J. Fluid Mech. (2002), *vol.* 466, *pp.* 408–410.
Printed in the United Kingdom

BOOK REVIEWS

Efficient Solvers for Incompressible Flow Problems. By S. Turek. Springer, 1999. 352 pp. ISBN 3540 65433 X. £57.50.
J. Fluid Mech. (2002), *vol.* 466. DOI: 10.1017/S002211200221215X

Spectral/hp Methods for CFD. By G. E. Karniadakis & S. J. Sherwin. Oxford University Press, 1999. 390 pp. ISBN 01951 02266. £62.50.
J. Fluid Mech. (2002), *vol.* 466. DOI: 10.1017/S002211200221215X

Here are two books with the acronym 'CFD' in a central place on the cover: Turek's book has the letters as obstacles around which we see (the computer simulation of) a flow; by contrast, it looks as though OUP ran out of funds in producing the plain blue cover of Karniadakis & Sherwin (the title of which contains CFD). The contrasting styles of these two texts on Computational Fluid Dynamics is not however limited to the cover.

Karniadakis & Sherwin's book admirably meets its aim to 'introduce a wider audience to spectral/hp element methods'. Such high-order numerical discretization methods have found use in varied situations where simple domain geometries have allowed easy application of boundary conditions and the authors have sought to demonstrate how spectral elements have more widespread applicability through the use of grids of irregular 'spectral elements'. Herein lies the connection with finite elements and the mesh-adaptive (h) and order-adaptive (p) approaches which combined give the 'hp' element methods appearing in the title.

The first half of the book describes in considerable detail the formulation and construction of spectral element methods – this is the sort of description that a good graduate student could really get into. One could construct from the ground up a spectral element code based on it. There is a lot of necessary detail to assimilate however – these will never be 10 line SOR codes! What a pity therefore that programming would be necessary: the authors surely have codes that they could have somehow provided to accompany the book. It should be said (and the authors do) that the description would probably be rather easier to follow if one already has some familiarity with the finite element method.

The second half of the book describes application of the ideas to solve the advection equation, the Helmholtz equation and finally the equations of incompressible and compressible flow: this is all good stuff.

Though there is a lot of detailed technical material here, Karniadakis & Sherwin have written in a very visual style with good graphics scattered throughout the text in a helpful way. They have brought together in one accessible volume a body of literature and have demonstrated the applicability and utility of this class of high-order numerical methods for differential equations.

Turek's is an altogether different book. In particular it is only a book to learn from if you already have some knowledge of finite element methods for incompressible flow problems. But if you have, then it is a real practitioners guide to the various algorithmic choices: which are possible and which are best! The author certainly pulls no punches in this respect – one finds for example on page 37 a table of the 'Structure of (almost) all solvers'.

The chunks of mathematical description of the possibilities are liberally interspersed with detailed tables of numbers which are the results of thorough computational comparisons. Turek really has explored nearly every avenue. A slight gripe is the lack of an index which would have seemed particularly appropriate for a book packed full of practical advice. The graphics are rather disappointing: some of the figures look as if a fountain pen with a leaky nib was used. This is rather unfortunate as the text is otherwise nicely presented.

The real gem in this book however is the compact disc stuck inside the back cover: put it into your cd drive and load into your browser and you're away. The cd not only has the code and complete documentation for the FEATFLOW software package which brings together the best ideas examined in the book, but also has the (good!) graphical results of application of the software to a wide range of two- and three-dimensional incompressible flow problems. (You can now also get more up to date versions over the web: http://www.featflow.de/featflow.html). Turek is certainly to be thanked for making this software freely available.

In conclusion, here are two advanced level books that demonstrate the power (and explain the pitfalls) of modern numerical methods for computing the solution of the most common models of fluid flow. They both show how the development of numerical algorithms has lead to a computational capability so much greater than was available with the finite difference and relaxation methods of the 1960s and 1970s. It is clear why, with corresponding advances in hardware, CFD has become an enabling technology for science and engineering.

A. WATHEN

SHORT NOTICES

Schwarz–Christoffel Mapping. By T. A. DRISCOLL & L. N. TREFETHEN. Cambridge University Press, 2002. 132 pp. ISBN 0521 807263. $40 or £30.

J. Fluid Mech. (2002), *vol.* 466. DOI: 10.1017/S0022112002222156

This short book discusses the Schwarz–Christoffel transformation and its numerical computation, and illustrates applications drawn from several fields of science and engineering. Familiarity with functions of a complex variable and elementary numerical methods is assumed. The book is composed of a brief introduction and four chapters: the essentials of the Schwarz–Christoffel mapping, numerical methods, variations of the main transformation, and applications. The book is illustrated with numerous figures generated using a Matlab software library produced by the authors, available from the internet site: www.math.udel.edu/~driscoll/SC. Those who do not have access to, or the means to purchase, Matlab (Scilab is a public domain alternative), may prefer to use the precursor Fortran 77 library SCPACK, available, along with other related software, from the internet site: www.netlib.org/conformal.

Annual Review of Fluid Mechanics, vol. 34. Edited by J. L. Lumley, S. H. Davis & P. Moin. Annual Reviews, 2002. 665 pp. ISBN 0 8243 0734 8.

J. Fluid Mech. (2002), *vol.* 466. DOI: 10.1017/S0022112002232152

Here is a list of articles and authors in the current volume of this periodical.