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Wavelets: A Tutorial in Theory and Applications (Volume 2 in series 'Wavelet Analysis and its Applications') and Wavelets and Their Applications FREE

Wavelets: A Tutorial in Theory and Applications (Volume 2 in series 'Wavelet Analysis and its Applications'). Charles K. Chui, Academic Press, Harcourt Brace Jovanovich, San Diego, CA, 1992; ISBN 0-12-174590-2, 736 pp., hardcover, \$69.95.

Wavelets and Their Applications. Mary Beth Ruskai, Gregory Beylkin, Ronald Coifman, Ingrid Daubechies, Stephane Mallat, Yves Meyer and Louise Raphael, editors, Jones and Bartlett, Boston, MA, 1992; ISBN 0-86720-225-4, 480 pp., hardcover, \$59.95.

Matthew Lundberg



Comput. Phys. 6, 698–699 (1992)

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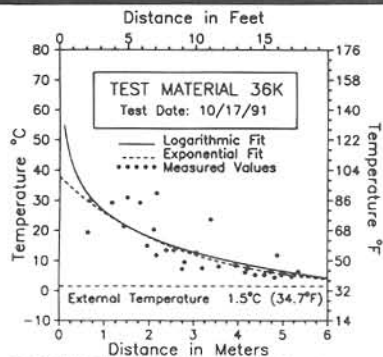
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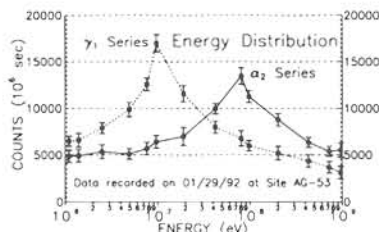
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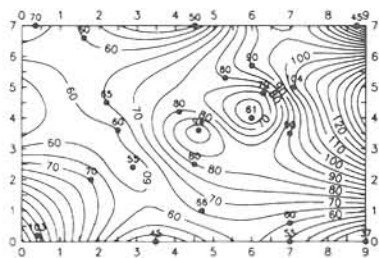
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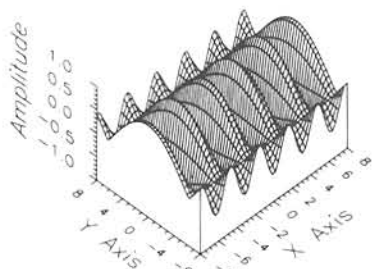
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Reviewed by Matthew Lundberg

In the past decade, wavelet analysis has generated new techniques in many of the sciences. Originally designed to eliminate the shortcomings of the windowed Fourier transform for signal analysis, the wavelet transform (WT) has been applied to many other types of problem. The widespread use of the WT is due in part to the efficiency of the fast WT algorithm, and in part to the almost arbitrary subdivision of the time-frequency plane made possible using this transform.

Two books have appeared that bring together discussions of wavelets by a variety of different authors. The two volumes, which are edited by C. K. Chui and by M. B. Ruskai *et al.*, cover many of the same problems and solutions, but their overlap is actually very small. Both volumes give a good introduction to the general theory of wavelet analysis and its rela-

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tionship to multiresolution analysis.

Local sine and cosine bases have been used in signal analysis for some time, corresponding to a partition of the time domain into disjoint intervals. In Chui's book, these are developed by Auscher, Weiss, and Wickerhauser in a discussion entitled "Local Sine and Cosine Bases of Coifman and Meyer and the Construction of Smooth Wavelets." The book edited by Ruskai *et al.* develops a dyadic decomposition of the time domain and a best basis algorithm, in "Wavelet Analysis and Signal Processing" by Coifman, Meyer, and Wickerhauser. The Ruskai volume also discusses wavelet packet bases and their use for a best basis algorithm, and describes software developed by the authors to implement this algorithm. Wavelet packets, which correspond to a decomposition of the Fourier domain, are well suited to a best basis algorithm, and are also developed in Wickerhauser's "Acoustic Signal Compression with Wavelet Packets" (Chui).

Also included in the Ruskai volume is a discussion of "Ridge and Skeleton Extraction from the WT," by Tchamitchian and Torresani. These authors describe the use of the continuous wavelet transform, indexed on the half plane, rather than a discrete subset. The usefulness of the skeleton in signal analysis is demonstrated, and algorithms are given for their fast numerical computations.

Operator representation and compression are covered by several chapters in each book, including fast numerical linear algebra routines. The application of the WT to partial differential equations is discussed in Jaffard and Laurencot's "Orthonormal Wavelets, Analysis of Operators, and Applications to Numerical Analysis" (Chui), and in "Numerical Resolution of Nonlinear Partial Differential Equations Using the Wavelet Approach," by Liandrat *et al.* (Ruskai *et al.*).

Nonorthogonal, sometimes called biorthogonal, wavelets are also

covered. Dropping the requirement for orthogonality leads to "nicer" wavelets, and allows the use of different functions for decomposition and reconstruction. Their construction and use are discussed in several chapters of each volume, including the construction of B-spline wavelets.

Chui includes a section on multivariate wavelets and the special problems that they present, in addition to material on image coding, sampling, interpolation, and the short-time Fourier and window-Radon trans-

forms, which are not covered by Ruskai *et al.*

Ruskai *et al.* devote a section to applications, including "Wavelets and Quantum Mechanics" by Paul and Seip, giving a link between wavelets and affine coherent states. "The Optical WT," by Arneodo *et al.* describes an experiment which performs a wavelet decomposition using coherent optical spatial filtering. The authors use the setup to study fractal geometries, for which a multiscale analysis is essential. ■

Books Received

Chaos and Fractals: New Frontiers of Science, Heinz-Otto Peitgen, Hartmut Jürgens, and Dietmar Saupe, Springer-Verlag, New York, 1992; ISBN 0-387-97903-4, 984 pp., hardcover, \$49.00.

Computing for Scientists and Engineers: A Workbook of Analysis, Numerics, and Applications, William J. Thompson, John Wiley & Sons, New York, 1992; ISBN 0-471-54718-2, 444 pp., hardcover, \$54.95.

A First Course in Chaotic Dynamical Systems: Theory and Experiment, Robert L. Devaney, Addison-Wesley, Reading, MA, 1992, ISBN 0-201-55406-2, 304 pp., hardcover, \$45.25.

Fractals and Disordered Systems, Armin Bunde and Shlomo Havlin, eds., Springer-Verlag, New York, 1991; ISBN 0-387-54070-9, 350 pp., hardcover, \$59.00.

Fractals for the Classroom, Part One, Heinz-Otto Peitgen, Hartmut Jürgens, and Dietmar Saupe, Springer-Verlag, New York, 1992; ISBN 0-387-97041-X, 450 pp., hardcover, \$29.00.

The Global Dynamics of Cellular Automata, Andrew Wuensche and Mike Lesser, Addison-Wesley, Reading, MA, 1992; ISBN 0-201-55740-1, 250 pp., hardcover, \$49.95.

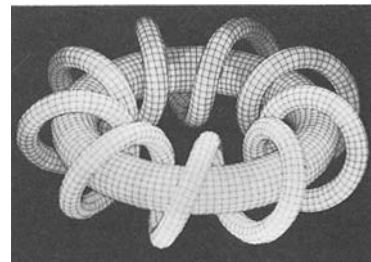
MacMath: A Dynamical Systems Software Package for the Macintosh, John H. Hubbard and Beverly H. West, Springer-Verlag, New York, 1992; ISBN 0-387-97416-4, 162 pp., softcover, \$49.95.

Molecular Dynamics Simulation: Elementary Methods, J.M. Haile, John Wiley & Sons, New York, 1992, ISBN 0-471-81966-2, 489 pp., hardcover, \$59.95.

Parallel Computational Fluid Dynamics, Horst D. Simon, ed., MIT Press, Cambridge, MA, 1992; ISBN 0-262-19326-4, 390 pp., hardcover, \$39.95.

A Survey of Nonlinear Dynamics ("Chaos Theory"), R.L. Ingraham, World Scientific, Singapore, 1992; ISBN 981-02-0777-8, 108 pp., hardcover, \$28.00.

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