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Hypersonic and High-temperature Gas Dynamics Hypersonic and High Temperature Gas Dynamics Hypersonic and High Temperature Gas Dynamics AIAA **This book is a self-contained text for those students and readers interested in learning hypersonic flow and high-temperature gas dynamics. It assumes no prior familiarity with either subject on the part of the reader. If you have never studied hypersonic and/or high-temperature gas dynamics before, and if you have never worked extensively in the area, then this book is for you. On the other hand, if you have worked and/or are working in these areas, and you want a cohesive presentation of the fundamentals, a development of important theory and techniques, a discussion of the salient results with emphasis on the physical aspects, and a presentation of modern thinking in these areas, then this book is also for you. In other words, this book is designed for two roles: 1) as an effective classroom text that can be used with ease by the instructor, and understood with ease by the student; and 2) as a viable, professional working tool for engineers, scientists, and managers who have any contact in their jobs with hypersonic and/or high-temperature flow. High Enthalpy Gas Dynamics** John Wiley & Sons **This is an introductory level textbook which explains the elements of high temperature and high-speed gas dynamics. Readers will gain an understanding how the thermodynamic and transport properties of high temperature gas are determined from a microscopic viewpoint of the molecular gas dynamics, and how such properties affect the flow features, the shock waves and the nozzle flows, from a macroscopic viewpoint. In addition, the experimental facilities for the study on the high enthalpy flows are described in a concise and easy-to-**

understand style. Practical examples are given throughout emphasizing the application of the theory discussed. Each chapter ends with exercises/problems and solutions to enhance the learning experience. The book begins with the basics about enthalpy, its nature and difference with internal energy and its relationship to heat. Subsequent sections in the chapter on the Basics cover the essence of the gas dynamics of perfect gas, covering all aspects of the theory, which assumes the specific heats of the gas as constants and independent of temperature. The chapter on Thermodynamics of Fluid Flow reviews the concept of energy which plays an important role in both high temperature flows and perfect gas flows. The chapter on Wave Propagation describes the waves, namely the Mach waves, compression waves and expansion waves, which prevail in all gas dynamic streams. The chapter on High Temperature Flows begins with the discussion on the difference between the perfect gas flow and high temperature flow, and proceeds to the importance of high-enthalpy flows covering the nature of high-enthalpy flows, most probable macro state, Bose-Einstein and Fermi-Dirac statistics, Boltzmann distribution, evaluation of thermodynamic properties and partition function, covering the various aspects of high-enthalpy flows with shocks. The final chapter on High Enthalpy Facilities describes the devices to provide hypersonic airflows at high enthalpy and high-pressure total conditions. Journal of Thermophysics and Heat Transfer New Results in Numerical and Experimental Fluid Mechanics Contributions to the 10th AG STAB/DGLR Symposium Braunschweig, Germany 1996 Springer Science & Business Media **This volume contains the papers of the 10th AG STAB (German Aerospace Aerodynamics Association). In this association all those scientists and engineers from universities, research-establishments and industry are involved, who are doing research and project work in numerical and experimental fluid mechanics and aerodynamics for aerospace and other applications. Many of the contributions are giving first results from the "Luftfahrtforschungsprogramm der Bundesregierung (German Aeronautical Research Program) 1995-1998". Some of the papers report on work sponsored by the Deutsche Forschungsgemeinschaft, DFG, which also was presented at the symposium. The volume gives a broad overview over the ongoing work in this field in Germany. Computational Fluid Mechanics and Heat Transfer** CRC Press **Computational Fluid Mechanics and Heat Transfer, Fourth Edition is a fully updated version of the classic text on finite-difference and finite-volume computational methods. Divided into two parts, the text covers essential concepts, and then moves on to fluids equations in the second part. Designed as a valuable resource for practitioners and students, new examples and homework problems have been added to further enhance the student’s understanding of the fundamentals and applications. Provides a thoroughly updated presentation of CFD and computational heat transfer Covers more material than other texts, organized for classroom instruction and self-study Presents a range of flow computation strategies and extensive**

computational heat transfer coverage Includes more extensive coverage of computational heat transfer methods Features a full Solutions Manual and Figure Slides for classroom projection Written as an introductory text for advanced undergraduates and first-year graduate students, the new edition provides the background necessary for solving complex problems in fluid mechanics and heat transfer. High Temperature Phenomena in Shock Waves Springer Science & Business Media **The high temperatures generated in gases by shock waves give rise to physical and chemical phenomena such as molecular vibrational excitation, dissociation, ionization, chemical reactions and inherently related radiation. In continuum regime, these processes start from the wave front, so that generally the gaseous media behind shock waves may be in a thermodynamic and chemical non-equilibrium state. This book presents the state of knowledge of these phenomena. Thus, the thermodynamic properties of high temperature gases, including the plasma state are described, as well as the kinetics of the various chemical phenomena cited above. Numerous results of measurement and computation of vibrational relaxation times, dissociation and reaction rate constants are given, and various ionization and radiative mechanisms and processes are presented. The coupling between these different phenomena is taken into account as well as their interaction with the flow-field. Particular points such as the case of rarefied flows and the inside of the shock wave itself are also examined. Examples of specific non-equilibrium flows are given, generally corresponding to those encountered during spatial missions or in shock tube experiments. The Proceedings of the 2018 Asia-Pacific International Symposium on Aerospace Technology (APISAT 2018)** Springer **This book is a compilation of peer-reviewed papers from the 2018 Asia-Pacific International Symposium on Aerospace Technology (APISAT 2018). The symposium is a common endeavour between the four national aerospace societies in China, Australia, Korea and Japan, namely, the Chinese Society of Aeronautics and Astronautics (CSAA), Royal Aeronautical Society Australian Division (RAeS Australian Division), the Korean Society for Aeronautical and Space Sciences (KSAS) and the Japan Society for Aeronautical and Space Sciences (JSASS). APISAT is an annual event initiated in 2009 to provide an opportunity for researchers and engineers from Asia-Pacific countries to discuss current and future advanced topics in aeronautical and space engineering. VDI Heat Atlas** Springer Science & Business Media **For more than 50 years, the Springer VDI Heat Atlas has been an indispensable working means for engineers dealing with questions of heat transfer. Featuring 50% more content, this new edition covers most fields of heat transfer in industrial and engineering applications. It presents the interrelationships between basic scientific methods, experimental techniques, model-based analysis and their transfer to technical applications. Aeronautical Engineering A Continuing Bibliography with Indexes Stagnation-point Solutions for Inviscid Radiating Shock Layers Hypersonic Research Summary The program areas included in this report are early work on the Wave**

Superheater and related research on Chemical Nonequilibrium in High-temperature Gas Flows, a Radiation Probe, Sound Propagation in an Excited of Dissociated Gas, Boundary Layer Phenomena in High-Temperature Gas Flows, and Molecular Interaction at High Temperatures. AIAA Journal GAS DYNAMICS, Seventh Edition PHI Learning Pvt. Ltd. **This revised and updated seventh edition continues to provide the most accessible and readable approach to the study of all the vital topics and issues associated with gas dynamic processes. At every stage, the physics governing the process, its applications and limitations are discussed in detail. With a strong emphasis on the basic concepts and problem-solving skills, this text is suitable for a course on Gas Dynamics/Compressible Flows/High-speed Aerodynamics at both undergraduate and postgraduate levels in aerospace engineering, mechanical engineering, chemical engineering and applied physics. The elegant and concise style of the book along with illustrations and worked-out examples makes it eminently suitable for self-study by students and also for scientists and engineers working in the field of gas dynamics in industries and research laboratories. The computer program to calculate the coordinates of contoured nozzle, with the method of characteristics, has been given in C-language. The program listing along with a sample output is given in the Appendix. NEW TO THE EDITION • A new chapter on the 'Power of Compressible Bernoulli Equation' • Extra chapter-end examples in Chapter 5 • Additional exercise problems in Chapters 5, 6, 7, and 8 KEY FEATURES • Concise coverage of the thermodynamic concepts to serve as a revision of the background material • Introduction to measurements in compressible flows and optical flow visualization techniques • Introduction to rarefied gas dynamics and high-temperature gas dynamics • Solutions Manual for instructors containing the complete worked-out solutions to chapter-end problems • In-depth presentation of potential equations for compressible flows, similarity rule and two-dimensional compressible flows •Logical and systematic treatment of fundamental aspects of gas dynamics, waves in the supersonic regime and gas dynamic processes TARGET AUDIENCE • BE/B.Tech (Mechanical Engineering, Aeronautical Engineering) • ME/M.Tech (Thermal Engineering, Aeronautical Engineering) High Temperature Gas Dynamics An Introduction for Physicists and Engineers** Springer Science & Business **High Temperature Gas Dynamics is a primer for scientists, engineers, and students who would like to have a basic understanding of the physics and the behavior of high-temperature gases. It is a valuable tool for astrophysicists as well. The first chapters treat the basic principles of quantum and statistical mechanics and how to derive thermophysical properties from them. Special topics are included that are rarely found in other textbooks, such as the thermophysical and transport properties of multi-temperature gases and a novel method to compute radiative transfer. Furthermore, collision processes between different particles are discussed. Separate chapters deal with the production of high-temperature gases and with electrical emission in plasmas, as well as related diagnostic**

techniques. This new edition adds over 100 pages and includes the following updates: several sections on radiative properties of high temperature gases and various radiation models, a section on shocks in magneto-gas-dynamics, a section on stability of 2D ionized gas flow, and additional practical examples, such as MGD generators, Hall and ion thrusters, and Faraday generators. Scientific and Technical Aerospace Reports Direct Methods for Solving the Boltzmann Equation and Study of Nonequilibrium Flows Springer Science & Business Media **This book is concerned with the methods of solving the nonlinear Boltz mann equation and of investigating its possibilities for describing some aerodynamic and physical problems. This monograph is a sequel to the book 'Numerical direct solutions of the kinetic Boltzmann equation' (in Russian) which was written with F. G. Tcheremissine and published by the Computing Center of the Russian Academy of Sciences some years ago. The main purposes of these two books are almost similar, namely, the study of nonequilibrium gas flows on the basis of direct integration of the kinetic equations. Nevertheless, there are some new aspects in the way this topic is treated in the present monograph. In particular, attention is paid to the advantages of the Boltzmann equation as a tool for considering nonequi librium, nonlinear processes. New fields of application of the Boltzmann equation are also described. Solutions of some problems are obtained with higher accuracy. Numerical procedures, such as parallel computing, are in vestigated for the first time. The structure and the contents of the present book have some com mon features with the monograph mentioned above, although there are new issues concerning the mathematical apparatus developed so that the Boltzmann equation can be applied for new physical problems. Because of this some chapters have been rewritten and checked again and some new chapters have been added. Low Density High Temperature Gas Dynamics Surface pressures on a flat plate with sharp leading edge were measured in a M = 1.5 monatomic gas flow. The results were in essential agreement with those recorded for a diatomic gas, but differed quantitatively from a recent theory based on a discrete ordinate solution of the BGK equation. The modulated hot-wire probe was proven conclusively to provide a measurement of local mass flux in a hypersonic flow. Surveys performed in a low density free jet showed very clearly the initial disturbance produced by the thick surrounding shock structure. The upstream influence of a sharp flat plate was measured with the modulated hot wire probe. The disturbance field was symmetrical about the leading edge and extended upstream for approximately three mean-free-paths based on a body-free stream collision. Thermographic phosphors were determined to exhibit a sensitivity of 8% change in output light intensity per deg C and to have an equivalent noise figure of 0.1C; thus they will be suitable for measuring local surface temperature at sharp leading edges. (Author). Government-wide Index to Federal Research & Development Reports Fundamentals of Gas Dynamics** John Wiley & Sons **New edition of the popular textbook, comprehensively updated throughout and now includes**

a new dedicated website for gas dynamic calculations The thoroughly revised and updated third edition of Fundamentals of Gas Dynamics maintains the focus on gas flows below hypersonic. This targeted approach provides a cohesive and rigorous examination of most practical engineering problems in this gas dynamics flow regime. The conventional one-dimensional flow approach together with the role of temperature-entropy diagrams are highlighted throughout. The authors—noted experts in the field—include a modern computational aid, illustrative charts and tables, and myriad examples of varying degrees of difficulty to aid in the understanding of the material presented. The updated edition of Fundamentals of Gas Dynamics includes new sections on the shock tube, the aerospike nozzle, and the gas dynamic laser. The book contains all equations, tables, and charts necessary to work the problems and exercises in each chapter. This book's accessible but rigorous style: Offers a comprehensively updated edition that includes new problems and examples Covers fundamentals of gas flows targeting those below hypersonic Presents the one-dimensional flow approach and highlights the role of temperature-entropy diagrams Contains new sections that examine the shock tube, the aerospike nozzle, the gas dynamic laser, and an expanded coverage of rocket propulsion Explores applications of gas dynamics to aircraft and rocket engines Includes behavioral objectives, summaries, and check tests to aid with learning Written for students in mechanical and aerospace engineering and professionals and researchers in the field, the third edition of Fundamentals of Gas Dynamics has been updated to include recent developments in the field and retains all its learning aids. The calculator for gas dynamics calculations is available at https://www.oscarbiblarz.com/gascalculator gas dynamics calculations The High Temperature Hypersonic Gasdynamics Facility A high temperature hypersonic gasdynamics facility is described. It was developed from efforts to extend the state of the art in hypersonic aerodynamic simulation. The high temperature facility is an operational hypersonic wind tunnel supplied by high pressure, heated air from a zirconia dioxide pebble heater. The maximum stagnation pressure and temperature is 40 atmospheres and 4500 F respectively. This facility is one of four of its kind in this hemisphere, and the only Air Force facility of its type. This report describes he first six months operation to include some design and development aspects. The successful operation of this facility is a significant achievement in the area of hypersonic aerodynamic testing techniques. Aerospace America The Scramjet Engine Processes and Characteristics Cambridge University Press **Demand for high-speed propulsion has renewed development of the supersonic combustion ramjet engine (Scramjet engine) for hypersonic flight applications. The High Temperature Aspects of Hypersonic Flow Proceedings of the AGARD–NATO Specialists' Meeting Sponsored by the Fluid Dynamics Panel of Agard Held at the Technical Centre for Experimental Aerodynamics, Rhode-Saint-Genèse, Belgium, 3–6 April 1962** Elsevier **The High Temperature Aspects of Hypersonic Flow is a**

record of the proceedings of the AGARD-NATO Specialists' Meeting, held at the Technical Centre for Experimental Aerodynamics, Rhode-Saint-Genese, Belgium in April 1962. The book contains the papers presented during the meeting that tackled a broad range of topics in the aspects of hypersonic flow. The subjects covered during the meeting include pressure measurements, interference effects, the use of wind tunnels in aircraft development testing, high temperature gas characteristics, boundary layer research, stability and control and the use of rocket vehicles in flight research. Aerospace engineers and aeronautical engineers will find the book invaluable. 19th AIAA Advanced Measurement and Ground Testing Technology Conference June 17-20, 1996/New Orleans, LA. U.S. Government Research Reports Applied Mechanics Reviews 7th AIAA/ASME Joint Thermophysics and Heat Transfer Conference June 15-18, 1998/Albuquerque, NM. Aerothermodynamics and Jet Propulsion Cambridge University Press **This robust introduction to aerothermodynamics uses example-based teaching to provide students with a solid theoretical foundation linked to real-world engineering scenarios. Combined Numerical/Analytical Perturbation Solutions of the Navier-Stokes Equations for Aerodynamic Ejector/Mixer Nozzle Flows 32nd Aerospace Sciences Meeting & Exhibit: 94-0740 - 94-0774 Paper 35th AIAA Thermophysics Conference 11-14 June, 2001, Anaheim, CA. Hypersonic Flow** Wiley-Interscience **The Ideal Text/Reference for Students, Engineers, and Research Scientists Not since the early days of space flight has the subject of hypersonic flow been of such importance to aerospace and mechanical engineers, research scientists, and students. Spurred by visions of hypersonic transport, and aerospace planes, the government now supports studies of hypersonic flow in at least eighteen graduate research centers across the nation, and numerous major universities now offer graduate and senior level undergraduate courses on the subject. Hypersonic Flow is the ideal text/reference for students and professionals interested in this burgeoning field. Written by a nationally recognized authority on the subject, it features a clear, accessible writing style along with sufficient depth and detail for self-study, and it is organized for speedy location of specific information. Numerous end-of-chapter exercises and homework problems enhance and solidify the student’s understanding of complex and sophisticated material. This book provides an in-depth look at all the major topics and issues associated with fluid flow at speeds in excess of Mach 5, including: elementary hypersonic flow problems; general similarity concepts; elements of hypersonic small disturbance theory; and much more. In addition, this book brings you: The most extensive coverage of viscous effects available anywhere A unique, in-depth presentation of waveriders Extensive treatment of asymmetric conical flows An introduction to computational fluid dynamics Extensive treatment of real-gas effects Air Force Research Resumés Similar Solutions for Viscous Hypersonic Flow Over a Slender Three-fourths-power Body of Revolution 28th AIAA Fluid Dynamics Conference, 4th AIAA Shear Flow Control**

Conference June 29-July 2, 1997, Snowmass Village, CO. Transactions of the Japan Society for Aeronautical and Space Sciences AIAA 90-1570 - AIAA 90-1604