area. The first paper notes that the complexity of current algorithms scales as $N^{10.5}$. One of the more intriguing predictions (on page 19) suggests that computer power will increase by a factor of one thousand every five years, allowing N to be doubled in each such period. My reality check compared this with recent experience regarding power increases. Given that we are now approaching only teraflops performance, it would imply that back in the sixties computers took nearly an hour to perform a floating point operation. A historically based assessment of performance is found in the graph on page 44 (in a subsequent article).

The last chapter of the book takes up the issue of defining a general-purpose parallel-computer architecture. The diversity of parallel-computer architectures has clearly been an impediment to their general adoption. One succinct definition of general-purpose computer is given on page 24 in terms of three different physical models to be computed efficiently. The book as a whole presents various applications whose efficient solution forces certain requirements on any general-purpose computer. It is significant that the fall of 1991 witnessed a convergence of commercial (distributed-memory) parallel-computer architectures onto the MIMD design. Not only did the company mentioned frequently in this book adopt this architecture but also the world's largest computer company introduced its first machine of this type.

The articles in the book were uniformly interesting and pertinent to "very large scale computing", even if the glimpse of the future was more modest than the title implies. We will have to wait a long time for the sequel (presumably entitled *VLSC22*). On the other hand, the title could have been even dramatic, e.g., *Scientific achievements in the third millenium.* Possibly such a book will be available for review later in the decade.

L.R.S.

27[65-02, 15A18, 65U05].—SABINE VAN HUFFEL & JOOS VANDEWALLE, *The Total Least Squares Problem: Computational Aspects and Analysis*, Frontiers in Applied Mathematics, Vol. 9, SIAM, Philadelphia, PA, 1991, xiii+300 pp., $25\frac{1}{2}$ cm. Price: Softcover \$28.50.

I should begin this review with a brief disclaimer: I am neither a mathematician nor a numerical analyst, merely a geologist with an interest in using total least squares (TLS) techniques to interpret chemical analyses of minerals in metamorphic rocks. On that basis, I might seem singularly unqualified to review a book such as this. On the other hand, Van Huffel and Vandewalle clearly wrote this book at least partly in hopes of making the TLS technique more accessible to scientists and engineers with relevant problems, who may be new to numerical analysis. On that basis, I am eminently qualified, and it is in that spirit that I undertake the task.

TLS techniques provide a simple, but powerful method for estimating parameters in problems in which all variables are subject to observational error. In appropriate problems, Van Huffel and Vandewalle claim that TLS techniques provide 10–15 percent better accuracy than classical least squares techniques, with almost no increase in computational cost.

The book divides naturally into three parts. Chapters 1 and 2 provide a basic introduction to TLS techniques and to the kinds of problems that benefit from TLS treatment. Chapters 3 through 7 focus on numerical issues: extensions of the basic TLS problem, iterative speed improvement for solving slowly varying TLS problems, algebraic connections between TLS and classical least squares problems, and comparisons of the sensitivity of TLS and classical methods. Chapters 8 and 9 deal with the statistical properties of the total least squares problem, and with multicolinearity problems, respectively. In their preface, Van Huffel and Vandewalle provide a simple road map to the book for readers with different objectives, so that those with a problem to solve can locate relevant material quickly.

Books such as this are difficult to write. The authors must strike a delicate balance, attempting to address both specialists in the field who are interested in a succinct account of new discoveries, and outsiders who must be carefully introduced to the terminology and culture of the field in order to follow the key arguments and make confident use of the algorithms. Obviously, I cannot comment on how well the authors have satisfied specialists in numerical analysis. But I can say that they have succeeded in making what is to me a difficult subject remarkably accessible. They carefully define the terminology and notation used, make extensive use of both geometric illustrations and concrete examples to motivate many of their arguments, and in general manage to write in a way that I find helpful and informative without even a hint of disdain for those who are not insiders in the field.

Scientists and engineers looking for a way to learn the simple but powerful methods the TLS techniques provide for dealing with a variety of knotty problems in analyzing real data need look no farther than this book.

George W. Fisher

Department of Earth and Planetary Sciences
Johns Hopkins University
Baltimore, MD 21218

28[68Q40, 65Y15, 65Y25, 11-04, 12-04, 13-04, 14-04, 30-04, 33-04].—David Harper, Chris Wooff & David Hodgkinson, *A Guide to Computer Algebra Systems*, Wiley, Chichester, 1991, xii+148 pp., 23 cm. Price: Softcover \$29.95.

The authors provide an overview of facilities to be expected in computer algebra systems, with specific reference to the programs REDUCE, MACSYMA, Maple, Mathematica, and Derive. The chapters cover basic algebra, calculus, solution of algebraic equations, matrix and vector algebra, input/output, and documentation. The book also includes a few short case studies showing some simple applications that may be of interest to potential users of such systems, as well as a modest annotated bibliography.

This book will be useful to persons familiar with one or more such systems hoping to find out how other systems compare; it may also be useful to persons trying to choose amongst these systems, or broadly speaking, trying to figure out if *any* of the systems might be of use.

This book represents systems by a matrix of check-offs. Those boxes indicating the absence of feature x from system y are likely to change over time as systems are revised. Yet, even if all systems have the same feature, one should