APPLICATIONS

Having studied various computational methods in Parts Two and Three and automatic grid generation, adaptive methods, and computing techniques in Part Four, we are now prepared to re-examine these methods and test our knowledge on some selected engineering problems of application. For the past four decades, many applications have been accumulated to such a great extent that it is impossible to review them all in this text. Rather, we limit our scope of study to the following areas: turbulence (Chapter 21), chemically reactive flows and combustion (Chapter 22), acoustics (Chapter 23), combined mode radiative heat transfer (Chapter 24), multiphase flows (Chapter 25), electromagnetic flows (Chapter 26), and relativistic astrophysical flows (Chapter 27).

The selection of computational methods depends on many factors such as types of flows, ranges of speeds, dimensions of domain, etc. A decision as to the choice of FDM, FEM, or FVM is now a matter of preference and judgments of the analyst in view of the information presented in the previous chapters.

In the following chapters, example problems and computational methods are chosen randomly, depending on availability of sources. Some of them are drawn from the student works at the University of Alabama in Huntsville, and others are from those available in the open literature. In each of the applications, the corresponding governing equations and associated physics are first introduced. This is then followed by the computational methods used, numerical results and evaluations, each example being self-contained as much as possible.

It is hoped that these examples serve as a reasonable guidance for the uninitiated reader toward his or her direction and destination in CFD research. Some examples are elementary, and others represent the research results which are highly specialized. Thus, the reader may wish to explore subject areas selectively.