

LAZĂR DRAGOȘ

MATHEMATICAL METHODS IN AERODYNAMICS



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Mathematical Methods In Aerodynamics

Lazăr Dragos



Mathematical Methods In Aerodynamics:

Mathematical Methods in Aerodynamics Lazăr Dragos, 2003 The book provides a solid and unitary mathematical foundation of the basic and advanced principles of aerodynamics The densities of the fundamental solutions are determined from singular integral equations The fundamental solutions method in aerodynamics was considered for the first time and used by the author in over 30 papers published in prestigious journals e g QAM AIAA ZAMM etc in order to develop a unitary theory The boundary element method is used for numerical approximations in compressible aerodynamics The text incorporates several original contributions among other traditional mathematical methods The book also represents a comprehensive presentation of research results since the seminal books on aerodynamics of Ashley and Landahl 1965 and Katz Plotkin 1991 A rigorous mathematical approach is used to present and explain classic and modern results in this field of science The author has therefore conceived several appendices on the Distribution Theory the singular Integral Equations Theory the Finite Part Gauss Quadrature Formulae etc The book is concluded by a relevant bibliographical list which is especially useful for researchers The book is aimed primarily at applied mathematicians aeronautical engineers and space science researchers The text may be used also as a comprehensive introduction to the mathematical foundations of aerodynamics by graduate students in engineering and fluid dynamics with a strong mathematical background

Mathematical Methods in Aerodynamics Lazăr Dragos, 2004-03-14 The researchers in Aerodynamics know that there is not a unitary method of investigation in this field The first mathematical model of the air plane wing the model meaning the integral equation governing the phenomenon was proposed by L Prandtl in 1918 The integral equation deduced by Prandtl on the basis of some assumptions which will be specified in the sequel furnishes the circulation C_y see Chapter 6 Using the circulation one calculates the lift and moment coefficients which are very important in Aerodynamics The first hypothesis made by Prandtl consists in replacing the wing by a distribution of vortices on the plan form D of the wing i e the projection of the wing on the plane determined by the direction of the uniform stream at infinity and the direction of the span of the wing Since such a distribution leads to a potential flow in the exterior of D and the experiences show that downstream the flow has not this character Prandtl introduces as a supplementary hypothesis another vortices distribution on the trace of the domain D in the uniform stream The first kind of vortices are called tied vortices and the second kind of vortices are called free vortices

Mathematical Methods in Aerodynamics Lazăr Dragoș, 2003-01-01 **Mathematical Methods of Airfoil Design** Alexander M. Elizarov, Nikolaï Borisovich Il'inskiï, Andreï Valer'evich Potashev, 1997-07-15 Devoted to the theory of aerodynamic design of subsonic airfoils It presents the results of more than thirty years research in Russia as well as research by new authors The state of the art situation in this theory is fully reflected **Transonic Aerodynamics** L. Pamela Cook, 1993-01-01 This volume offers exciting results perspectives and case studies for the treatment of problems arising in transonic aerodynamics New advances including triple deck theory analysis of stagnation at the nose of a body

transonic choked flow and the transonic area rule are presented Interest in analyzing the transonic range of flight its stability properties and especially the question of designing reduced drag shockless or weak shock airfoils keeps growing Present day commercial aircraft cruise in the transonic range Mechanical and aeronautical engineers interested in compressible fluid flows design of optimal wings and an understanding of transonic flow held about wings and airfoils will find the book invaluable This book is understandable to those with a knowledge of continuum mechanics fluids and asymptotic methods It is appropriate for graduate courses in aerodynamics and mathematical methods

Variational Analysis and Aerospace Engineering Aldo Frediani, Bijan Mohammadi, Olivier Pironneau, Vittorio Cipolla, 2016-12-27 This book presents papers surrounding the extensive discussions that took place from the Variational Analysis and Aerospace Engineering workshop held at the Ettore Majorana Foundation and Centre for Scientific Culture in 2015 Contributions to this volume focus on advanced mathematical methods in aerospace engineering and industrial engineering such as computational fluid dynamics methods optimization methods in aerodynamics optimum controls dynamic systems the theory of structures space missions flight mechanics control theory algebraic geometry for CAD applications and variational methods and applications Advanced graduate students researchers and professionals in mathematics and engineering will find this volume useful as it illustrates current collaborative research projects in applied mathematics and aerospace engineering

Basic Aerodynamics Gary A. Flandro, Howard M. McMahon, Robert L. Roach, 2011-11-14 In the rapidly advancing field of flight aerodynamics it is especially important for students to master the fundamentals This text written by renowned experts clearly presents the basic concepts of underlying aerodynamic prediction methodology These concepts are closely linked to physical principles so that they are more readily retained and their limits of applicability are fully appreciated Ultimately this will provide students with the necessary tools to confidently approach and solve practical flight vehicle design problems of current and future interest This book is designed for use in courses on aerodynamics at an advanced undergraduate or graduate level A comprehensive set of exercise problems is included at the end of each chapter

Theoretical and Applied Aerodynamics J. J. Chattot, M. M. Hafez, 2015-03-31 This book covers classical and modern aerodynamics theories and related numerical methods for senior and first year graduate engineering students including The classical potential incompressible flow theories for low speed aerodynamics of thin airfoils and high and low aspect ratio wings The linearized theories for compressible subsonic and supersonic aerodynamics The nonlinear transonic small disturbance potential flow theory including supercritical wing sections the extended transonic area rule with lift effect transonic lifting line and swept or oblique wings to minimize wave drag Unsteady flow is also briefly discussed Numerical simulations based on relaxation mixed finite difference methods are presented and explained Boundary layer theory for all Mach number regimes and viscous inviscid interaction procedures used in practical aerodynamics calculations There are also four chapters covering special topics including wind turbines and propellers airplane design flow analogies and hypersonic rotational flows A unique feature

of the book is its ten self tests and their solutions as well as an appendix on special techniques of functions of complex variables method of characteristics and conservation laws and shock waves The book is the culmination of two courses taught every year by the two authors for the last two decades to seniors and first year graduate students of aerospace engineering at UC Davis Computational Methods in Hypersonic Aerodynamics T.K.S. Murthy,1992-03-31 This book contains chapters written by some eminent scientists and researchers on Computational Methods in Hypersonic Aerodynamics and forms a natural sequel to the earlier publications on Computational Methods in Potential Flow 1986 and Computational Methods in Viscous Aerodynamics 1990 In this book the earlier attempts at the solution of the highly nonlinear Navier Stokes equations are extended to the aerothermodynamics of flow in the hypersonic regime including the effects of viscosity on the physical and chemical processes of high temperature nonequilibrium flow at very high speeds such as vibrational excitation dissociation and recombination ionization and radiation as well as real gas effects and the effects of high temperature and low density The book has been prepared as a valuable contribution to the state of the art on computational methods in hypersonic aerodynamics All the chapters have been written by eminent scientists and researchers well known for their work in this field *Handbook of Research on Aspects and Applications of Incompressible and Compressible Aerodynamics* Kumar, Sathish K.,Radhakrishnan, Naren Shankar,2022-06-24 Aerodynamics is a science that improves the ability to understand theoretical basics and apply fundamental physics in real life problems The study of the motion of air both externally over an airplane wing and internally over a scramjet engine intake has acknowledged the significance of studying both incompressible and compressible flow aerodynamics The Handbook of Research on Aspects and Applications of Incompressible and Compressible Aerodynamics discusses all aspects of aerodynamics from application to theory It further presents the equations and mathematical models used to describe and characterize flow fields as well as their thermodynamic aspects and applications Covering topics such as airplane configurations hypersonic vehicles and the parametric effect of roughness this premier reference source is an essential resource for engineers scientists students and educators of higher education military experts libraries government officials researchers and academicians

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