Book Review

Turbulence Modeling for CFD

David C. Wilcox, DCW Industries, Inc., La Canada, California, 1993, 460 pp., $75.00 (Solutions Manual, 218 pp., $40.00)

This is a good book for students, engineers, and computational fluid dynamicists interested in learning about turbulence modeling, its limitations, and something about its current status. The material was assembled for a graduate-level course in turbulence modeling. A problem solution workbook and a diskette containing several useful analysis tool codes and a robust boundary-layer code that can be run on a personal computer or a scientific workstation are provided along with the text. The book is well written and easy to follow because of highlighted key words and phrases. The material is organized to provide a systematic approach toward developing constitutive equations suitable for the computation of turbulent flows. With a good grasp of the material, serious CFD practitioners should be able to embark on choosing and eventually developing models for their own applications.

The text itself is divided into eight chapters. The first two provide a concise description of turbulence and the process for arriving at the Reynolds-averaged Navier-Stokes equations. Progressively more complex models for the Reynolds stresses are introduced and discussed as regards their inherent physical assumptions and limitations. Zero-, one-, and two-equation eddy viscosity models are presented sequentially followed by Reynolds stress models. Examples showing the successes and failures of various models are provided. It is here where the author could have been more even-handed and forthright about the limitations of his own modeling contributions. Nevertheless, the readers should be able to determine the status of modeling and its present limitations, and develop a grasp for a systematic approach to modeling. The seventh chapter focuses on incorporating advanced models into numerical schemes. Although the discussion is brief and more specific to boundary-layer equation formulations, it serves to sensitize the reader to issues such as numerical stiffness. The last chapter provides a brief description of direct numerical simulation of turbulence and the theory of chaos. It serves to acquaint the reader with the newest ideas in turbulence research. Appendices are provided to assist the readers in using the analysis and boundary-layer computer programs provided with the text.

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