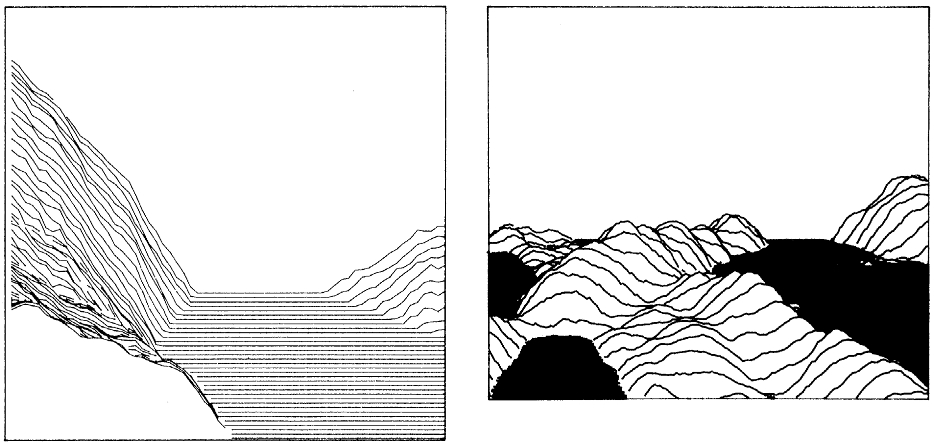

Landscapes generated by fractals. "A simulation of the curvature of the earth," as at right, "is needed in coastal landscapes in order to avoid the impression that the landscape is cut off at the horizon," as at left. [From *Fractals*]

Much of the book is concerned with self-similar fractals and self-affine fractal curves and surfaces, the simplest fractals that (so far) have had the broadest range of applications. Feder describes in detail the difference between them, an appropriate topic since indiscriminate application of the simple methods that work well for characterizing self-similar fractals to self-affine fractals appears to be a common error.

Satisfactory procedures for measuring fractal dimensions with these classes of fractal geometry have now been developed. Further advances can be expected, but these parts of the book will have lasting value. For multifractals (fractal measures), practical methods for characterization are just emerging, so the discussion of applications to convection, diffusion-limited aggregation, and viscous fingering should soon be superseded.

In real applications the fractal scaling does not extend over an unlimited range of length scales but is bounded by upper and lower cut-off lengths that depend on the details of the system. In some cases, one type of fractal behavior on one length scale may cross over to a different type on another range of length scales. These issues are discussed when they appear in examples, but it might have been appropriate to discuss them in more detail since difficulties associated with this behavior are commonly encountered in research. Similarly, a more detailed discussion of how to assess both statistical and systematic uncertainties would have been valuable.

The book is concerned primarily with two of the major topics of recent research: the quantitative description of random systems and the phenomenology and kinetics of the growth of fractals. Feder gives little coverage to the third major focus of current research, the physical and chemical processes occurring in, on, and around fractals.

This is a relatively short book, but I believe it is the right length for its purpose. It is well written and careful. The most technically complex topic it covers, multifractals, is described in a clear, direct fashion. Although fractal geometry is a mathematical subject, little mathematical background is required to benefit from this book. I highly recommend it for those who are interested in using fractal geometry but do not want it to become the major focus of their research. It would also provide a sound basis for a course in fractal geometry.

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Contemporary Mechanics

Hamiltonian Systems. Chaos and Quantization. ALFREDO M. OZORIO DE ALMEIDA. Cambridge University Press, New York, 1989. x, 238 pp., illus. $64.50. Cambridge Monographs on Mathematical Physics. Translated from the Portuguese.

Most university students of physical science and engineering must take a course that covers classical mechanics—the study of the motion of material bodies in response to forces. The basic concepts underlying classical mechanics have been known since their enunciation by Isaac Newton and the revealing reformulation by William Rowan Hamilton. It is therefore remarkable that this old field has lately become a "hot" area of research with an explosion in the number of papers, conferences, and new textbooks.

The element stimulating this activity has been the introduction of topological and analytic ideas from the branch of mathematics known as dynamical systems theory. In particular, the concept of chaos has been key to this awakening interest. The word *chaos* is used to describe the time evolution of a deterministic system with very complicated dynamics (complicated in a way that is quantifiable by dynamical systems theory). When viewing chaotic behavior over time, one is very often led to the well-founded thought that its description might best be made statistically. The surprise is that such complicated behavior is common even in very simple Hamiltonian mechanics problems.

This book presents Hamiltonian mechanics from this modern point of view and deals with the implications of chaos for quantum mechanics. The book had its origin in a graduate university course, and it has what I would consider an excellent selection of topics for a graduate course following the standard one in classical mechanics in American universities.

The first part of the book deals with classical mechanics, covering such topics as the Poincaré surface of section technique, the Hartman-Grobman theorem, structural stability, horseshoes, normal forms, bifurcations, and the Kolmogorov-Arnold-Moser theorem. The second part (about one-third of the book) discusses the implications of chaotic dynamics for the solution of a classical problem when quantum mechanical effects are included. The author's treatment of this fascinating topic is very expert, as might be expected from the fact that he has been a major contributor to it.

Since there has been a rapid increase in books on chaotic dynamics, it is fair to ask where the current one fits in. It is not a comprehensive reference, nor does it supply mathematical proofs, extensive illustrative examples, or computer results. However, it successfully (despite some minor errors and obscurities) gives a concise treatment of well-chosen key elements of the field that are suitable for an upper-level graduate physics course.

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Books Received

AIDS and AIDS-Related Infections. Current Strategies for Prevention and Therapy. Adrian J. Bint, John Oxford, and Philip J. Daly, Eds. Academic Press, San Diego, CA, 1989. vi, 137 pp., illus. Paper, $24.95. From a meeting, Stratford-on-Avon, U.K., April 1988.

Atomic Spectra and Collisions in External Fields. K. T. Taylor, M. H. Nayfeh, and C. W. Clark, Eds. Plenum, New York, 1989. xiv, 457 pp., illus. $95. Physics of Atoms and Molecules. From a meeting, Egham, U.K., July 1987.