

## PREFACE

Flow visualization is one of the most effective tools in flow analysis, and it has been crucial for improving our understanding of complex fluid flows. In fact, some of the major discoveries in fluid mechanics were made using flow visualization. Professor F.M.N. Brown of the University of Notre Dame wrote:

... A man is not a dog to smell out each individual track, he is a man to see, and seeing, to analyse. He is a sight tracker with each of the other senses in adjunctive roles. Further, man is a scanner, not a mere looker. A single point has little meaning unless taken with other points and many points at different times are little better. He needs the whole field, the wide view.

The book is designed to provide source material for those who are intending to carry out flow visualization studies. Although it is written primarily for students and researchers in areas of mechanical, aerospace, and civil engineering, as well as oceanography and physics, we hope that other research workers, including those in medical fields will find the book useful. We hope, too, that the depth and breadth of the book will make it valuable to people who have little or no prior experience in flow visualization as well as to those with considerable experience in this subject. To obtain a complete understanding of the flow behavior, it is usually necessary to complement the flow visualization with quantitative measurements. One of the most exciting advances in flow imaging is that some flow visualization techniques, such as Particle Image Velocimetry (PIV) and Molecular Tagging Velocimetry (MTV), can also provide quantitative results. We have highlighted such dual-use methods in this book.

The text is organized into two major parts. The first part consists of 12 chapters, each dealing with a different technique, or a related set of techniques for flow visualization. The first chapter in this part deals with the interpretation of flow visualization results using critical point theory, and it is a must for everyone as it highlights some of the possible traps and dangers in interpreting flow visualization results. The remaining chapters are devoted to discussion

and implementation of particular flow visualization techniques, covering hydrogen bubble, dye and smoke methods, MTV, planar laser imaging, digital PIV, thermochromic crystals, pressure and shear sensitive coatings, methods for compressible flows, three- and four-dimensional imaging, and the interpretation of numerical visualizations of compressible flows with strong gradients. They are all written by recognized experts in flow visualization. We deliberately asked the authors to emphasize the practical aspects of their craft, to help others get started in this field. Extensive references are given for more detailed study. The second part of the text is made up of a collection of flow images taken by leading researchers from around the world. These illustrations give examples of the techniques described in the book, and they were chosen to provide high-quality images of some fascinating fluid flow phenomena.

Flow visualization covers a broad range, and it is certainly impossible for us to include all the topics in a single volume. The choice of the topics must be somewhat controversial and necessitates many arbitrary omissions. We apologize for any gaps and omissions in this book.

Finally, we would like to take this opportunity to thank all the authors for sharing their expertise in flow visualization, and their hard work in preparing their particular contributions. It is they who made this book a reality and we hope they are pleased with the final product.

We welcome constructive comments and suggestions.

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