If numerical analysts have been complaining that their admitted high quality public domain software packages do not yet have the deserved impact on the 'end-user', this book will certainly contribute to change the situation. But it is more than just a guide to numerical software: It is a fundamental work on numerical computation which makes many major achievements in numerical analysis available to the practitioner.

An English translation of the book is under preparation.

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8[68Q05, 68–06]—*Abstract machine models for highly parallel comptuers*, John R. Davy and Peter M. Dew (Editors), Oxford University Press, New York, 1995, xii + 337 pp., 24 cm, $80.00

For sequential computers the von Neumann model has served the needs of practitioners and theoreticians for a long time. In its simplest form a von Neumann computer executes instructions one at a time in a fetch-execute cycle. First an operation code and operand data are fetched from memory, then the corresponding instruction is executed and the result is sent back to memory for storage. Despite the many elaborations of this simple idea in actual computer hardware, reality has been represented closely enough by this model for some purposes. On the practical side, software and hardware designers have been able to advance their own craft without need for a detailed understanding of the opposite craft. And theoreticians concerned with such issues as complexity analysis of algorithms have also been able to make effective use of the model.

The model breaks down when multiple processors and memories are linked together in a parallel computer system. A variety of replacement models have emerged but often these are positioned too closely to either the software or the hardware end of the spectrum, with the result that the main advantages of the von Neumann model (simplicity and generality) are lost. This book contains 18 papers presented at a Workshop on Abstract Machine Models for Highly Parallel Computers which was held at Leeds University in April, 1993. The purpose of this workshop, the second on the subject, was to consider whether a model can be devised to bridge the hardware-software gap somewhere near its center. Interestingly, relatively concrete proposals have been made that appear to do this quite well. This book provides a valuable cross section of work in this important area of computer science.

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9[86-06]—*Mathematics, climate and environment*, J.-I. Diaz and J.-L. Lions (Editors), Research Notes in Applied Mathematics, Vol. 27, Masson, Paris, 1993, 315 pp., 24 cm, softcover, F 320

There are many books on water waves that are a successful blend of high quality mathematics and physics. With regards to mathematics, climate, and environment, however, books written in the same spirit are difficult to find. Among the climate-related books, M. Ghil and S. Childress' "Topics in Geophysical Fluid Dynamics:

Atmospheric Dynamics, Dynamo Theory, and Climate Dynamics", published by Springer-Verlag in 1987, and "Physics of Climate" by J. P. Peixoto and A. H. Oort, published in 1992 by the American Institute of Physics, come to mind as examples of books that present the scientific issues in appropriate detail and that emphasize the most important character of climate/meteorology and environmental dynamics from a physical and mathematical point of view: they are the result of the complex interaction of a multitude of physical phenomena. Both of these books are required reading for mathematicians working on climate problems. However, neither of these books' authors intended to address the issues from a mathematical standpoint.

There is great demand on the part of applied mathematicians for books that take a comprehensive view of the subject of mathematics and the environment. A publication in this category could have been "Mathematics Climate and Environment", a book which introduces a few of the main climate and environmental issues and many of the mathematical techniques used to study these issues to a mathematically-inclined audience. However, this book cannot be included in this category and, in my opinion, this situation could have been avoided by more diligence with regards to presentation on the part of the Editors, and by more attention to content by a couple of the contributors.

The book is a meeting proceedings. It comprises eleven lectures and twelve short talks which were presented at the "Summer Course of the Universidad Complutense: Mathematics, Climate, and Environment", held in El Escorial, Spain, in August of 1991. There were presentations on pollution control, global and regional climate, meteorology, traffic flow, stationary solutions to Navier-Stokes equations, and even the disaster at Chernobyl. With regards to mathematics, topics were drawn from large-scale computation; empirical analysis and statistics; optimal control, sensitivity analysis, inverse problems, and data assimilation; inertial manifolds, and global attractors; analysis, especially solutions smoothness, uniqueness, stability, and well-posedness of equations. Some of the lectures and talks were delivered by leading authorities in their respective subspecialty, for example, J. L. Lions covered approximate and optimal controllability of nonlinear systems; R. Temam had a nice introduction on inertial and slow manifolds, G. North, J. Diaz, I. Stakgold presented energy-balance models, Marchuk and Le Dimet discussed sensitivity analysis and data assimilation, A. Ruiz de Elvira covered statistical techniques in the analysis of signals from nonlinear systems. M. Ghil apparently (the manuscript for this lecture is inexplicably limited to the abstract) spoke on dynamical systems techniques in the analysis of field data.

The shortcomings of the book are mostly editorial in nature, however, in a couple of the lectures, there are problems with content as well. The Editors should have availed themselves of a copy editor in order to substantially improve the translations, to avoid the excessive number of typographical errors, and to typeset the manuscript using a single text processing software package. Many of the books' figures are poorly reproduced and, in some instances, were not properly commented upon in the accompanying text. One lecture does not contain a reference list, others have irritating typographical errors in their bibliographies.

With regards to content, the most salient problem is that a couple of the authors who alluded to modeling physical phenomena did so in a very cursory or simplistic manner. While it is certainly true that the main emphasis of these lectures is mathematical rather than physical, some would argue that disregard for the issues of modeling severely undermines some of the reasons for studying these models from a mathematical standpoint in the first place.

In summary, "Mathematics Climate and Environment" is an attempt, as the Editors say in their preface, to cover some of the basic issues of climate and the environment for the mathematically-inclined scientist. For the non-specialist, some of the papers are good starting points on several of the topics. Many will appreciate the expository style of most of the lectures, avoiding excessive technicalities in the presentation. However, rapid progress in some areas of climate and the environment (of which some of the authors in the book can take responsibility) and a better definition of the role mathematics research plays in contributing to furthering our understanding of climate and the environment, makes some of the material that appears in the book somewhat dated. Alas, when compared to current research, the book is a testimonial of what makes this line of research so exciting to those of us who work in the field.

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10[65F10, 65H10, 65H20]—*Iterative methods for linear and nonlinear equations*, by C. T. Kelley, Frontiers in Applied Mathematics, Vol. 16, SIAM, Philadelphia, PA, 1995, xiv + 165 pp., $25\frac{1}{2}$ cm, softcover, $32.50

This volume gives an introduction to the topic of iterative algorithms for systems of algebraic equations. It gives an overview of a few methods for linear systems followed by a somewhat deeper summary of the main approaches for solving nonlinear systems.

The contents are as follows. The first three chapters concern linear equations. Chapter 1 introduces some basic concepts such as splitting operators. Chapter 2 gives an introduction to Krylov subspace methods and an overview of the conjugate gradient method, applicable to symmetric positive systems or the normal equations associated with other systems. Chapter 3 discusses methods for nonsymmetric systems with emphasis on GMRES. For both classes of methods, the presentation begins with theoretical properties (minimizing functionals over subspaces), and this is followed by discussions of implementation and some examples of numerical performance on model problems. The rest of the book (five chapters) concerns nonlinear equations. Chapter 4 presents introductory material such as fixed point methods and rates of convergence (linear, superlinear, etc.). Chapter 5 concerns Newton's method and simple variants such as chord methods which reuse the Jacobian matrix. Chapter 6 concerns inexact Newton methods in which the Jacobian systems are not solved exactly, but instead inner iteration is used to compute approximate solutions. Chapter 7 discusses Broyden's method as an example of quasi-Newton methods, which construct approximation to the Jacobian matrix. There is convergence analysis for all of these methods. Chapter 8 presents criteria on step-lengths to ensure global convergence.

I believe this book will be valuable as a reference and of some use as a graduate text for a "topics" course in iterative methods. It is very up-to-date and provides pointers to MATLAB software available through the World Wide Web