

**Finite Elements for Structural Analysis.** By William Weaver Jr. and Paul R. Johnston. Prentice-Hall, Inc., Englewood Cliffs, N.J., 1984. 404 Pages. Price \$38.95.

REVIEWED BY A. S. DOUGLAS<sup>1</sup>

The authors have provided another basic text on the use of the finite element method in structural mechanics. The reader is assumed to be familiar with the basic mathematics usually included in undergraduate engineering curricula (including matrix algebra) and is not required to have any previous exposure to elasticity. The principle of virtual work is used as the basis of the finite element procedure but while the potential energy basis is also given, no mention is made of variational calculus.

After a brief discussion on discretization of the solid continuum, the principle of virtual work is stated and used to develop the finite element method for the one-dimensional elastic beam element. This is followed by an introduction to generalized stresses and strains and to axis transformations. The first chapter is completed by brief comments on the potential energy basis for the finite element method and elementary criteria required for convergence.

Subsequent chapters develop the method for the basic structural systems beginning with plane stress and strain. All the details of the matrices are presented for linear strain elements. The calculation of the right-hand side vector is well presented. While the authors comment briefly on their choice of a mesh in an example, they do not give adequate attention to mesh characteristics, such as element aspect ratios and discontinuous changes in element size, which can adversely affect results.

Isoparametric elements for two-dimensional elements are clearly introduced and the authors explanation of their implementation is enhanced by macroflow charts. Only passing mention is made of super and subparametric elements. This development is extended to the general three-dimensional solid.

Attention is then given to those systems pertinent to the structural engineer. This begins with the details of axisymmetric solids which includes a useful discussion of nonaxisymmetric loads. (Uncharacteristically, the details of axisymmetric elements which have nodes on the axis of revolution are omitted.) Subsequent development includes plate and shell elements.

The authors now turn their attention to two important aspects of the behavior of the structural system, namely those of vibration analysis and stability analysis. While the presentation of the physical and mathematical basis for the existence of natural frequencies is terse, the construction of

consistent and lumped mass matrices is well developed. For stability analysis, the authors return to the potential energy formulation, but their mathematical basis is again brief.

The text concludes with useful appendices covering integration formulas, Gaussian quadrature, and some computer methods for solving linear equations (including detailed flow charts). Each chapter is followed by examples, a macroflow chart (which clarifies the procedures developed), a number of problems, and a few important references. The problems are directed primarily at developing facility with the basic steps. Few of them are designed to entertain a critical analysis of the finite element method.

Overall, the authors have provided an excellent text for engineering students and practitioners who want to learn the basic procedures involved in the finite element method. The book contains much detail not found in other introductory texts, but, as the title implies, it is strictly limited to structural applications. This book has not attempted to foster a critical appraisal of the finite element method, nor does it address some important practical issues, such as the appropriate choice of elements and the rational prescription of meshes.

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**Numerical and Physical Aspects of Aerodynamic Flows II.** Edited by Tuncer Cebeci. Springer-Verlag, New York, 1984. 416 Pages. Price \$58.00.

REVIEWED BY S. WIDNALL<sup>2</sup>

This book contains a portion of the proceedings of a symposium by the same name held at California State University in January 1983. Exclusive of a keynote address by A. M. O. Smith, all of the papers are devoted to two-dimensional aerodynamic calculations. The focus is on viscous-inviscid interactions in both subsonic and transonic flows. The papers deal with the development and evaluation of calculation methods for flows around airfoils, especially with regions of separated flow, and for downstream wakes. Subjects discussed include Navier-Stokes methods, interactive methods, and analytical methods. A review paper on the calculation of two-dimensional flow past airfoils by Cebeci, Stewartson, and Whitelaw opens the proceedings. The volume is dedicated to Keith Stewartson.

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Finite Element Structural Analysis on an Excel Spreadsheet. Course No: S04-003 Credit: 4 PDH. Richard Campbell, P.E., S.E. Continuing Education and Development, Inc. 9 Greyridge Farm Court Stony Point, NY 10980 P: (877) 322-5800 F: (877) 322-4774 info@cedengineering.com. Finite element structural analysis on an excel spreadsheet. COURSE DESCRIPTION: Conventional thinking is that Finite Element (FE) analysis is complex and requires expensive commercial software. This course shows that this is not necessarily true; FE theory can be understood in a few hours and is simple enough to put on an Excel spreadsheet. A finite element analysis is presented for a railway concrete bridge that will be strengthened to ensure the future use of the train-type TB-360 and that during the execution of bridge structural reinforcements with a consideration of a train-type TB-20 does not cause impacts of interruption of the railway track operation. Finite Element Modeling. Concrete structures and structural steel reinforcements modeled by ANSYS SHELL181 element. Formwork structures modeled by ANSYS BEAM188 element. Track rails modeled by fictitious beam elements to apply the live loads (bridge traffic loading). Boundary conditions: Soil-structure interaction represented by restriction all translation for the bridge's foundation and the basis of formwork structures. Find freelance finite-element-analysis experts for hire. Access 27 finite-element-analysis freelancers and outsource your project. Finite Element Analysis AutoCAD Structural Engineering Structural Analysis Microsoft Excel Tekla Structures Autodesk Revit SAP2000 Microsoft Project Building Estimation. Overview. I'm a structural engineer with experience in structural analysis, design, drafting and projects managing.