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Book reviews

Computational Aerodynamics and Fluid Dynamics: An Introduction
by Jean-Jacques Chattot (Springer, 2002, 186 pp.). Recommended retail price: EUR 49.95

Twenty years ago, textbooks on Computational Fluid Dynamics (CFD) were white crows. Today, several CFD textbooks exist, often either 'encyclopedic', giving a good overview of the state-of-the-art in CFD in the time of publication (examples are:[1,2,3,4]), or monographic, giving a detailed account of the state-of-the-art in a specific subfield of CFD, also in the time of publication (examples of the latter are:[5,6,7,8]). The present book does not fall in one of the above categories. It does not describe today's CFD techniques. The book considers early finite-difference discretizations (no finite-volume or finite-element methods), together with the early solution techniques for the corresponding systems of finite-difference equations. The most recent finite-difference scheme it considers is the Murman and Cole scheme, which dates from 1970 already. The author seems to have deliberately kept distance from state-of-the-art techniques, techniques of which the practical value is often not yet fully known. Particularly illustrating for this distance is the fact that the author still refers to the – as far as I know – first textbook on CFD: Roache's book from 1972,[9] and *not* to the above cited, updated and significantly extended successor by the same author. There is an argument for being classical instead of state-of-the-art. CFD is still developing at a rapid pace; techniques that are good today may be obsolete within a few years. Writing a state-of-the-art textbook on CFD may therefore be an unrewarding task.

Although the present book considers well-proven CFD techniques only, it is definitely not obsolete. Many of the techniques it describes are used in today's CFD software packages. Given the wide spreading of these packages, the book is of great practical value.

The description of the discretization and solution methods is rigorous; the author tries to give the reader a full understanding of the methods and also tacitly invites the reader to implement the techniques and test them in practice. I support the author's belief that a method is not fully understood when it has not been coded and applied in simulations by the user him-/herself. The book may be a good help for the growing community of students, engineers and also scientists who are applying ready-for-use CFD software packages.

A somewhat controversial statement made by the author is that the Murman and Cole scheme is of the same value to the advancement of CFD as the Godunov scheme. From an industrial point of view this may (still) be true today. From a scientific point of view it is not. The Murman and Cole scheme has not initiated such a huge tide of research and development in CFD as the Godunov scheme. All of the aforementioned textbooks show this, particularly the monographs. In fact, all four cited monographs embroider to a large extent on Godunov's work, I do not know any monograph on the basis of the Murman and Cole scheme. The Murman and Cole scheme is also more limited in its range of applications than the Godunov scheme. It is exclusively directed towards transonic aerodynamics. The author is a known expert in the field of computational transonic aerodynamics, which might explain his statement.

The book has been written in a neat and pleasant style, large steps are avoided almost everywhere. I like the short length of the sections, the book is well-structured. The attention for real fluid-dynamics problems makes the book lively as well. The book

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concludes with a set of exercises and worked out solutions, corroborating the author's statement that the book is self-contained. I am glad with my pay for refereeing prof. Chattot's book: the book itself.

Barry Koren
Centre for Mathematics and Computer Science (CWI)
Amsterdam
The Netherlands

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Optical Measurements Techniques and Applications, 2nd edition
by Franz Mayinger and Oliver Feldmann (Eds.) (Springer, 2001) ISBN 3-540-66690-7

When I started out in fluid dynamics and proposed to buy expensive fotonic equipment, one of my colleagues told me "... but G.I. Taylor could do fluid dynamics with a rubber band...". Well, *we* cannot, and with the advent of the laser and digital image acquisition, instrumentation in fluid dynamics has reached maturity. Optical techniques hold the promise of time-resolved full 3D images of the velocity field and quantitative 3D information of the species concentration and temperature in reacting flows.

Since the invention of laser-Doppler anemometry, the number of optical techniques for fluid dynamics has grown tremendously. Some of these techniques actually require fluid dynamicists to be versed in molecular spectroscopy. The present range of applications is so wide that it is good to have an overview over what is possible with lasers, monochromators and cameras. Such an overview is precisely provided by this book. This new second edition followed the first one published in 1996. It has been updated, but some of the more modern techniques are still missing.

Separate teams of specialists have written the chapters on different optical techniques. Each chapter starts with the basics and ends with a few real-life applications. The different chapters can be read separately, with the consequence that some subjects (such as holography) are introduced several times; it did not bother me. The described techniques include holographic interferometry, laser-Doppler velocimetry (LDV), dynamic light scattering, Raman scattering, laser induced fluorescence, absorption spectroscopy, thermography and particle image velocimetry (PIV). The book further contains contributions on tomography and digital image processing.

The reason a fluid dynamicist should read this book is not because of the chapters on LDV and PIV, which add little to what most of us already know. In fact, most of the LDV chapter is devoted to the extraction of turbulence statistical quantities from velocity records; the argument being that LDV systems come as black boxes these days and we better understand what to do with their signals. Instead, the prime reason a fluid dynamicist should read this book is to get acquainted with the spectroscopic techniques that give access to chemical species concentration and temperature. I especially liked the excellect chapters on laser-induced fluorescence and Raman spectroscopy. I also enjoyed reading the precise and well-written description of dynamic light scattering for measuring molecular diffusivities.

I realize that it is difficult to cover the rapidly expanding field of photonics, but I missed a discussion of techniques that made inroads only recently, such as cavity ringdown spectroscopy for absorption measurements, and molecular spectroscopy techniques for velocimetry such as global Doppler velocimetry or molecular tagging velocimetry.

Read this book if you are interested in new optical techniques that may become part of your experiment. Do not buy it because you want to see the CD ROM that has been advertised with it. The CD has a few movies of explosions and contains a few color illustrations that should have been printed in the book anyway.

Willem van de Water
Physics Department
Eindhoven University of Technology
P.O. Box 513
5600 MB Eindhoven
The Netherlands

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