Journal of Pressure Vessel Technology

Book Reviews

Structural Engineering and Applied Mechanics Data Handbook, Volume 1: Beams, Gulf Publishing Company, Dept. V9, P.O. Box 2608, Houston, TX 77252, 1988, 290 pp., $55.00

This handbook should prove to be a useful reference for formulas to be used in the analysis and design of continuous beams. Formulas for the reactions, moments, deflections, etc., at critical points, are tabulated for beams of one to four spans, loaded by concentrated or uniform forces. For uses involving spans of different stiffnesses and/or other load conditions, formulas and an example are given whereby an analysis may be performed by, say, moment distribution or the conjugate beam method, among others.

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Finite Element Systems – A Handbook, 3rd Edition, editor, C. A. Brebbia, Springer-Verlag, New York, NY, 1985, 767 pp., $85.00, ISBN 3-540-15116-8.

Finite element (FE) methods have become established and in a number of cases essential to the engineer and scientist. FE can be considered to be composed of the following: (*a*) a given physical or mathematical problem is modeled by dividing it into small or fundamental parts called elements; (*b*) an analysis of the physics or mathematics of the problem is made upon those elements; (*c*) finally, one reassembles the elements as a whole. The solution of the original problem is acquired through this assembly procedure. FE methods are currently being used in structural mechanics (statics and dynamics), heat transfer, fluid flow and other physical problems. The user of the FE is often amazed at the varied number of systems which are available in the commercial market. The systems can be applicable to a particular problem or be a large packet containing a number of different programs. In addition, systems for minicomputers and macrocomputers are now manageable. As stated by the editor, "This book consists of a series of papers describing the different systems and some tables to present in a schematic way the capabilities of each system . . . . The handbook has been prepared with the practicing engineer in mind and with the genuine desire as a useful guide to the finite element systems." Since a description of all finite elements (2D, 3D, etc.) in a program would make this review very unwieldy and long. Consequently, the elements are deleted. However, one can infer from the program the element contents. The main function of the program is only considered. Should a FE program have certain peculiarities and outstanding advantages, they are brought forth in the text. For availability of the FE programs, Table VI of the text should be consulted. The book contains 52 chapters.

The opening chapter comments on the various FE programs. The author points out the various codes, pre and post-processors in both the US and Europe. He further indicates the choice of code required in the user's day-to-day needs. It is expected that no new commercial codes would be available, but the present ones do have a great deal to offer. The continuous question of general versus special codes is brought up. Each has its respective place. The constitution of the element library of the common codes and methods of eigenvalues is considered. The user conference is a good thing, but it should not be allowed to become stale. The new manuals, viz, MSC/NASTRAN ADINA, and ANSYS, are a great boon to the user. CAD/CAM and solid modeling are constantly being improved. The concluding section mentions future projections and their use. They are computer advances, FE machines, interactive graphics, standards and software. This is a most thought-provoking chapter and well worth reading.

The next chapter begins the current FE systems. ABAQUS, which is a general-purpose linear and nonlinear code, reported in Chapter 2. Tables are included showing the elements and options available in the program. It describes the program design, engineering features as to type of elements, material models and procedures in static and dynamic analysis. Applications include fracture mechanics, creep, heat transfer analysis, fluid flow coupled with stress analysis and response spectrum analysis. It is available in the US, parts of Europe, Japan, South Africa and Austrialia. The third chapter describes ADINA, which is a well-known FE program. The philosophy and present state of the program for displacement and stress analysis is mentioned. Its brother programs ADINAT (heat transfer), ADINA-IN (preparation and display of input data) and ADINA-PLOT (display of calculated results) are briefly stated. The solution schemes in static and dynamic analysis, element library and material models, heat transfer analysis, pre and post-processors are briefly stated. The chapter concludes with the mention that the program is available. The aim of the computing center in the US is to improve the program in the future. The fourth chapter covers ANSYS. This is a general-purpose FE program for the solutions of structural and heat transfer engineering analysis. Among its major capabilities are static analysis, elastic, plastic, thermal stress, dynamic analysis, harmonic response, fluid flow and substructures. It does contain bilinear elements. It has extensive nonlinear options, material behavior, and above all is user oriented. Other additional factors are graphic capabilities and it can be run in the interaction and batch modes. The program is available throughout the world. The developer plays an active role in supporting this code to the various users.

The fifth chapter describes APPLE-SAP structural analysis systems. It is a general-purpose structural analysis and FE system. It has wide capabilities in static, dynamic, earthquake and heat transfer analysis. As in its forerunner (SAP4), it contains two and three-dimensional isoparametric elements,