Preface

The impetus to write this book came about from three sources:

The first source was the bi-yearly computational fluid dynamics (CFD) course, which has been offered over the last 15 years at the American University of Beirut (AUB) by both Drs. Darwish and Moukalled to senior and graduate mechanical engineering students, a course that focuses on the finite volume method (FVM) and CFD applications.

The second source grew over the years to become more significant as it was noticed that graduates have started working on increasingly more focused areas and topics in CFD while becoming less cognizant of the general algorithmic expertise that earlier students developed. It became clear that there is a need not only to cover the basis of the numerics at the core of CFD codes but also to discuss the implementation issues to ensure that all students receive a robust understanding of the techniques they are working on.

Finally, the collaborative work in advanced numerics with Prof. Dr. Mangani from HSLU, Lucerne, Switzerland, which started during the Ph.D. supervision of M. Buchmyer (Ph.D.) from TUGraz, provided all the incentive to clarify and detail much of the numerical basis of the algorithms used in OpenFOAM®.

To this end, it was decided that the book would combine a mix of numerical and implementation details allowing the reader, if she/he desires, to fully understand and implement a robust and versatile CFD code based on the FVM.

This ambitious task was possible only by selecting from the various numerical methods in each of the topics covered in the book a handful set with which the authors are intimately familiar. The result is a book that covers intimately all the topics necessary for the development of a robust CFD code for the simulation of fluid flow at all speeds within the framework of the collocated unstructured finite volume method.

The book was also written with the classroom in mind as reflected by the use of copious illustrations; the provision of many exercises covering numerics, programming, and applications; the availability of an academic code (in MATLAB®) that imbeds much of the numerics presented in the book; and finally the various programs and routines in OpenFOAM®.

The hope is that as you read through this book, you will share with us the excitement and intense interest that we have grown to have for this subject.

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