Journal of Mechanical Design

Book Reviews

Elementary Finite Element Method. by C. S. Desai, Prentice-Hall, Englewood Cliffs, N.J., 1979. 434 pages, Price: $24.95

Reviewed by H. Saunders[1]

Finite elements become more sophisticated with the passing of time. Previously, finite elements (FE) concerned themselves with structural applications. Lately, FE applications have become more noticeable in other disciplines i.e., fluid mechanics, soil and rock mechanics, heat conduction, seepage, consolidation, stress wave propagation, and electromagnetic theory. At present, the previous youth (FE) has matured to a full-grown man.

The book is unique since the author attempts to discuss all of the foregoing topics in an elementary fashion. He performs a most admirable job in his undertaking.

Most books on elementary aspects of FE discuss structural mechanics of frames, rods, and beams but nary a mention of additional topics. The new fields in FE as stated above were originally founded on empirical techniques and finite difference methods. They now have a new partner in FE.

The introductory Chapters 1 and 2 supply the steps used in FE. With this under our belt, Chapter 3 considers one-dimensional stress and deformation. This includes relations between global and local coordinates, complementary energy approach, and formulations by Galerkin's method. The latter is usually never mentioned in elementary texts on FE.

Continuing further, Chapters 4-6 dwell upon one-dimensional flow, one-dimensional time dependent flow, and computer coding for the previous chapters. This latter feature is a definite plus, since computer programs are at the heart of the FE method.

We next encounter beam bending and beam columns. This subject is covered more deeply here than in a number of other FE books. Departing from structures, we now confront one-dimensional mass transport and channel flow. The latter is formulated by Galerkin's method.

Chapter 10 contains an introduction and derivation of one-dimensional stress wave propagation while Chapter 11 considers one- and two-dimensional torsion. This is a most exhilarating chapter, and boundary conditions are brought forth with clarity. The author uses computer solutions to explain the salient points of torsion of a square bar. The author further brings to our attention the use of hybrid approach. Here, one assumes displacements inside the element and stresses on the boundary, the latter meant to overcome some of the deficiencies of the usual FE approach. The chapter concludes with static condensation of an element. This is important when we are required to eliminate an interior mode.

Chapter 12 briefly considers potential, thermal, and fluid flow problems. Chapters 13 and 14 conclude the book with a brief mention of two-dimensional analysis and multi-component systems.

In summary, this is an excellent book for beginners as well as the more advanced person grounded in the knowledge of FE. This book is replete with good discussions and examples showing how FE can be used in practical problems. The reviewer would like to see an advanced treatise on FE written by the author in his inimitable style. I was highly impressed with the book. Bravo to the author for his well-written book!

An International Survey of Shock and Vibration Technology, edited by H. C. Pusey, R. H. Volin, J. G. Showalter, Shock and Vibration Information Center, Washington, D.C., 1979. Price: $60

Reviewed by H. Saunders

Are you in the midst of planning a vibration test or perhaps diagnosing the health of some vital manufacturing equipment? You would like to know what tests and analytical works were performed on a similar type of specimen or component. Furthermore you are not anxious to invent "new wheels" but would like to capitalize on the experience of previous experimenters or designers in this field. In all probability, you can be aided by referring to the various reports, papers, and technical information published within the past eight years.

This interesting report contains information on mathematical analysis of modeled engineering problems leading to computers, and analytical methods, including nonlinear and variational methods. Numerical methods spurred on by the digital computer encompasses both finite elements and finite differences and are the basic formulations required to solve shock and vibration problems. The latter topics or methods play important roles in supplementing and extending shock and vibration information.

This book contains a very broad survey of the shock and vibration technology from an international standpoint. More then 7000 abstracts from the years 1971-9 were scanned from

[1] General Electric Co., Schenectady, N.Y. 12345