BOOK REVIEWS

I. FOUNDATIONS & BASIC METHODS

7R1. Boundary Element Methods for Engineers and Scientists: An Introductory Course With Advanced Topics.- Edited by L Gaul *(Inst A of Mech, Univ of Stuttgart)*, M Kogl *(Dept of Struct and Found Eng, Univ of Sao Paulo, Brazil)*, and M Wagner *(BMW Group, Munich, Germany)*. Springer-Verlag, Berlin. 2003. 488 pp. Hardcover. ISBN 3-540-00463-7. $79.95.

Reviewed by Jeng-Tzong Chen (Dept of Harbor and River Eng, Natl Taiwan Ocean Univ, PO Box 7-59, Keelung, Taiwan 202, ROC).

As the title of this book emphasizes, an introductory course to the boundary element method (BEM) and advanced formulations is presented. The book contains four parts: Part I: The direct Boundary Element Method, Part II: Dual Reciprocity method (DRM), Part III: Hybrid Boundary Element Methods, and Part IV: Appendix.

Part I can be seen as an introductory course, while Parts II and III cover advanced topics that contain the authors' research material. The appendices in Part VI contain some fundamental solutions and particular solutions for the DRM. Exercises and programs are not provided. The reviewer found that an on-line book of BEM by the first author is available on the web site of http://www.bem.uni-stuttgart.de/. This site provides a more friendly and suitable textbook for beginners since exercises are given.

As it is common with other BEM books, this text begins with an introduction and mathematical preliminaries. A special chapter on continuum physics is added in Chapter 3: The basic laws and constitutive equations for elastodynamics, heat conduction, eletrodynamics, thermoelasticity, acoustics and piezoelectricity are covered to provide a complete overview on the physical modeling. Chapters 4 and 5 introduce the direct BEM for potential problems of the Laplace and Navier equations with emphases on the issues of anisotropy and piezoelectricity. No indirect formulations in terms of single-layer or double-layer representations are developed. Numerical integration schemes for regular and singular integrals are addressed in Chapter 6.

Part II and III on advanced topics include the dual reciprocity BEM and the hybrid BEM. Chapter 7 basically follows the DRM book by Partridge *et al*, for a general introduction to the method. Chapter 8 focus on the solution of the DRM equation of motion and Chapters 9 and 10 present the application of the DRM to piezoelectricity and thermoelasticity.

The hybrid BEM is derived from variational principles of mechanics that are reviewed in Chapter 11. Hybrid displacement and hybrid stress methods are both addressed in Chapter 12 and 13, respectively. Since the presented hybrid BEM uses the same source of variational principles as for hybrid FEM, one obtains symmetric system matrices. In contrast to symmetric Galerkin BEM, the hybrid BEM does not require a double integration over the boundary.

Although *Boundary Element Methods for Engineers and Scientists: An Introductory course with advanced topics* can be used as a text in a BEM course, it contains some original results regarding the dual reciprocity BEM and the variational formulation of the hybrid BEM. The book is thus recommended to graduate students and engineers. The authors have succeeded in fulfilling their aim of a dual-purpose textbook. In Part I, students as well as practitioners find a clear introduction to the method, whereas Parts II and III can serve as a valuable reference to researchers and engineers. The main distinction of the book in comparison to available works on the BEM may be its focus on the application of the method to anisotropy, piezoelectricity and thermoelasticity, as well as the presentation of the hybrid BEM. The book contains 488 pages with 135 figures. The quality of print and figures is adequate. In general, this is a well-written book and is recommended to individuals and libraries.

7R2. An Introductory Guide to Finite Element Analysis.-Edited by AA Becker *(Dept of Mech Eng, Univ of Nottingham)*. ASME International, New York. 2004. 171 pp. Hardcover. ISBN 0-7918-0205-1. $79.00.

Reviewed by D Karamanlidis (Dept of Civil Eng, Univ of Rhode Island, Bliss Hall, Kingston RI 02881).

As anyone who ever taught or took a course on finite elements will attest, there is no short supply on introductory texts on Finite Element Analysis (FEA). In fact, there must be over a hundred such texts currently in print and several of them are nothing short of excellent. On the top of this reviewer's list are (in no particular order) Segerlind, Huebner, Bathe, and Wilson, Gallagher, Yang, Desai and Abel, and others. Thus, with so many good books to choose from the following question arises: What does a new FEA text need to offer in order to have a chance against all these well-established, time-honored heavyweights? The key, in the opinion of this reviewer, is pedagogy. Present the subject in such a way that today's undergraduates (with a relatively limited experience in math and mechanics) can grasp the salient concepts behind the method.

According to the preface, "the book is suitable both for beginners and those seeking to strengthen their background knowledge of FE methods." It is broken down in ten chapters, namely: 1) Introduction and background, 2) Structural analysis using pin-jointed elements, 3) Continuum elements, 4) Energy and variational principles, 5) Higher order quadratic elements, 6) Beam, plate, and shell elements, 7) Practical guidelines for FE applications, 8) Introduction to nonlinear FEA, 9) Thermal Problems, 10) Examples of FE applications. Chapters 1 through 9 contain a combined total of three (3) examples and not a single assignment problem.

Now taking a closer look at the contents, one is puzzled by the sheer volume of omissions, misrepresentations and confusing statements that made the final print. Some examples are listed below:

Page 9, Strain Energy: Concerning the formula, in Equation (1.14) the integration symbol is missing and should be replaced by. In the next equation on the same page, the factor 1/2 is missing.

Page 14: In both equations (1.30) and (1.31), the factor 2 is missing in front of the shear terms.

Pages 17 and 19: Equation (2.2) states that the axial strain for a rod is given by whereas Equation (2.13) leads to.

Page 19: With reference to the two-noded truss element, it stated that "such an element is said to have one degree of freedom." Actually, the element is known to have two degrees of freedom (=independent displacements), namely u1 and u2.

Page 26: Concerning the stiffness matrix for the two-noded truss element using global displacement variables, it is stated that it is derived by taking the partial derivatives of the strain energy in terms of the four global displacements. Since these four variables are linearly dependent, the above operation is not permissible.

Boundary Conditions: The reader comes away with the impression that first the global stiffness matrix is assembled and then the boundary conditions are imposed. Actually, it is common practice to impose the boundary conditions *on the fly* during the assembly thereby avoiding the need to unnecessarily inflate both the size of the glo-

