



AERODYNAMIC PREDICTIVE METHODS AND THEIR VALIDATION IN HYPERSONIC FLOWS



AK Sreekanth

**Defence Scientific Information & Documentation Centre
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PREFACE

This monograph presents a summary of engineering methods most commonly employed for preliminary aerodynamic analysis of bodies travelling at hypersonic speeds. To the extent possible, an attempt has been made to make the present work self-sufficient. However, references are cited if one is interested in the source or more details.

The work is in three parts. Part 1 deals with Predictive Methodology, Part 2 covers Validation of Prediction Methods and Part 3 the Aerodynamics of Rarefied Gases.

Secunderabad
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AK Sreekanth

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PART - I

AERODYNAMIC PREDICTIVE METHODS

IN

HYPersonic FLOWS

CHAPTER 1

AERODYNAMIC PREDICTIVE METHODS IN HYPERSONIC FLOWS

1.1 INTRODUCTION

The conceptual design of an efficient hypersonic cruise vehicle or a missile requires a detailed knowledge of how various geometrical configuration parameters affect the aerodynamic performance of such a vehicle. Besides, it is desirable to have the ability to compare one configuration's performance with another in a relatively short amount of time. During the preliminary design phase involved in arriving at feasible configurations for a specified mission, simple engineering-type empirical and semi-empirical methods are invariably employed. The expensive and time-consuming wind tunnel tests and sophisticated computational techniques are reserved for possible designs evolved from the preliminary analysis.

A variety of engineering methods applicable to flows at hypersonic Mach numbers have been reported over the years in open literature. Each of these methods works well on very specific types of components. Therefore, it is necessary to choose a combination of these methods to analyse the complete vehicle made up of various components, such as body, lifting, and control surfaces.

The present work is a compilation of some of the well-known prediction methods, their applicability and limitations. Examples of the application of a few of these methods to calculate aerodynamic parameters of some specific components of vehicle configurations have been made and the results presented. Some published work on the aerodynamic characteristics of a few of hypersonic configurations, their predictions and comparison with

experimental data are discussed in Part II(Chapter 6) of this monograph, to illustrate the applicability and validity of the approximate methodology.

About the Book

This monograph presents a summary of engineering methods most commonly employed for preliminary aerodynamic analysis of bodies travelling at hypersonic speeds. The work is divided into three parts: Part I deals with Predictive Methodology, Part II covers Validation of Predictive Methods and Part III the Aerodynamics of Rarefied Gases.

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Dr AK Sreekanth has multiple qualifications to his credit starting with B.E. (Mech) from College of Engineering, Bangalore; D.I.I.Sc (Aero), I.I.Sc, Bangalore, followed with M.A.Sc and Ph.D from University of Toronto, Canada.

He started working as Lecturer at University of Toronto, as Staff Scientist at Boeing Company, Seattle, NRC-NASA Senior Post Doctoral Research Fellow, NASA Ames Research Center, California, Professor and Head of Aerodynamics Group, Indian Institute of Technology, Madras, India, Member of International Rarefied Gas Dynamics Advisory Committee for many years and CSIR Emeritus Professor, I.I.Sc, Bangalore.

His area of specialization is Experimental and Numerical Gas and Fluid dynamics with special reference to Rarefied and Hypersonic Flows - High Speed Wind Tunnel and Shock Tube testing.

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