

(Even in one as short as that given, Ehrlich should have included the Morrisons' book *Powers of Ten*, (Freeman, 1991) based on the fabulous Eames film of the same name.)

The essays are mostly successful. The book should be in the library of any teacher offering a course for non-science majors. It would make a nice gift to a curious person of any age.

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Dynamics: Numerical Explorations

Helena E. Nusse and
James A. Yorke

Springer-Verlag, New York, 1994.
484 pp. \$79.00 hc
ISBN 0-387-94254-8

If you learn by example, this is the dynamics book for you. But beware, because *Dynamics: Numerical Explorations* and its accompanying software are addictive. Before you get to the end of the book you may succumb to the allure of dynamical systems. This happened to me several years ago, and I've been working in the field ever since.

Yorke, more than anyone else, understands the importance of a graphical intuition about dynamical systems, and for several years he has circulated his graphics-based software program with the intent of conveying the beauty and intricacies of nonlinear dynamics. Now he and coauthor Helena E. Nusse present the most current investigative tools of nonlinear dynamical systems in a beautifully illustrated book that includes the Dynamics software package.

Tools such as dimensions, Lyapunov exponents, bifurcation diagrams, basins of attraction, straddle trajectories, unstable and stable manifolds and unstable periodic orbits are presented in numerous hands-on examples. All of these tools can be put to use on an extensive list of nonlinear differential equations and maps, including the Henon, cubic, logistic, tent and Ikeda maps and the forced damped pendulum, Lorentz, Lotka-Volterra and Duffing differential equations. The authors also provide excellent instructions, enabling the readers to add their own favorite dynamical systems to the program. This makes *Dynamics* an excellent research tool, because the included tools and techniques are state of the art.

This is not a conventional textbook. Think of it as an exploratorium of nonlinear dynamics and chaos. Consequently it would serve

as an excellent companion volume to a textbook on dynamical systems (such as the excellent *Nonlinear Dynamics and Chaos: with Applications to Physics, Biology, Chemistry, and Engineering* by Steven H. Strogatz (Addison-Wesley, 1994) or as a stand-alone text for a dynamical systems computer lab (all source code in C is provided).

The accompanying Dynamics program runs under the MS-DOS and UNIX operating systems. I found the MS-DOS installation to be quite straightforward. For the UNIX installation I shamelessly procured the help of Hank Roark, a UNIX-savvy undergraduate. He installed the program on several unsuspecting workstations with equal ease.

Lest you think I am in the pay of the authors, I should offer a few critical comments. First, a Macintosh version of the software would be nice. Also, the user interface for Dynamics, while easy to use, looks a bit dated compared to more current Windows-based interfaces. Paradoxically this may also be Dynamics's strength, as the hardware requirements to support the interface are quite modest (PC and VGA graphics) and the source code is very readable. Indeed the authors encourage the use of their excellent routines in the user's own programs (with proper citation of course).

With all the books on chaos and nonlinear dynamics appearing these days, one has to show some discrimination in what to read. I can recommend *Dynamics: Numerical Explorations* as high on the list of required reading for those who are interested not just in reading about but in exploring dynamical systems. But be forewarned: You might be seduced by the beauty of dynamics before you know it.

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A Friendly Guide to Wavelets

Gerald Kaiser

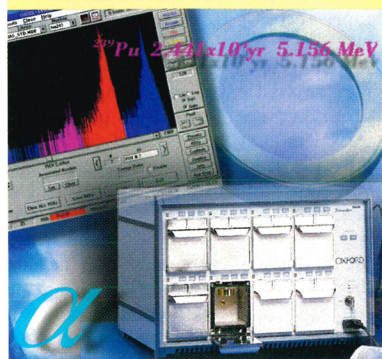
Birkhäuser, Boston, 1994. 300 pp.
\$34.50 hc ISBN 0-8176-3711-7

Wavelet transforms have been finding widespread acceptance over the past 10 years, with contributions coming from the mathematics, physics and engineering communities. Wavelets may be thought of as atomic functions that are localized in both time and frequency and whose dilates and translates span some Hilbert space of interest. The field is much richer than one might expect upon casual ob-

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ervation: The class of Calderon–Zygmund operators, as well as the pseudodifferential operators, can be very effectively treated with wavelet bases. Wavelet analysis has also proved to be a viable alternative to windowed Fourier methods in analysis and signal processing. Indeed, the underlying theory has served to unify many important ideas that previously were explored by independent disciplines.

Gerald Kaiser is a mathematical physicist whose contributions initially involved quantum mechanics but more recently come from wavelet theory. In *A Friendly Guide to Wavelets*, he seeks to address readers who may lack sophisticated mathematical backgrounds, and he succeeds quite well. Part I is easy to read and could stand on its own as a fine introduction to wavelet transforms. The material is organized into a hierarchy of increasing specificity from continuous wavelet transforms to generalized frames, discrete frames, multiresolution analyses and finally orthogonal expansions. There are also generous sections on continuous and discrete Fourier transforms, which appear immediately before the corresponding topics for wavelets. These serve as a warm-up to the notation and as a reminder of the mathematical tools with which wavelets are handled. At the beginning of each chapter is an abstract and a list of prerequisites, which can be used to guide an advanced reader past unnecessary material. This part should appeal to a very wide audience.

Part II contains Kaiser's personal contributions to the field. It goes far beyond a basic introduction and, while interesting, could safely be skipped by most readers. It seeks to unify the physics of electromagnetism and acoustics with the signal processing aspects of wavelet analysis. But the analogy between acoustics and electromagnetics is at times awkward and unfamiliar, and some acousticians may in fact find it rather strained.

The book quite adequately covers the material necessary for a one-semester course. For graduate physics and applied math majors it is probably just about right. It might take considerable effort to bring this book to engineering students; a number of supplementary examples, problems and projects would be required. There is almost no how-to information, such as code fragments and response to test signals, and the book is also quite weak on filter implementations and design. The bibliography gives a fair overview of the field, but a little more work could be done on the index for the next printing. Also, there are quite a few typos, some figures are poorly

labeled, and the book ends rather abruptly. On the other hand, it contains the first serious attempt to provide a cohesive set of homework problems on the subject—a highly nontrivial endeavor.

On the whole, I found this to be an excellent book. It is eminently more readable than the books by Ingrid Daubechies (*Ten Lectures on Wavelets*, SIAM, 1992) and Charles Chui (*An Introduction to Wavelets*, Academic, 1992), which might be considered the principal alternatives for textbooks on wavelets.

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