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<u>Gaussian Self-Affinity and Fractals</u>. By B. B. Mandelbrot. Springer, New York. (2002). 654 pages. \$54.95. Contents:

Preface. Overview of fractals and multifractals. I. Advances in old but open topics. 1. Tile self-affinity: Closeup on a versatile family. 2. Steps toward a definition of self-affine functions. 3. Fractal dimensions of Wiener Brownian motion, random walk, and their clusters: 2, 3/2, 4/3, 1, and the new "transient" 5/3. 4. Still growing Weierstrass family of functions. 5. Iso- and heterodiffusion, and statistics using the bridge range; mesodiffusion. 6. Diffusion self-affine fractal functions: Their stationarity in logarithmic time. II. Broad continuing issues. 7. Experimental power-laws suggest that self-affine scaling is ubiquitous in nature. 8. Recorded history and personal recollections. III. Introductions from the 1960s. 9. Self-affinity and Hurst's law. 10. Noah, Joseph and operational hydrology. IV. Fractional Brownian motions. 11. Fractional Brownian motions, fractional noises and applications. 12. Computer experiments with fractional Gaussian noises. Part 1: Sample graphs, averages and variances. 13. Computer experiments with fractional Gaussian noises. Part 2: Rescaled bridge ranges and "pox diagrams". 14. Computer experiments with fractional Gaussian noises. Part 3: Mathematical appendix. 15. Fast fractional Gaussian noise generator. 16. Broken-line approximation to fractional noise. V. Fractional Brownian surfaces. 17. Poisson approximation of the multi-temporal Brownian functions and generalizations. 18. Geometry of homogeneous scalar turbulence: Iso-surface fractal dimensions 5/2 and 8/3. 19. Earth's relief, shape and fractal dimension of coastlines, and number-area rule for islands. 20. Midpoint displacement cartoon surfaces. VI. Selfaffine cartoons in grids; Their multiple fractal dimensions. 21. Self-affinity and fractal dimension. 22. Diagonally self-affine fractal cartoons. Part 1: Mass, box and gap dimensions, local or global. 23. Diagonally self-affine fractal cartoons. Part 2: Length and area "anomalies". 24. Diagonally self-affine fractal cartoons. Part 3: Anomalous Hausdorff dimension and multifractal "localization". VII. R/S analysis and its uses. 25. Robustness of R/S in measuring non-periodic global dependence. 26. Limit theorems on the self-normalized bridge range. 27. Global dependence in geophysical and other records. 28. Secular pole motion and Chandler wobble. 29. Clustering in a point process: Intertoken histograms and R/S pox diagrams. 30. Global (long-term) dependence in economics and finance. 31. Fractal aspects of computer memories. Cumulative bibliography. Index.

<u>Neurotechnology for Biomimetic Robots</u>. Edited by Joseph Ayers, Joel L. Davis, and Alan Rudolph. The MIT Press, Cambridge, MA. (2002). 636 pages. \$65.

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Preface. Introduction. I. Neurotechnology. Overview: Advances in the development of biomimetic sensors, actuators, and controllers (A.I. Selverston). Biomimetic sensors. 1. Biomimetic flow and contact/bending MEMs sensors (N.E. McGruer, G.C. Adams, T.Q. Truong, T.G. Barnes, X. Lu and J.C. Aceros). 2. Fly-inspired VLSI vision sensors (R.R. Harrison). 3. Visual servo system based on a bilogically inspired scanning sensor (S. Viollet and N. Franceschini). 4. Visual sensors using eye movements (O. Landolt). 5. Using biology to guide development of an artificial olfactory system (J. White, S. Mall and J.S. Kauer). Biomimetic actuators. 6. SMA actuators applied to biomimetic underwater robots (J. Witting, K. Safak and G.G. Adams). 7. Engineering a muscle: An approach to artificial muscle based on field-activated electroactive polymers (R. Kornbluh, R.J. Full, K. Meijer, R. Pelrine and S.V. Shastri).8. Polymer-based MEMS actuators for biomimetics (R. Horning and B. Johnson). 9. A piezoelectrically actuated mesoscale robot quadruped (M. Goldfarb, M. Gogola, G. Fischer, N. Celanovic, I. Celanovic and E. Garcia). Biomimetic control architectures. 10. Optimization of swimming locomotion by genetic algorithm (D. Barrett). 11. Biomechanical primitives and heterarchical control of limb motion in tetrapods (S.F. Giszter). 12. A conservative biomimetic control architecture for autonomous underwater robots (J. Ayers). II. Vehicles. Overview: Vehicles in neurobiology (P.K. Pook). 13. Snake robots for search and rescue (G.S.P. Miller). 14. A lamprey-based undulatory vehicle (C. Wilbur, W. Vorus, Y. Cao and S.N. Currie). 15. Biomimetics in action: Design and performance of an autonomous robotic fish (J.M. Anderson and P.A. Kerrebrock). 16. Development of a two-joint dolphin robot (M. Nakashima and K. Ono). 17. Pectoral fin controllers (N. Kato). Ambulatory robots. 18. The role of reflexes versus central pattern generators in dynamical legged locomotion (E. Klavins, H. Komsuoglu, R.J. Full and D.E. Koditschek). 19. A decentralized, biologically based network for autonomous control of (hexapod) walking (H. Cruse, J. Dean, V. ürr, Th. Kindermann, J. Schmitz and M. Schumm). 20. Toward the development of agile and mission-capable legged robots (F. Kirchner, D. Spenneberg and R. Linnemann). Flying robots. 22. The organization of insect locomotion systems and computer-based flight control in the tobacco hawkmoth Manduca sexta (G. Wendler). 23. A micromechanical flying insect thorax (R.S. Fearing, S. Avadhanula, D. Campolo, M. Sitti, J. Yan and R. Wood). 24. The entomopter (R.C. Michelson). III. Autonomous behavior. Overview (W.G. Sykes). 25. Visual homing without image matching (R. Möller). 26. Phonotaxis in crickets and robots (B. Webb and R.R. Harrison). 27. Flow and chemo-sense for robot and lobster guidance in tracking chemical sources in turbulence (F.W. Grasso). 28. Sensory fusion in free-flight search behavior of fruit flies (M. Dickinson, L. Tammero and M. Tarstino). 29. Visual flight control and navigation in honeybees: Applications to robotics (M.V. Srinivasan). Contributors. Index.

<u>Microarrays for an Integrative Genomics</u>. By Isaac S. Kohane, Alvin T. Kho, and Atul J. Butte. The MIT Press, Cambridge, MA. (2002). 306 pages. \$40. Contents:

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<u>Advanced Solid State Physics</u>. By Philip Phillips. Westview Press, Boulder, CO. (2002). 386 pages. \$55. Contents:

Foreword. Preface. 1. Noninteracting electron gas. Problems. 2: Born-Oppenheimer approximation. 2.1. Basic Hamiltonian. 2.2. Adiabatic approximation. 2.3. Reduced-electron problem. References. 3. Second quantization. 3.1. Bosons. 3.2. Fermions. 3.3. Fermion operators. Problems. References. 4. Hartree-Fock approximation. 4.1. Noninteracting limit. 4.2. Hartree-Fock approximation. 4.3. Diagrams. Problems. References. 5. Interacting electron gas. 5.1. Uniform electron gas. 5.2. Hartree-Fock excitation spectrum. 5.3. Cohesive energy of metals. 5.4. Summary. Problems. References. 6. Local magnetic moments in metals. 6.1. Local moments: Phenomenology. 6.2. Mean-field solution. 6.3. Summary. Problems. References. 7. Quenching of local moments: The Kondo problem. 7.1. Kondo Hamiltonian. 7.2. Why is J negative? 7.3. Scattering and the resistivity minimum. 7.4. Electron-impurity scattering amplitudes. 7.5. Kondo temperature. 7.6. Poor man's scaling. 7.7. Summary. 7.8. Appendix: The Schrieffer-Wolff transformation. Problems. References. 8. Screening and plasmons. 8.1. Thomas-Fermi screening. 8.2. Plasma oscillations. 8.3. Linear-response theory. 8.4. Dielectric-response function. 8.5. Stopping power of a plasma. 8.6. Summary. Problems. References. 9. Bosonization. 9.1. Luttinger liquid. 9.2. Pair binding: Can electrons do it alone? 9.3. Excitation spectrum. 9.4. Summary. Problems. References. 10. Electron-lattice interactions. 10.1. Harmonic chain. 10.2. Acoustic phonons. 10.3. Electron-phonon interaction. 10.4. Ultrasonic attenuation. 10.5. Electrical conduction. 10.6. Hydrodynamic limit: Phonon drag. 10.7. Sound propagation. 10.8. Summary. Problems. References. 11. Superconductivity. 11.1. Superconductivity: Phenomenology. 11.2. Electron-phonon effective interaction. 11.3. Model interaction. 11.4. Cooper pairs. 11.5. Fermi-liquid theory. 11.6. Pair amplitude. 11.7. BCS ground state. 11.8. Pair fluctuations. 11.9. Ground state energy. 11.10. Critical magnetic field. 11.11. Energy gap. 11.12. Quasi-particle excitations. 11.13. Thermodynamics. 11.14. Experimental applications. 11.15. Josephson tunneling. 11.16. Summary. Problems. References. 12. Localization: The strong, the weak, and the defiant. 12.1. Primer on localization. 12.2. Strong localization: The Anderson transition. 12.3. Scaling theory. 12.4. Weak localization. 12.5. The defiant: Exceptions to localization. 12.6. Summary. Problems. References. 13. Quantum phase transitions. 13.1. Quantum rotor model. 13.2. Scaling. 13.3. Mean-field solution. 13.4. Landau-Ginsburg theory. 13.5. Transport properties. 13.6. Ex-