etc.

A graduate level introduction to the theory and applications of time correlation functions and the molecular theory of fluid dynamics. "Quite well organized . . . the literature coverage is impressive." — Physics Today. 110 illustrations.

Table of contents

A theoretical method is derived for computing the motions and hydrodynamic loads during water landings of prismatic bodies involving appreciable immersion of the chines. A simplified method of computation covering flat-plate and V-bottom bodies with beam-loading coefficients greater than unity is given as a separate section. Comparisons of theory with experiment are presented as plots of impact lift coefficient and maximum draft-beam ratio against flight-path angle and as time histories of loads and motions. Fair agreement is found to exist for chine-immersed landings for angles of dead rise of 0 degrees and 30 degrees, beam-loading coefficients from 1 to 36.5, flight-path angles from 2 to 90 degrees, and trims from 6 to 45 degrees.

Hydrodynamics

NASA Technical Translation

Analytic Theory

Computational Fluid Dynamics and the Theory of Fluidization

Applications of the Kinetic Theory of Granular Flow

Introduction to Theoretical and Computational Fluid Dynamics

Hydrodynamics of High-Speed Marine Vehicles, first published in 2006, discusses the three main categories of high-speed marine vehicles - vessels supported by submerged hulls, air cushions or foils. The wave environment, resistance, propulsion, seakeeping, sea loads and manoeuvring are extensively covered based on rational and simplified methods. Links to automatic control and structural mechanics are emphasized. A detailed description of waterjet propulsion is given and the effect of water depth on wash, resistance, sinkage and trim is discussed. Chapter topics include resistance and wash; slamming; air cushion-supported vessels, including a detailed discussion of wave-excited resonant oscillations in air cushion; and hydrofoil vessels. The book contains numerous illustrations, examples and exercises.

This collection of papers in honour of Juan-Carlos Simo cover subjects including: dynamical problems for geometrically exact theories of nonlinearly viscoelastic rods; gravity waves on

the surface of the sphere; and problems and progress in microswimming.
Starting in 1996, a sequence of articles appeared in the Journal of Nonlinear Science dedicated to the memory of one of its original editors, Juan-Carlos Simo, Applied Me chanics, Stanford University. Sadly, Juan-Carlos passed away at an early age in 1994. We lost a brilliant colleague and a wonderful person. These articles are collected in the present volume. Many of them are updated and corrected especially for this occasion. These essays are in areas of scientific interest of Juan-Carlos, including mechanics (particles, rigid bodies, fluids, elasticity, plastic ity, etc.), geometry, applied dynamics, and, of course, computation. His interests were extremely broad-he did not see boundaries between computation, mathematics, me chanics, and dynamics, and, in that sense, he ideally reflected the spirit of the journal and many of the most exciting areas of current scientific interest. Juan-Carlos was one of those select and gifted people who could cross interdisci plinary boundaries with extremely high quality and productive interactions of lasting value. His contributions, ranging from concrete engineering problems to fundamental mathematical theorems in geometric mechanics, are remarkable. In current conferences as well as in scientific books and articles, and over a wide range of subjects, one frequently hears how his ideas as well as specific results are often used and quoted-this is one indication of just how profound and fundamental his work has impacted the community.
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 to the most complex, considering linear and nonlinear situations, and analyzing temporal and spatial stability. The authors examine each problem both analytically and numerically. Many 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. The text includes copious illustrations and an extensive bibliography, making it suitable for courses on hydrodynamic stability or as an authoritative reference for researchers. In this second edition the opportunity has been taken to update the text and, most importantly, provide solutions to the numerous extended exercises.

Theory and Procedure for Determining Loads and Motions in Chine-immersed Hydrodynamic Impacts of Prismatic Bodies
The Theory And Practice Of Hydrodynamics And Vibration
Hydrodynamics of High-Speed Marine Vehicles
Mathematical Approaches in Hydrodynamics
Unified Non-Local Theory of Transport Processes
Generalized Boltzmann Physical Kinetics

The complementary nature of physically-based and data-driven models in their demand for physical insight and historical data, leads to the notion that the predictions of a physically-based model can be improved and the associated uncertainty can be systematically reduced through the conjunctive use of a data-driven model of the residuals. The

This book is for engineers and students to solve issues concerning the fluidized bed systems. It presents an analysis that focuses directly on the problem of predicting the fluid dynamic behavior which empirical data is limited or unavailable. The second objective is to provide a treatment of computational fluidization dynamics that is readily accessible to the non-specialist. The approach adopted in this book, starting with the formulation of predictive expressions for the basic conservation equations for mass and momentum using kinetic theory of granular flow. The analyses presented in this book represent a body of simulations and experiments research that has appeared in numerous publications over the last 20 years. This material helps to form the basis for university course modules in engineering and applied science at undergraduate and graduate level, as well as focused, post-experienced courses for the process, and allied industries.

This book collects the latest results and new trends in the application of mathematics to some problems in control theory, numerical simulation and differential equations. The work comprises the main results presented at a thematic minisymposium, part of the 9th International Congress on Industrial and Applied Mathematics (ICIAM 2019), held in Valencia, Spain, from 15 to 18 July 2019. The topics covered in the 6 peer-review contributions involve applications of numerical methods to real problems in oceanography and naval engineering, as well as relevant results on switching control techniques, which can have multiple applications in industrial complexes, electromechanical machines, biological systems, etc. Problems in control theory, as in most engineering problems, are modeled by differential equations, for which standard solving procedures may be insufficient. The book also includes recent geometric and analytical methods for the search of exact solutions for differential equations, which serve as essential tools for analyzing problems in many scientific disciplines.

A hydrodynamics computer module was developed for the evaluation of the linear and nonlinear loads on floating wind turbines using a new fluid-impulse formulation for coupling with the FAST program. The recently developed formulation allows the computation of linear and nonlinear loads on floating bodies in the time domain and avoids the computationally intensive evaluation of temporal and nonlinear free-surface problems and efficient methods are derived for its computation. The body instantaneous wetted surface is approximated by a panel mesh and the discretization of the free surface is circumvented by using the Green function. The evaluation of the nonlinear loads is based on explicit expressions derived by the fluid-impulse theory, which can be computed efficiently. Computations are presented of the linear and nonlinear loads on the MIT/NREL tension-leg platform. Comparisons were

carried out with frequency-domain linear and second-order methods. Emphasis was placed on modeling accuracy of the magnitude of nonlinear low- and high-frequency wave loads in a sea state. Although fluid-impulse theory is applied to floating wind turbines in this paper, the theory is applicable to other offshore platforms as well.

Molecular Hydrodynamics

Scientific and Technical Aerospace Reports

Theory, Computation, and Numerical Simulation

Hydrodynamics of Offshore Structures

Hydrodynamics VI: Theory and Applications

Proceedings of the XV Conference of the Italian Association for Wind Engineering

Unified Non-Local Theory of Transport Processess, 2nd Edition provides a new theory of transport processes in gases, plasmas and liquids. It is shown that the well-known Boltzmann equation, which is the basis of the classical kinetic theory, is incorrect in the definite sense. Additional terms need to be added leading to a dramatic change in transport theory. The result is a strict theory of turbulence and the possibility to calculate turbulent flows from the first principles of physics. Fully revised and expanded edition, providing applications in quantum non-local hydrodynamics, quantum solitons in solid matter, and plasmas Uses generalized Boltzmann kinetic theory as an highly effective tool for solving many physical problems beyond classical physics Addresses dark matter and energy Presents non-local physics in many related problems of hydrodynamics, gravity, black holes, nonlinear optics, and applied mathematics

Ready access to computers has de?ned a new era in teaching and learning. The opportunity to extend the subject matter of traditional science and engineering curricula into the realm of scienti?c computing has become not only desirable, but also necessary. Thanks to portability and low overhead and operating cost, experimentation by numerical simulation has become a viable substitute, and occasionally the only alternative, to physical experimentation. The new framework has necessitated the writing of texts and monographs from a modern perspective that incorporates numerical and computer progr- ming aspects as an integral part of the discourse. Under this modern directive, methods, concepts, and ideas are presented in a uni?ed fashion that motivates and underlines the urgency of the new elements, but neither compromises nor oversimpli?es the rigor of the classical approach. Interfacing fundamental concepts and practical methods of scienti?c c- puting can be implemented on di?erent levels. In one approach, theory and implementation are kept complementary and presented in a sequential fashion. In another approach, the coupling involves deriving computational methods and simulation algorithms, and translating equations into computer code - structions immediately following problem formulations. Seamlessly interjecting methods of scienti?c computing in the traditional discourse o?ers a powerful venue for developing analytical skills and obtaining physical insight.

With the amazing advances of scientific research, Hydrodynamics - Theory and Application presents the engineering applications of hydrodynamics from many countries around the world. A wide range of topics are covered in this book, including the theoretical, experimental, and numerical investigations on various subjects related to hydrodynamic problems. The book consists of twelve chapters, each of which is edited separately and deals with a specific topic. The book is intended to be a useful reference to the readers who are working in this field.

Advanced numerical simulations that use adaptive mesh refinement (AMR) methods have now become routine in engineering and science. Originally developed for computational fluid dynamics applications these methods have propagated to fields as diverse as astrophysics, climate modeling, combustion, biophysics and many others. The underlying physical models and equations used in these disciplines are rather different, yet algorithmic and implementation issues facing practitioners are often remarkably similar. Unfortunately, there has been little effort to review the advances and outstanding issues of adaptive mesh refinement methods across such a variety of fields. This book attempts to bridge this gap. The book presents a collection of papers by experts in the field of AMR who analyze past advances in the field and evaluate the current state of adaptive mesh refinement methods in scientific computing.

Computational Gas-Solids Flows and Reacting Systems: Theory, Methods and Practice

The Theory of Hydrodynamic Stability

Hydrodynamic Propulsion and Its Optimization

Information Theory and Artificial Intelligence to Manage Uncertainty in Hydrodynamic and Hydrological Models

Unsteady Propeller Forces, Fundamental Hydrodynamics [and] Unconventional Propulsion

This book presents an in-depth systematic investigation of a dissipative effect which manifests itself as the growth of hydrodynamic stability and suppression of turbulence in relaxing molecular gas flows. The work describes the theoretical foundations of a new way to control stability and laminar turbulent transitions in aerodynamic flows. It develops hydrodynamic models for describing thermal nonequilibrium gas flows which allow the consideration of suppression of inviscid acoustic waves in 2D shear flows. Then, nonlinear evolution of large-scale vortices and Kelvin-Helmholtz waves in relaxing shear flows are studied. Critical Reynolds numbers in supersonic Couette flows are calculated analytically and numerically within the framework of both linear and nonlinear classical energy hydrodynamic stability theories. The calculations clearly show that the relaxation process can appreciably delay the laminar-turbulent transition. The aim of the book is to show the new dissipative effect, which can be used for flow control and laminarization. This volume will be of interest and useful to mechanical engineers, physicists, and mathematicians who specialize in hydrodynamic stability theory, turbulence, and laminarization of flows.

"This book provides various approaches to computational gas-solids flow and will aid the researchers, graduate students and practicing engineers in this rapidly expanding area"--Provided by publisher.

Essays in Honor of Juan-Carlos Simo
Introduction to Hydrodynamic Stability
Twenty-Fourth Symposium on Naval Hydrodynamics
Bénard Cells and Taylor Vortices
Theory, Methods and Practice