LAPACK++ (C++ extension to LAPACK), CLAPACK (a C version of the entire LAPACK obtained by using the automatic Fortran to C conversion program), ScaLAPACK (a subset of LAPACK routines that run on certain distributed memory parallel computers), and some routines exploiting IEEE arithmetic. A number of algorithms are added to the new release of LAPACK and further discussed in the User's Guide. They are for the generalized nonsymmetric eigenproblems, the generalized linear least squares problems, the generalized singular value decomposition and a generalized banded symmetric definite eigenproblem. There are also new routines that implement the divide-and-conquer methods for symmetric eigenproblems.

Chapter 1 contains a brief introduction to LAPACK and its availability, including the World Wide Web URL address. It also provides references for several related packages mentioned earlier. Discussions on how to use CLAPACK and the difference in the definition, as well as memory allocation, of a two-dimensional array in Fortran and C are included in Section 1.11.2. I think this is useful for any C users of the package. There is no discussion on efficiency issues related to the conversion from Fortran to C.

Chapter 2 provides the contents of LAPACK and a short introduction for each algorithm. A number of subsections are added to describe the newly implemented routines.

Chapter 3 presents some performance measurements for LAPACK. Some of the old computers used in obtaining performance figures in the first edition of the User's Guide are replaced by newer machines. A new section, LAPACK Benchmark, is added to this chapter. It contains performance numbers for some of the most commonly used routines in numerical linear algebra on a variety of workstations, vector computers, and shared memory parallel computers.

Chapter 4 discusses accuracy and stability issues. The presentation is different from what appeared in the first edition and, in my opinion, is easier to read. Much of the detailed theory is discussed in separate sections marked with "Further Details". A few Fortran code fragments are included in this chapter to calculate the errors for certain quantities computed by LAPACK. These code fragments are useful, at least for expert users.

The rest of the book includes Chapter 5 for documentation and convention, Chapter 6 for installation, Chapter 7 for troubleshooting and Appendices A, B, C, D, E for indices, reference to BLAS, converting from LINPACK or EISPACK and a list of LAPACK Working Notes. Part 2 contains specifications of all the routines.

Overall, this is a well-written book, and I highly recommend it to those who are new to LAPACK or have used LAPACK and are interested in understanding or using the new routines released in version 2.0 of LAPACK.

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46[00A20, 68Q40]—*The Maple V handbook*, by Martha L. Abell and James P. Braselton, AP Professional, Boston, MA, 1994, viii+726 pp., $23\frac{1}{2}$ cm, softcover, $39.95

The authors describe this book as "a reference book for all users of Maple V, in

particular, for students, instructors, engineers, business people, and other professionals who use Maple V in their work" (p. vii). They aim to satisfy users who are looking for a reference "between the very elementary handbooks available on Maple V and those reference books written for advanced Maple users" (p. vii). This is a worthy, and challenging, objective. The key element of such a book should be an up-to-date, accurate, and comprehensive summary of all commands available in Maple, organized in an accessible format. Measured against these standards, the final product unfortunately falls short of the authors' objectives.

The original introductory Maple reference is *First Leaves: A Tutorial Introduction to Maple V* [5]; other books that attempt to achieve the same goals as *The Maple V Handbook* include *Maple V Quick Reference* [2], *Introduction to Maple* [6] and *The Maple Handbook* [7]. I will evaluate the current book both against the criteria listed above (ease of use and content), and relative to its prime competitors ([2], [5], [6] and [7]).

The Maple V Handbook begins with a one-chapter (23 pages) introduction to Release 2 of Maple V. The discussion includes information for users of a one-chapter (23 pages) introduction to Release 2 of Maple V. The discussion includes information for users of the Macintosh, Windows, DOS, and UNIX implementations of the Maple worksheet environment and an introduction to the Maple on-line help system. There is virtually no introduction to Maple itself (e.g., assignments vs. equations, default data type assumptions, and evaluation rules). Even experienced users often need to be reminded of these fundamental principles. By comparison, [5], written for Release 1, provides an extensive and accessible introduction (at the novice level). Both [2] and [7] have been updated for Release 3; each contains an overview of the Maple environment that is appropriate for intermediate users. Although written for Release 2, the introductory chapters of [6] provide both an excellent introduction and additional technical information needed by intermediate and advanced users.

The introduction to the Maple on-line help provided in *The Maple V Handbook* is effective, but slightly dated because keyword searches were not supported in the worksheet environment in Release 2. While this section should be improved, it is surpassed only by [2] and [6].

The remaining sixteen chapters of the book describe the built-in functions (Chapter 2, 192 pages), miscellaneous library functions (Chapter 3, 40 pages), and fourteen packages that are provided with Maple (Chapters 4–17, 458 pages). Each chapter begins with a brief explanation of the types of commands contained in the chapter, including general `help` information and any special steps needed to load the appropriate additions to Maple. The organization is most similar to [2]; [5] and [6] make no attempt to be comprehensive. The most flexible organization, commands grouped by general subject area and extensively cross-referenced, is found in [7].

The organization of material can substantially affect the ease with which information can be extracted. In this area *The Maple V Handbook* is disappointing. For example, suppose a user wants to solve a differential equation, but does not know the appropriate Maple command. The index contains only Maple command names and keywords. Thus, there are no entries for "differential", "equation", or other related keywords. The closest matches seem to be `Diff` and `diff`. Looking through these entries, in order, we encounter an example for the `assign` command

(p. 48) which includes finding the solution to an initial value problem. From this information one infers that `dsolve` is a Maple command for solving differential equations. Other paths to this same information include guessing that the `DEtools` package (Chapter 5) has something to do with differential equations or examining the list of cross references listed under the `solve` command. Each of these paths is indirect, and inefficient. In comparison, a direct path to `dsolve` is easily found in each of [2], [5], [6] and [7]; the keyword searches performed from the command line (by `help` or `?`) or from the worksheet are even more efficient. In general, the index in *The Maple V Handbook* seems to be effective only when the name of the Maple command or keyword is known in advance.

Beyond the question of organization, what information is provided? Each entry contains, in order, a list of cross references, a brief explanation of the basic command syntax, and one or more examples illustrating how the command might be used. The cross references are extensive, but often refer to information not contained in this handbook. The explanations are correct, but sometimes incomplete. Attention to data types is essential for the effective use of Maple; this book is very inconsistent on the matter. In contrast, the information in [7] is more detailed and technical, but contains no examples; the cross references are generally excellent, including explicit references to [3], [4], and [5]. The entries in [2] are technically complete, easy to read, and concise. There are, however, only limited examples and no Maple output. In contrast, [6] presents a large number of illustrative examples and exercises.

One strength of *The Maple V Handbook* is that examples are provided for each entry. Many of the examples are posed in a mathematical context similar to that found in an undergraduate textbook. This should be particularly beneficial to faculty and students who use Maple in their classes. On the other hand, some examples are so trivial that they add very little to the user's knowledge. For example, the only illustrations provided for standard mathematical functions (e.g., `arctan`, `cos`, and `BesselJ`) are exact and approximate evaluation and simple plots. These entries should mention, at a minimum, the domain, range, automatic simplifications and other technical information (e.g., branch cuts).

Also included in this handbook are a list of references (2 pages) and a convenient one-page pull-out Quick Reference. Noticeably absent from the book is any mention of the Maple Share Library (a public domain archive of user-contributed additions to and applications of Maple, available via the WWW at the URL: `ftp://ftp.maplesoft.com/pub/maple/share`); the Maple Users Group (an e-mail based mailing list, archived on the WWW at the URL: `ftp://daisy.uwaterloo.ca/pub/maple/MUG`); and *The Maple Technical Newsletter* (a refereed journal for Maple-related articles, editor: Tony Scott, `tscott@maths.ox.ac.uk`).

While this review has not included a careful proofreading of the entire text, a few typographical errors were found (e.g., $2^i - 4$ should be $2i - 4$ on p. 81, the running headings for Chapter 9 should be "The Linear Algebra Package: `linalg`", and the index entry for `evalhf` is misspelled on p. 717). Also, the two subsections in Chapter 13 (`plots` package) are out of place; these options are part of the built-in `plot` and `plot3d` commands described in Chapter 2.

While there is much useful information in *The Maple V Handbook*, it is my opinion that this book does not meet its stated objectives. While the ideal reference book does not yet exist, there are better handbooks than the one reviewed here. Another book, also by Abell and Braselton, that appears to be better organized is *Maple V by Example* [1]. Any reader who works through the examples in [1],

which are different from the ones in *The Maple V Handbook*, would quickly become a skilled Maple user.

References

1. Martha L. Abell and James P. Braselton, *Maple V by Example*, AP Professional, Boston, MA, 1994.
2. Nancy R. Blachman and Michael J. Mossinghoff, *Maple V Quick Reference*, Brooks/Cole Publishing Company, Pacific Grove, CA, 1994.
3. Bruce W. Char, Keith O. Geddes, Gaston H. Gonnet, Benton L. Leong, Michael B. Monagan and Stephen M. Watt, *Maple V Language Reference Manual*, Springer-Verlag, New York, 1991.
4. ———, *Maple V Library Reference Manual*, Springer-Verlag, New York, 1991.
5. ———, *First Leaves: A Tutorial Introduction to Maple V*, Springer-Verlag, New York, 1992.
6. André Heck, *Introduction to Maple*, Springer-Verlag, New York, 1993. MR **94e:**68087
7. Darren Redfern, *The Maple Handbook*, 2nd ed., Springer-Verlag, New York, 1994.

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47[11-02, 11Gxx]—*Arithmetic of algebraic curves*, by Serguei A. Stepanov, (translated from Russian by Irene Aleksanova), Monographs in Contemporary Mathematics, Consultants Bureau, New York, 1994, xiv+422 pp., 26 cm, $115.00

Based on a lecture series given at the Tata Institute of Fundamental Research, this book was intended to give a full picture of the state of the art in Diophantine equations. However, owing to space limitations, the author had to leave out analytic aspects connected with the circle method of Hardy and Littlewood. Also the logical aspects in connection with Hilbert's 10th problem had to be limited in size. Even within the remaining techniques from arithmetic algebraic geometry the author had to make choices. What remains, roughly speaking, is an extensive treatment of points on curves over finite fields, the study of integral points on curves over algebraic number fields and a discussion of Hilbert's 10th problem in a (too short) Appendix.

In the study of points on curves over finite fields the author has made an important contribution by giving an elementary proof of the Riemann hypothesis for the zeta-function of such a curve. This proof has later been streamlined by E. Bombieri who used the Riemann-Roch theorem rather than Stepanov's original estimates. This adapted proof, which cannot be found in many other books, is presented in Chapter 5. Before getting to that level, the reader in the preceding chapters was already led through several excursions into topics of number theory. For example in Chapters 1 and 2 we find a treatment of exponential sums and their estimates. In particular, we find a full discussion of Burgess's inequalities which, again, is not often found in other books. One of the interesting consequences of Burgess's estimate is that the least quadratic nonresidue modulo a prime p is bounded by $O_\varepsilon(p^{1/4\sqrt{e}+\varepsilon})$ for any $\varepsilon > 0$. The estimates of exponential sums are based on the estimates arising from the Riemann hypothesis for curves and techniques from Vinogradov.

The third chapter deals with rational points on algebraic curves of genus zero and one. The approach is very much in the spirit of Mordell's book on Diophantine