

FLUID MECHANICS AND ITS APPLICATIONS

J.A. Sparenberg

Hydrodynamic Propulsion and Its Optimization

Analytic Theory



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Hydrodynamic Propulsion And Its Optimization Analytic Theory

Harold Ramkisson



Hydrodynamic Propulsion And Its Optimization Analytic Theory:

Hydrodynamic Propulsion and Its Optimization J.A. Sparenberg, 2013-04-17 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

Hydrodynamic Propulsion and Its Optimization J.A. Sparenberg, 1994-12-31 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 IUTAM Symposium on Lubricated Transport of Viscous Materials Harold Ramkisson, 2012-12-06 The main objective of the First

International Symposium on Lubricated Transport of Viscous Materials was to bring together scientists and engineers from academia and industry to discuss current research work and exchange ideas in this newly emerging field. It is an area of fluid dynamics devoted to laying bare the principles of the lubricated transport of viscous materials such as crude oil, concentrated oil-water emulsion slurries and capsules. It encompasses several types of problem. Studies of migration of particulates away from walls, Segre-Silverberg effects, lubrication versus lift and shear-induced migration belong to one category. Some of the technological problems are the fluid dynamics of core flows emphasizing studies of stability problems of start-up, lift-off and eccentric flow where gravity causes the core flow to stratify. Another category of problems deals with the fouling of pipe walls with oil, with undesirable increases in pressure gradients and even blocking. This study involves subjects like adhesion and dynamic contact angles. The topics of shear-induced diffusion of small particles and wall slip in slow flow are other appropriate subjects. Computer-intensive studies of flow-induced microstructures and moving interface problems are yet additional research directions. The general consensus was that the Symposium was a tremendous success although the number of presentations fell below expectations. Scientists from the petroleum industry and this includes INTEVEP Venezuela, Schlumberger and Syncrude Canada Ltd and consultants to oil companies actively participated in the Symposium. The meeting produced new insights which should lead to further interesting research work and established contacts for possible joint investigations.

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. Finally 12 invited lectures, 48 papers and 23 posters were selected by the Scientific Committee 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 rUTAM Symposium were classified under three groups devoted 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 provided by external sources. The third group was devoted to control concepts for presenting methods of control theory and new techniques of flow control.

Direct and Large-Eddy Simulation

II Jean-Pierre Cholle, Peter R. Voke, Leonhard Kleiser, 2012-12-06 Progress in the numerical simulation of turbulence has been rapid in the 1990s. New techniques both for the numerical approximation of the Navier-Stokes equations and for the subgrid-scale models used in large eddy simulation have emerged and are being widely applied for both fundamental and applied engineering studies along with novel ideas for the performance and use of simulation for compressible, chemically reacting and transitional flows. This collection of papers from the second ERCOFTAC Workshop on Direct and Large Eddy Simulation held in Grenoble in September 1996 presents the key research being undertaken in Europe and Japan on these

topics Describing in detail the ambitious use of DNS for fundamental studies and of LES for complex flows of potential and actual engineering importance this volume will be of interest to all researchers active in the area

IUTAM Symposium on Nonlinear Analysis of Fracture J.R. Willis, 2012-12-06 This volume constitutes the Proceedings of the IUTAM Symposium on Nonlinear Analysis of Fracture held in Cambridge from 3rd to 7th September 1995 Its objective was to assess and place on record the current state of understanding of this important class of phenomena from the standpoints of mathematics materials science physics and engineering All fracture phenomena are nonlinear the reason for inclusion of this qualification in the title was to reflect the intention that emphasis should be placed on distinctive aspects of nonlinearity not only with regard to material constitutive behaviour but also with regard to insights gained particularly from the mathematics and physics communities during the recent dramatic advances in understanding of nonlinear systems in general The expertise represented in the Symposium was accordingly very wide and many of the world's greatest authorities in their respective fields participated The Symposium remained focussed on issues of practical significance for fracture phenomena with concentration on aspects that are still imperfectly understood The most significant unifying issue in this regard is that of scale this theme was addressed from several perspectives One important aspect is the problem of passing information on one scale up or down as an input for analysis at another scale Although this is not always the case it may be that the microscopic process of fracture is understood in some particular class of materials

Vibration Control of Active Structures A. Preumont, 2012-12-06 I was introduced to structural control by Raphael Haftka and Bill Hallauer during a one year stay at the Aerospace and Ocean Engineering department of Virginia Tech during the academic year 1985-1986 At that time there was a tremendous interest in large space structures in the USA mainly because of the Strategic Defense Initiative and the space station program Most of the work was theoretical or numerical but Bill Hallauer was one of the few experimentalists trying to implement control systems which worked on actual structures When I returned to Belgium I was appointed at the chair of Mechanical Engineering and Robotics at ULB and I decided to start some basic vibration control experiments on my own A little later smart materials became widely available and offered completely new possibilities particularly for precision structures but also brought new difficulties due to the strong coupling in their constitutive equations which requires a complete reformulation of the classical modelling techniques such as finite elements We started in this new field with the support of the national and regional governments the European Space Agency and some bilateral collaborations with European aerospace companies Our Active Structures Laboratory was inaugurated in October 1995

Nonlinear Dynamics and Chaotic Phenomena B.K Shivamoggi, 2013-03-09 Following the formulation of the laws of mechanics by Newton Lagrange sought to clarify and emphasize their geometrical character Poincare and Liapunov successfully developed analytical mechanics further along these lines In this approach one represents the evolution of all possible states positions and momenta by the flow in phase space or more efficiently by mappings on manifolds with a symplectic geometry and tries to

understand qualitative features of this problem rather than solving it explicitly One important outcome of this line of inquiry is the discovery that vastly different physical systems can actually be abstracted to a few universal forms like Mandelbrot's fractal and Smale's horse shoe map even though the underlying processes are not completely understood This of course implies that much of the observed diversity is only apparent and arises from different ways of looking at the same system Thus modern nonlinear dynamics¹ is very much akin to classical thermodynamics in that the ideas and results appear to be applicable to vastly different physical systems Chaos theory which occupies a central place in modern nonlinear dynamics refers to a deterministic development with chaotic outcome Computers have contributed considerably to progress in chaos theory via impressive complex graphics However this approach lacks organization and therefore does not afford complete insight into the underlying complex dynamical behavior This dynamical behavior mandates concepts and methods from such areas of mathematics and physics as nonlinear differential equations bifurcation theory Hamiltonian dynamics number theory topology fractals and others

Probabilistic Methods for Structural Design Carlos Guedes Soares, 2012-12-06 This book contains contributions from various authors on different important topics related with probabilistic methods used for the design of structures Initially several of the papers were prepared for advanced courses on structural reliability or on probabilistic methods for structural design These courses have been held in different countries and have been given by different groups of lecturers They were aimed at engineers and researchers who already had some exposure to structural reliability methods and thus they presented overviews of the work in the various topics The book includes a selection of those contributions which can be of support for future courses or for engineers and researchers that want to have an update on specific topics It is considered a complement to the existing textbooks on structural reliability which normally ensure the coverage of the basic topics but then are not extensive enough to cover some more specialised aspects In addition to the contributions drawn from those lectures there are several papers that have been prepared specifically for this book aiming at complementing the others in providing an overall account of the recent advances in the field It is with sadness that in the meanwhile we have seen the disappearance of two of the contributors to the book and in fact two of the early contributors to this field

IUTAM Symposium on Statistical Energy Analysis F.J. Fahy, W.G. Price, 2013-03-09 This volume is a record of the proceedings of the Symposium on Statistical Energy Analysis SEA held at the University of Southampton in July 1997 which was held under the auspices of the International Union of Theoretical and Applied Mechanics Theoretical SEA is a form of modelling the vibrational and acoustical behaviour of complex mechanical systems which has undergone a long period of gestation before recent maturation into a widely used engineering design and analysis tool which is supported by a rapidly growing supply of commercial software SEA also provides a framework for associated experimental measurement procedures data analysis and interpretation Under the guidance of the members of a distinguished International Scientific Committee participants were individually invited from the broad spectrum of SEAfarers including academics consultants industrial

engineers software developers and research students The Symposium aimed to reflect the balance of world wide activity in SEA although some eminent members of the SEA community were sadly unable to attend In particular Professor Richard Lyon and Dr Gideon Maidanik two of the principal originators of SEA were sorely missed This publication contains copies of all the papers presented to the Symposium together with a summary of the associated discussions which contains valuable comments upon the contents of the formal papers together with the views of participants on some fundamental issues which remain to be resolved

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

Mechanical Behaviour of Materials Dominique François, André Pineau, André Zaoui, 1998-11-30 Designing new structural materials extending lifetimes and guarding against fracture in service are among the preoccupations of engineers and to deal with these they need to have command of the mechanics of material behaviour The first volume of this two volume work deals with elastic and elastoplastic behaviour this second volume continues with viscoelasticity damage fracture resistance to cracking and contact mechanics As in Volume I the treatment starts from the active mechanisms on the microscopic scale and develops the laws of macroscopic behaviour Chapter I deals with viscoplastic behaviour as shown for example at low

temperatures by the effects of oscillatory loads and at high temperatures by creep under steady load Chapter 2 treats damage phenomena encountered in all materials for example metals polymers glasses concretes such as cavitation fatigue and stress corrosion cracking Chapter 3 treats those concepts of fracture mechanics that are needed for the understanding of resistance to cracking and Chapter 4 completes the volume with a survey of the main concepts of contact mechanics As with Volume I each chapter has a set of exercises either with solutions or with indications of how to attack the problem and there are many explanatory diagrams and other illustrations

Advances in Turbulence VII Uriel Frisch, 2012-12-06 *Advances in Turbulence VII* contains an overview of the state of turbulence research with some bias towards work done in Europe It represents an almost complete collection of the invited and contributed papers delivered at the Seventh European Turbulence Conference sponsored by EUROMECH and ERCOFTAC and organized by the Observatoire de la Côte d'Azur New high Reynolds number experiments combined with new techniques of imaging non intrusive probing processing and simulation provide high quality data which put significant constraints on possible theories For the first time it has been shown for a class of passive scalar problems why dimensional analysis sometimes gives the wrong answers and how anomalous intermittency corrections can be calculated from first principles The volume is thus geared towards specialists in the area of flow turbulence who could not attend the conference as well as anybody interested in this rapidly moving field

IUTAM Symposium on Interaction between Dynamics and Control in Advanced Mechanical Systems Dick H. van Campen, 2012-12-06 During the last decades applications of dynamical analysis in advanced often nonlinear engineering systems have been evolved in a revolutionary way In this context one can think of applications in aerospace engineering like satellites in naval engineering like ship motion in mechanical engineering like rotating machinery vehicle systems robots and biomechanics and in civil engineering like earthquake dynamics and offshore technology One could continue with this list for a long time The application of advanced dynamics in the above fields has been possible due to the use of sophisticated computational techniques employing powerful concepts of nonlinear dynamics These concepts have been and are being developed in mathematics mechanics and physics It should be remarked that careful experimental studies are vitally needed to establish the real existence and observability of the predicted dynamical phenomena The interaction between nonlinear dynamics and nonlinear control in advanced engineering systems is becoming of increasing importance because of several reasons Firstly control strategies in nonlinear systems are used to obtain desired dynamic behaviour and improved reliability during operation Applications include power plant rotating machinery vehicle systems robotics etc Terms like motion control optimal control and adaptive control are used in this field of interest Since mechanical and electronic components are often necessary to realize the desired action in practice the engineers use the term mechatronics to indicate this field If the desired dynamic behaviour is achieved by changing design variables mostly called system parameters one can think of fields like control of chaos

IUTAM Symposium on Nonlinear Instability and Transition in Three-Dimensional Boundary

Layers Peter W. Duck, Philip Hall, 2012-12-06 Most fluid flows of practical importance are fully three dimensional so the non linear instability properties of three dimensional flows are of particular interest In some cases the three dimensionality may have been caused by a finite amplitude disturbance whilst more usually the unperturbed state is three dimensional Practical applications where transition is thought to be associated with non linearity in a three dimensional flow arise for example in aerodynamics swept wings engine nacelles etc turbines and aortic blood flow Here inviscid cross flow disturbances as well as Tollmien Schlichting and Görtler vortices can all occur simultaneously and their mutual non linear behaviour must be understood if transition is to be predicted The non linear interactions are so complex that usually fully numerical or combined asymptotic numerical methods must be used Moreover in view of the complexity of the instability processes there is also a growing need for detailed and accurate experimental information Carefully conducted tests allow us to identify those elements of a particular problem which are dominant This assists in both the formulation of a relevant theoretical problem and the subsequent physical validation of predictions It should be noted that the demands made upon the skills of the experimentalist are high and that the tests can be extremely sophisticated often making use of the latest developments in flow diagnostic techniques automated high speed data gathering data analysis fast processing and presentation Advances

in Turbulence VI S. Gavrilakis, L. Machiels, P.A. Monkewitz, 2012-12-06 Advances in Turbulence VI presents an update on the state of turbulence research with some bias towards research in Europe since it represents an almost complete collection of the paper presentations at the Sixth European Turbulence Conference sponsored by EUROMECH ERCOFTAC and COST and held at the Swiss Federal Institute of Technology in Lausanne July 2-5 1996 The problem of transition together with the structural description of turbulence and the scaling laws of fully developed turbulence have continued to receive most attention by the research community and much progress has been made since the last European Turbulence Conference in 1994 The volume is thus geared towards specialists in the area of flow turbulence who could not attend the conference as well as anybody who wishes quickly to assess the most active current research areas and the groups associated with them

IUTAM Symposium on Transformation Problems in Composite and Active Materials Yehia A. Bahei-El-Din, George J. Dvorak, 2006-04-11 The field of composite materials has seen substantial development in the past decade New composite systems are being continually developed for various applications Among such systems are metal intermetallic and superalloy matrix composites carbon carbon composites as well as polymer matrix composites At the same time a new discipline has emerged of active or smart materials which are often constructed as composite or heterogeneous media and structures One unifying theme in these diverse systems is the influence that uncoupled and coupled eigenfields or transformation fields exert on the various types of overall response as well as on the respective phase responses Problems of this kind are currently considered by different groups which may not always appreciate the similarities of the problems involved The purpose of the IUTAM Symposium on Transformation Problems in Composite and Active Materials held in Cairo Egypt from March 10 to 12

1997 was to bring together representatives of the different groups so that they may interact and explore common aspects of these seemingly different problem areas New directions in micromechanics research in both composite and active materials were also explored in the symposium Specifically invited lectures in the areas of inelastic behavior of composite materials shape memory effects functionally graded materials transformation problems in composite structures and adaptive structures were delivered and discussed during the three day meeting This book contains the printed contributions to the IUTAM Symposium *Methods of Fracture Mechanics: Solid Matter Physics* G.P. Cherepanov, 2013-03-09 Modern fracture mechanics considers phenomena at many levels macro and micro it is therefore inextricably linked to methods of theoretical and mathematical physics This book introduces these sophisticated methods in a straightforward manner The methods are applied to several important phenomena of solid state physics which impinge on fracture mechanics adhesion defect nucleation and growth dislocation emission sintering the electron beam effect and fractal cracks The book shows how the mathematical models for such processes may be set up and how the equations so formulated may be solved and interpreted The many open problems which are encountered will provide topics for MSc and PhD theses in fracture mechanics and in theoretical and experimental physics As a supplementary text the book can be used in graduate level courses on fracture mechanics solid matter physics and mechanics of solids or in a special course on the application of fracture mechanics methods in solid matter physics

IUTAM Symposium on Combustion in Supersonic Flows M. Champion, B. Deshaies, 2012-12-06 Proceedings of the IUTAM Symposium held in Poitiers France 2 6 October 1995 *IUTAM Symposium on Micromechanics of Plasticity and Damage of Multiphase Materials* André Pineau, André Zaoui, 2012-12-06 The IUTAM Symposium on Micromechanics of Plasticity and Damage of Multiphase Materials was held in Sevres Paris France 29 August 1 September 1995 The Symposium was attended by 83 persons from 18 countries In addition 17 young French students attended the meeting During the 4 day meeting a total of 55 papers were presented including 24 papers in the poster sessions The meeting was divided into 7 oral and 3 poster sessions The 7 oral sessions were the following Plasticity and Viscoplasticity I and II Phase transformations Damage I and II Statistical and geometrical aspects Cracks and interfaces Each poster session was introduced by a Rapporteur as follows Session I Plasticity and Viscoplasticity G Cailletaud Session 2 Damage D Franc ois Session 3 Phase transformation statistical and geometrical aspects D Jeulin The main purpose of the Symposium was the discussion of the state of the art in the development of micromechanical models used to predict the macroscopic mechanical behaviour of mUltiphase solid materials These materials consist of at least two chemically different phases present either initially or formed during plastic deformation when a strain induced phase transformation takes place One session was devoted to the latter case Continuously strengthened composite materials containing long fibers were out of the scope of the Symposium

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