REVIEWS AND DESCRIPTIONS OF TABLES AND BOOKS

The numbers in brackets are assigned according to the American Mathematical Society classification scheme. The 1991 Mathematics Subject Classification can be found in the annual subject index of *Mathematical Reviews* starting with the December 1990 issue.

20[65-01, 68N15].—JEAN-ETIENNE ROMBALDI, *Algorithmique Numérique et ADA*, Collection Logique Mathématiques Informatique, Vol. 12, Masson, Paris, 1993, xx + 336 pp., 24 cm. Price: Softcover F 260.

This is a book on standard numerical methods which differentiates itself from other similar books by the fact that it contains implementations of the algorithms in the ADA language. Indeed, one of its aims, as claimed in the preface, is to show that ADA is a suitable language for mathematical programming. It is not meant to be a book on programming with ADA. In fact, the selection of numerical analysis topics that are covered is quite good. However, some of the methods presented are now outdated and should have been replaced by more modern ones. In particular, I am referring to the section on eigenvalue problems (Section 4, in Chapter 3), where all the methods based on characteristic polynomials may have been omitted and replaced by the usual QR/Householder approach.

This book comes at a time when object-oriented programming is gaining ground in many areas. Although FORTRAN, and increasingly C, are still the preferred languages in scientific computing, it is argued in this book that ADA has some important advantages, which makes it particularly suitable for scientific computing. In particular, it allows components to be reusable, a feature of object-oriented programming, and tends to be an effective language in which to develop and maintain large applications software.

This is the only book I know of, in French or English, which presents Numerical Analysis from the viewpoint of ADA, or any Object Oriented Programming language. Whether ADA is a good choice is hard to judge now. It is certainly an important language, but C++ is currently more popular, although there are currently some inefficiencies in C++ which make it a little unattractive for real scientific applications. This book would certainly be helpful to those wishing to start programming scientific applications in ADA as opposed to a more traditional language. It is its main attraction since there are alternative numerical analysis textbooks, both in French and in English, which offer a better coverage of the numerical analysis material. In addition, the book can also be viewed as a nice introduction to object-oriented programming and software development in scientific computing.

The following is a brief list of contents of the book. Chapter 1 is an overview

of the language ADA with a nice historical perspective and some parts on motivation. It also presents Open ADA, a compiler which is available on PC platforms. Chapter 2 describes a library of utilities which is used throughout the book. These include graphics functions for PCs and some standard functions such as random number generators, timers, and standard mathematical functions. Some of these utilities have a somewhat limited portability, but many of them are not publicly available and can be very useful to a first ADA user who is undertaking a sophisticated application in ADA. The other chapters deal with numerical techniques: Matrix computations (Chapter 3), Nonlinear systems (Chapter 4), Approximation and Interpolation (Chapter 5), Numerical Integration and FFTs (Chapter 6), Solution of Ordinary Differential Equations (Chapter 7), and Partial Differential Equations (Chapter 8).

A diskette containing a library of utilities and the programs discussed in the book is provided. The software is meant to be used in a PC platform, which could be a limiting factor for those programming in a Unix environment.

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21[65N30, 73K05, 73K10, 73K15].—G. PRATHAP, *The Finite Element Method in Structural Mechanics: Principles and Practice of Design of Field-Consistent Elements for Structural and Solid Mechanics*, Solid Mechanics and Its Applications, Vol. 24, Kluwer, Dordrecht, 1993, x + 14 pp., $24\frac{1}{2}$ cm. Price $139.00/Dfl.245.00.

As the subtitle indicates, this book deals with the design of field-consistent elements for structural mechanics applications. To paraphrase the author, 'this book is not intended to be a text-book, delineating the full scope of finite element methodology, nor is it a comprehensive handbook of modern finite element practice for the finite element engineer.' It is a monograph on the design of finite element models of certain structural theories, based on the field-consistency concept the author has been promoting over the last decade. In fact, the book is composed of the papers the author and his colleagues published on the topic.

The book is divided into twelve chapters. Chapter 1 provides a general introduction and the author stresses the importance of "consistency" and "correctness" in finite element formulations. Chapter 2 contains a description of Timoshenko beam elements and a discussion on the associated shear locking phenomenon. The author describes the a priori error associated with the so-called inconsistent formulation and calls his approach "mathematically rigorous". While the approach is variationally correct/consistent, the mathematical rigor can be achieved only through the use of functional analysis tools. No such tools are used in this book to bring more rigor to what is covered. Chapter 3 deals with the membrane locking phenomenon and the simple curved beam element. Essentially, the field-consistent concept is studied with respect to shear flexible beam elements (Chapter 2), curved beam elements, assumed-strain formulations, plane stress elements, plate elements, brick elements, shell elements (Chapters 3–10), and a few other special elements (Chapter 11). Finally, the