

Preface

Helmholtz' ground breaking vortex theorems in the mid-nineteenth century provided the tools for the momentous discoveries in theoretical aerodynamics by Prandtl and others nearly a century ago. Since then, studies of vorticity dynamics have received continual impetus from diverse applications in engineering, physics, and mathematics. A number of books on vortex theory and vortex dynamics addressing a broad range of topics of theoretical and practical interests are presently available. In comparison with these books, the present monograph has a narrower focus. It is aimed at sharing my understanding of theoretical aerodynamics with the reader interested in the classical circulation theory and in the role of modern vorticity dynamics in theoretical aerodynamics involving unsteady and non-streamlined flows.

My lectures in a short course at the Tsinghua University and at the Second Biennial Retreat on Vorticity Aerodynamics, both scheduled for September in Beijing, presented an ideal occasion for preparing my notes: an audience and a firm target date. As it turned out, however, my initial estimate of required time was overly optimistic. In the end, to meet target dates, certain compromises had to be made.

One major compromise is the omission of a chapter discussing vorticity-based flow computations. While computational aerodynamics is one of my favorite subjects, time limitations prevented the inclusion of this subject as a component of this monograph. Topics discussed in the present work, however, form the core of vorticity-based computation methods. Detailed discussions of these methods are available in some of the references quoted in Chaps. 1 and 3.

Other compromises involve editorial issues such as curtailing redundancies and adding figures, exercises, and more sample problems. Chapters of my notes were prepared more or less as independent articles, each with its own themes, references, and introductory discussions, intermittently over an extended period of time. Efforts to tie the chapters together and to implement the obviously desirable improvements were ultimately limited by available time.

The present monograph is based essentially on my lecture notes completed in August of 2004. It is my intent to prepare a “**Version 2.0**” of the monograph in the

reasonable future. It is my hope that my colleagues would kindly provide commentaries and critiques about this initial version. One issue of special concern during my preparation of the present version is the proper discussion of certain viewpoints and strategies about vorticity aerodynamics, acquired and used over the years in my research and teaching. These viewpoints and strategies are obviously not the only ones that work; they are by no means a panacea for all applications of vorticity dynamics. I am, however, convinced that they are consistent, rational, and very effective within the perimeters defined in this monograph. Advocating these viewpoints and strategies is not meant to underplay the merits of alternative viewpoints and strategies, especially the classical ones. In this regard, I wish to acknowledge the special help of Prof. J.Z. Wu, who kindly reviewed my draft manuscripts on very short notices.

During my teaching and research career, I had the good fortune of associations with many brilliant and marvelous individuals—teachers, colleagues, and former students—who provided indispensable inspiration for my work. I wish to take this opportunity to express my gratitude for their contribution to my understanding of vorticity aerodynamics.

I would be remiss not to mention again the love and support of my wife Mei-Ying Wu, especially during the past year, as the preparation of my notes took up more and more, eventually virtually all, of the time at my disposal.

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