sources, they provide a coherent exposition of the subjects treated together with sufficient information about the referenced papers so that one can decide whether or not he or she needs or wishes to consult them for further details. I do not see this as a textbook for even an advanced class, but it (or parts of it) could be used as a skeleton to be fleshed out by independent reading or supplementary lecturing.

To say that such an extensive work shows signs of hasty writing would be manifestly unfair. Still, it would have benefitted by some editorial attention, for it seems to me that it contains more misspelled and misused words and more awkward or obscure sentences than is normal. However, none of this really detracts from its usefulness. The typography also deserves comment. It is customary in mathematical text to set variables in italic type and operators in roman. Here everything is in roman. Although I was aware of this while reading, I did not find it any way confusing. If substantial costs in typesetting are thus effected, perhaps it should be used more widely, although I prefer the usual convention.

Although it might appear appropriate to compare the book under review with a similar one *Vagues et Ouvrages Petroliers en Mer,* by G. Susbielles and Chr. Bratu, Editions Technip, Paris, 1981), which appeared almost simultaneously, I think I should disqualify myself on the grounds of possible partiality. We are fortunate, however, to have two such treatises available.

Techniques of Finite Elements. by B. Irons and S. Ahmad, Wiley, New York, 1981. 529 pages. Price $30.95.

REVIEWED BY K. J. BATHE[6]

This is a valuable and enjoyable book to read for those who basically know already quite a bit about finite element methods. In a conversational style, the authors summarize their experiences about almost every topic of finite element techniques in linear structural analysis. Details are primarily given in the discussion of those methods that the authors have researched over the last two decades (and the authors are certainly well known in the finite element community for their research contributions). Two major topics are the frontal solution method and the semiloof elements, for which computer programs are also given; but the menu includes a large variety of topics, which can be appreciated by studying the titles of the 29 chapters: Overview; Basic Techniques; Shape Functions; Various Elastic Problems; Nodal Loads from Shape Function Routines; Problems of Management; Matrix-Structural Theory; The Matched Solution; Convergence – The Patch Test; Developing and Implementing Elements; How Nodes Hang Together: Front or Band?; Element Assembly and Equation Solving; A Frontal Solution Package; Roundoff Errors; Further Matrix-Structural Theory; Plate Bending; Shells; The Semiloof Beam and Shell; Symmetry; Sectorial Symmetry; Nonlinearity; Eigenvalues and Numerical Stability; Eigenvalues and Structural Problems; Non-Structural Problems; Implications of the Patch Test; Interpolation and Numerical Integration; Matrices; Vectors and Differential Geometry; and Stress and Strain.

Although quite detailed in some descriptions, the book is probably intended to be a strong subjective representation of finite element methods, and the authors have obviously not researched related literature to a high degree. The most notable contribution in this book is that the authors attempt to make the reader appreciate the structural and finite element principles from both a mathematical *and* a physical viewpoint. This is a very valuable endeavor and goes well with the conversational style of the book.

The readers most attracted to the volume will probably be finite element teachers and researchers who desire to obtain further insight into finite element techniques – the authors provide much valuable and thought-provoking material in that regard.

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Hydrodynamic Stability. By P. Drazin and W. Reid. Cambridge University Press, 1981. 525 pages. Price $77.00.

REVIEWED BY F. H. BUSSE[7]

Over the past decades the subject of hydrodynamic stability has assumed a central role in theoretical fluid dynamics. In spite of some earlier doubts, stability theory has become an indispensable tool for the understanding of the onset of turbulence in fluid flow and applications of the theory in engineering, and physical and environmental sciences are growing rapidly. Several books on the subject have been published, but there is a continuing demand for clear exposition of its foundation and methods.

The book by Drazin and Reid goes the farthest in meeting this expectation. Faced with the large variety of stability problems, the authors decided to treat the most basic problems of stability in detail instead of attempting to cover all known hydrodynamic instabilities. Many of the examples neglected in the main text appear in the extensive problem sections at the end of most chapters. The book starts with a discussion of the simplest examples of hydrodynamic instability such as Benard convection and Taylor vortices. It then proceeds to the more complex problems of the stability of parallel shear flows. Both the inviscid problem of stability based on Rayleigh's equation and the viscous problem based on the Orr-Sommerfeld equation are discussed in considerable detail. Asymptotic methods are emphasized, but numerical methods are not neglected. A final chapter of the book reviews nonlinear aspects of stability theory. Readers interested in this area research may regret that only brief outlines of various methods and results are given in this chapter. But a more complete account of the nonlinear theory would probably have required a separate volume.

While the authors have approached their subject mainly from the applied mathematician's point of view, they have kept the use of mathematical formalism at a minimum. The book should thus be readily accessible to engineers and physicists. In fact, the examples treated in this book may serve as a suitable introduction to singular perturbation techniques such as matched asymptotic expansions. On the other hand, physical ideas are not always expressed quite as clearly. In the discussion of the Boussinesq approximation, for example, it is not evident that the smallness of the ratio between mechanical energy and thermal energy variations of a fluid parcel is the basis of this approximation. Stress-free boundary conditions are summarily described as unrealistic, even though they have been well approximated in the experiment of Goldstein and Graham (*Phys. Fluids*, 1969). The reader may also search in vain for heuristic physical ideas on the origin of shear flow instabilities such as those developed by Lin (1945) and Gill (1965).

But these minor criticisms should not distract from the impression that this book is likely to be the standard reference

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for most aspects of hydrodynamic stability theory for many years to come. The book can be recommended as a text for a graduate course in hydrodynamic stability. It is well produced and remarkably free of misprints. Its success should prompt the publisher to make it available soon in a more affordable paperback format.

The Theory of Thin-Walled Bars. By Atle Gjelsvik. Wiley, New York, 1981. pp. ix–248. Price $31.50.

REVIEWED BY D. H. HODGES[8]

The theory of bending and torsion of bars is important in the design of aircraft, spacecraft, wind turbines, buildings, bridges, and ships. Since a general theory of thin-walled bars is a relative latecomer to mechanics, textbooks that cover the theory in detail, unlike similar books for plate and shell theories, are not common. This book is the first English text in this field that the reviewer has encountered since Vlasov's *Thin-Walled Elastic Beams* was translated in 1961.

There are several features that make this book distinctive. First is the development of the bar equations from shell theory. This approach has the advantage of elucidating the physical meaning of certain assumptions that are commonly made in beam theories. Second is the development of the closed cross-section theory from an extension of open cross-section theory. The book has many example problems involving open and closed cross sections. Third is the enlightening discussion of the behavior of the analysis variables at junctions involving discontinuities.

The chapter entitled "Nonlinear Theory" is written clearly and for applications that demand arbitrarily large rotations, the necessary extension can be developed based on what is already given. Solutions for a wide variety of buckling problems are given in the chapter on buckling. Plasticity is covered in the final chapter. The book would be useful for graduate students and researchers in the area of thin-walled bars, especially because of the original material it contains, which is not available elsewhere in published form.

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