reader looks in vain for a simple relationship describing the development of the skin-friction coefficient (e.g. Kàrmàn–Schoenherr) or the boundary layer thickness δ. Boundary layers with separation are exemplified by the Stratford flow which, admittedly, is a specific case. Only at the end of section (18.5.2) does one find a reference to Simpson's review paper, which in combination with other reviews might have been part of a more general introduction to the phenomenon of separation. The turbulent boundary layer "coupled to the temperature field" is dealt with in chapter 19 (15 pages) and axisymmetric and three-dimensional boundary layers in chapter 20 (12 pages). Free turbulent shear flows conclude Part IV. Section 23 finally deals with the numerical integration of the boundary-layer equations, which is a review in its own right.

In conclusion, the reviewer is convinced that this book would have gained a lot by having been revised by a team of specialists who could at least have provided a more balanced view of the field and a more modern update of many sections. Time will show whether this book will attract the same target audience as the old book. I shall keep my old 'Schlichting'.

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Viscous Fluid Flow by T.C. Papanastasiou, G. Georgiou, A.N. Alexandrou (Springer-Verlag, Heidelberg, Germany, 2000, 418 pp.) DM 176; öS 1285; sFr 159; FF 663; £ 60.50; US$ 89.95 hardcover
ISBN 0-8493-1606-5

This is an interesting book on viscous fluid flow which has both strengths and weaknesses. One of its main strengths is the enormous amount of information it contains but, as a result, it is short on explanation and it is difficult to see who would benefit from reading it – it is too hard for a first introduction to viscous flow yet does not go far enough with the more advanced material to do more than act as a reference source. The introduction suggests it is based on a lecture course and it does seem that it would be most effective as a 'back up' reference book to a set of lectures – where the explanations and physical background missing in the book can be given in the lectures.

The stated aims of the book are to "develop and rationalize the mathematics" and "to exhibit the systematic application of these principles to flow occurring in fluid processing and other applications". These two aims do cause some unevenness in the presentation and it is particularly noticeable that the style varies from chapter to chapter and there is very little reference from one chapter to another. The second of these aims is the more interesting, since there are already many textbooks on the mathematics of viscous flow, and is mostly achieved by interesting practical examples (both worked and as problems for the reader), and a very broad set of references which are provided chapter by chapter. Some of these problems look very challenging, however, and I wish some 'hints for solution' could have been provided. The open-ended aspect of many of the exercises is intentional but it will often be frustrating for both student and teacher.

The order in which the early material is presented is unconventional and I have my doubts as to whether this will work pedagogically. However, while I am of the school of thought that believes in starting with the easiest situation first and building up to difficult ones later, I know there is a case to be made for presenting a fuller picture from the beginning.

Chapter 1 starts with some very basic material but also includes some sophisticated ideas about fluids and the stress tensor. I think it is confusing to introduce the dyadic notation as well as tensor notation – dyadic notation is not now in common use and is only referred to again fleetingly in Chapter 3. The problems at the end of the chapter are demanding, requiring both physical insight and good manipulative skills.

The Navier–Stokes equations are then derived in three stages. First, the principles of conservation of mass and momentum are introduced and the idea of vorticity is explored thoroughly. Examples and problems at this stage involve global balances and a thorough knowledge of engineering principles is assumed. Then the partial differential equations of fluid flow are derived and, after a digression into fluid in static equilibrium, the constitutive equations are introduced and the Navier–Stokes equation derived.

There is a tendency throughout the early part of the book to produce long lists of definitions and models (e.g. special fluids in Chapter 2, constitutive relations in Chapter 5), but nowhere is it *explained* what the essential assumptions are that lead to the Navier–Stokes equations. One is left with a sense of endless possibilities without being given either physical or mathematical reasons for the course pursued.

The second half of the book (Chapters 6–10) concentrates on applications. These are divided into exact solutions of the Navier–Stokes equations, boundary layers, nearly unidirectional flow (including lubrication) and creeping flows. While each chapter is clear and self-contained, there is a certain disconnectedness and unevenness in presentation which is unfortunate. This is most marked in the boundary layer theory in Chapter 8 which is extremely old-fashioned (note the dates of the references in this chapter) and does not properly exploit the perturbation theory which has been presented in Chapter 7.

The book is clearly written and will probably be most useful as a reference book for both students and teachers. Throughout the book there are summaries and tables of useful formulae and fluid properties, and there are a plethora of worked examples. For a teacher of a practically-oriented course on fluid dynamics, it will provide a rich source of problems and useful references.

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Numerical Methods for Wave Equations in Geophysical Fluid Dynamics by Dale R. Durran (Springer-Verlag Inc., New York, 1999, 465 pp.) DM 98; US$ 49.95 hardcover ISBN 0-387-98376-7

It rarely happens that an urgently required book appears at the right moment. In our group, we were discussing the design of a numerical model for atmospheric boundary layer flow. The main point was to decide what set of approximated equations should be solved and what schemes are to be used. Discussing these issues, Dale Durran's book helped us not only to clarify definitions and terminology but it provided excellent tools for illustrating the properties of different numerical approaches. It is the attraction of this book that it gives easy access to standard and advanced numerical techniques and illustrates all these by numerous examples and