

Numerical Recipes: The Art of Scientific Computing

William H. Press, Brian P. Flanner, Saul A. Teukolsky, William T. Vetterling, Cambridge University Press, 1986, 818 pp. \$39.50; Example Book (in Fortran or Pascal), \$18.95

This superb book covers many topics, explains the theory, and provides computer programs to apply the theory. The programs (in Fortran or Pascal) are available on microcomputer diskettes. The book is useful not only for its information on a variety of topics but for the programs themselves.

The topics include linear algebra, interpolation and evaluation of functions, sorting algorithms, root finding and minimization, eigensystems, Fourier methods (including Fast Fourier Transforms), statistical analysis of data, integration of ordinary differential equations as initial value problems or as boundary value problems, and partial differential equations. Some of these subjects are in my own area of expertise and I can evaluate the treatment as an expert; others are in subjects I've not worked in, and which I evaluate as a novice. It gets good marks on both scores.

Because the book covers so many topics, the treatment of each topic is somewhat limited. For integration of initial value problems that are ordinary differential equations, the reader is given Runge-Kutta methods with an adaptive mesh selection, Richardson extrapolation, and how to treat singularities. The book does not cover stiff methods in detail, but does refer to other literature. For boundary value problems, shooting methods or finite difference methods are presented; however, the iterative strategy for the shooting methods is not sophisticated and the automatic mesh placement for the finite difference method is *ad hoc* which does not control the error. These limitations are carried over to the treatment of partial differential equations, where finite element methods are relegated to a few references. However, in the format of the book, "I have a problem, how do I solve it?", this is understandable. Someone wanting only to solve one problem should probably steer clear of the finite element method with its greater demands on programming effort. For hy-

perbolic methods, those included are the leap frog and Lax-Wendroff methods. Newer and better methods (such as random choice and flux-corrected transport) are not mentioned. The chosen methods do work, however, as long as the oscillations do not bother you. For elliptic problems, Laplace's equation and iterative finite difference methods are focused on.

Throughout the book each subject begins with a clear description of the key theory, some practical tips, and the computer programs. It also contains such useful tips as what is "small," or how the adjustable or tuning parameters of a method are chosen. It explains why a certain strategy was used first in approaching a problem. The computer programs are easy to read, and a modified format is used to clarify the nesting of loops. The style of writing is friendly and conversational: for example, "Until you have enough experience to make your own judgment between the two methods, you might wish to follow the advice of your authors as notorious computer gunslingers: We always shoot first, and only then relax."

The book explains the programs fully (in Fortran). The example book gives examples of using the programs and subroutines. Four diskettes (IBM-compatible) offer machine-readable versions of all the programs and the example programs: two are in Pascal and the other two are in Fortran, each set with the examples and the programs. The programs are adaptable to any minicomputer or microcomputer. Overall, this is a valuable reference book, whose computer programs are available in machine-readable format on microcomputer diskettes.

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Avoiding and Managing Environmental Damage from Major Industrial Accidents

Air Pollution Control Association, 498 pp., 1985

This book contains the proceedings of the 1985 international conference of the same name sponsored by the APCA in cooperation with a number of interna-

tional associations, universities, and governmental agencies.

Twenty-nine papers in this book are divided into six major categories: case histories; financial and legal implications of major industrial accidents; prevention; contingency planning; perceptions by society and their impact on the management of hazardous materials; and international policy initiatives. The executive summaries of these six sessions, which were prepared during the conference by the session rapporteurs, are most useful.

Discussed in the first section are the case histories of three controversial accidents: the accident at the Union Carbide plant at Bhopal, India; the nuclear power plant accident at Three Mile Island, PA; and the train derailment at Mississauga, Ontario, Canada resulting in a propane fire, explosion and a chlorine release. All three case histories graphically demonstrate the need and benefit of advanced planning, preparedness, and public awareness.

The second section's four papers covered the following topics: experience in the application of hazard assessment on World Bank industrial projects; evolving trends in environmental audits; risk assessment for environmental liability insurance in both Europe and North America; and evolving trends in legal liability. The consensus was that industry must be proactive in its management of environmental risks for its future economic viability.

Section 3 on Prevention has five papers covering process and design decisions, siting and zoning issues, risk analysis techniques, management philosophy/training and skills development, and the audit process. The paper on risk analysis techniques is limited in that it deals primarily with the fault tree approach. Interestingly, one paper that discusses Dow Chemical's philosophy and experience in emergency incident management places emphasis on prevention rather than on reaction.

Three papers discuss contingency planning in Section 4. They review elements of effective contingency planning, development, and commitment to contingency planning, and criteria to assess integrated communications plans for emergency response.