

BOOK REVIEWS

shrinkment of the Morley-Koiter equations for the bending of circular cylindrical shells; without a doubt, these are the simplest possible *displacement* equations consistent with the inherent errors in first-approximation theory. (There are, for static problems, even simpler, alternative *displacement-stress function* equations that, thanks to the static-geometric duality, can be written in a compact, complex-valued form, as explained in a recent survey by Sanders (1983).) My only disappointment in this middle part of the book is with the treatment of the axisymmetric bending of shells of revolution: it is out of date. E. Reissner's work (1950 onward) has superceded that of Meissner (1913) and the application of Langer's method (1935) of uniform asymptotic approximation by Clark (1950, 1964), Naghdi and DeSilva (1954, 1955), Baker and Cline (1962), and Steele (1962 onward) has superceded the work of Geckeler (1926).

The last part of the book touches on nonlinear problems. In the last half of Chapter 15 the nonlinear Donnell-Mushtari-Vlasov equations are derived via order-of-magnitude arguments, but no examples are worked out. Chapter 16 applies the von Karman equations to several static and dynamic problems involving plates and membranes of rectangular and circular planform. The final chapter derives buckling equations for a general shell, assuming a membrane prebuckling state and using the method of adjacent equilibrium. The resulting equations are applied to a circular cylindrical shell under axial compression, and the important role of imperfections is discussed briefly.

In summary, this book contains the best introduction to first-approximation shell theory that I know of and covers diverse applications in a clean, straightforward way. It would be an excellent text for a first-year graduate course.

Elastic-Plastic Fracture Mechanics. Edited by L. H. Larsson. D. Riedel Publishing Company, Dordrecht, Holland, 1985. 527 Pages. Price: \$64.00.

REVIEWED BY A. S. DOUGLAS⁶

This volume contains the edited proceedings of the 4th Advanced Seminar on Fracture Mechanics, held at the Joint Research Center, Ispra, Italy, in October, 1983. The authors can all be considered among Europe's foremost researchers in the area of ductile fracture, and Dr. Larsson has put together a good balance of relevant work which constitutes excellent material for both researchers and practitioners in this field. There are 13 technical papers, some of which include particularly good reviews of that author's previous work, four workshops (on the applications of different fracture evaluation methods) and the introduction and conclusion. These articles represent the (then) state of the art in the basis and use of fracture criteria (including J and COD), micromechanisms of ductile growth and of ductile fracture design methodology.

The article by Nilsson and Brikstad on dynamic fracture is a particularly well researched and referenced paper dealing with both impact loading and rapidly propagating cracks in ductile materials. The shadow optical method of caustics and its application to dynamic fracture is well described in the article by

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Kalthoff, who also provides a good review of his excellent past work.

The four workshops detail the background to, and use of, four different fracture evaluation techniques. The first is the CEGB procedure, which cites six illustrative examples, followed by the EPRI method, the COD method and the EnJ criterion. All have at least one case study or example problem with discussion to illustrate the use of the method and the results (such as sensitivity studies) which can be drawn therefrom.

Introduction to Applied Mathematics. By G. Strang. Wellesley-Cambridge Press, Wellesley, MA, 1986. 758 Pages. Price: \$39.00.

REVIEWED BY L. B. FREUND⁷

This book is intended to serve as a text for a course dealing with methods of applied mathematics at the advanced undergraduate or introductory graduate level. The general subject matter covered is usually taught under the heading of methods of applied mathematics or advanced calculus or engineering analysis. Professor Strang opens the Preface of his book with the statement. "I believe that the teaching of applied mathematics needs a fresh approach." He argues that the way in which mathematical concepts are applied to solve physical problems continues to change, due to the availability of computers and the types of problems being addressed. He succeeds admirably in conveying the vitality of applied mathematics, as well as his own enthusiasm for the subject.

Most of the topics normally identified with the subject at this level have been included, such as linear algebra and matrix theory, ordinary differential equations, introductory partial differential equations, calculus of variations, Fourier series and orthogonal functions, functions of a complex variable and complex integration, and so on. In addition, some not-so-traditional topics have been included, such as the finite element method, fast Fourier transforms, network theory, shock waves and solitons, chaotic motion of dynamic systems, and linear programming and optimization. The common theme through all topics is the development of either differential equations or matrix equations as models for physical systems, along with the means of using mathematics to draw conclusions of consequence about these systems. The many parallels between the differential equations and matrix equations are emphasized to great advantage, and geometrical arguments are used effectively to make certain points or to illustrate certain ideas.

The book includes eight chapters with the following titles: Symmetric Linear Systems, Equilibrium Equations, Equilibrium in the Continuous Case, Analytical Methods, Numerical Methods, Initial-Value Problems, Network Flows and Combinatorics, and Optimization. Each section (there are five or six sections per chapter) is followed by an extensive list of exercises, and answers to selected exercises are listed at the back of the book. The topics introduced are treated quite thoroughly, and there is more than enough material for a full year course. Overall, the book is highly recommended, both as a text and as a general introduction to the topics covered.

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