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European Journal of Mechanics B/Fluids 24 (2005) 407

Book review

T. Cebeci, Turbulence Models and their Application. Efficient Numerical Methods with Computer Programs, Springer-Verlag, Berlin, ISBN 3-540-40288-8, 2004, 118 p. 40 illus. With CD-ROM. Hardcover. EUR 119.95 (net price), £92.50, sFr 203.00, $129.00.

Efficient and accurate calculation of turbulent boundary layer flows has been a subject of research for many years. Although the growing power of computers has led to an ever increasing use of direct numerical simulation, where no turbulence model is needed, turbulence models are still necessary for many practical applications, in which the Reynolds number is generally very high. The author of the present book, T. Cebeci, is one of the pioneers in turbulence modelling for boundary-layer flows and this book shows the high potential of the use of efficient numerical methods for such flows.

The book discusses numerical methods for the solution of the boundary-layer equations for two-dimensional geometries in which the Cebeci–Smith or the k–ϵ turbulence model is used. The governing equations and numerical solution methods are specified in detail. In particular Chapter 5, in which the interactive boundary-layer method is presented, provides a very good introduction to this topic, where an inviscid panel method is combined with a boundary-layer method in an interactive way.

I found it useful to start reading the book in the last chapter. In this chapter an overview is given of the accompanying computer programs. This not only illustrates the connection between the previous chapters of the book, but also shows the power of the methods presented. Within a very short calculation time a complete lift curve of an airfoil can be computed with high accuracy, as can be seen in Fig. 7.7 where a comparison with experimental data is presented.

The accompanying CD-ROM contains all computer programs discussed in the book: one for the Cebeci–Smith and k–ϵ turbulence models, one for the panel method, one for the inverse boundary-layer method for flows with separation and the final one for the interactive boundary-layer method. For all programs sample input files are provided along with the corresponding output files. On my Windows PC all programs ran without any problem, but for some of the programs I had to search for the correct input files, since some filenames mentioned in the book are incorrect. I also could change the input files, for example, to another airfoil geometry, but a better description of the format of the input files would have been helpful. Moreover, the error handling of the programs could have been better. If the input file is wrong or if the program encounters an error during execution, the best you get is an incomprehensible error message. Another thing that could have been better explained is the sudden appearance of the Mach number as an input parameter in the interactive boundary-layer program. The program appears to work for not too high values of the Mach number, but as the Mach number is not mentioned in the other chapters of the book, it remains unclear to what extent compressibility is taken into account.

A more serious criticism on the present book is its purpose. The introduction of the book does not make clear for whom this book is intended and after reading it is still not clear to me. A potential user of the computer programs would not be very interested in all details of the equations and numerical methods. On the other hand, almost all material presented in the book has already appeared in other books by the same author [1–3]. Chapters 2–5 are almost literally taken from these books, which moreover contain more material, such as extension to three dimensions. In conclusion, although the material presented in the book is useful, it provides too little new information compared to [1–3] to recommend it.

References

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Available online 11 September 2004

doi:10.1016/j.euromechflu.2004.08.001