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Universality in chaos. A reprint selection compiled and introduced by Predrag Cvitanović. (Consultant editor: R. F. Streater). (English) [Zbl 0576.58017](#)

Bristol: Adam Hilger Ltd. XI, 513 p. hbk: £28.00; \$ 47.50; pbk: £11.50; \$ 19.00 (1984).

The book is a valuable collection of reprints of 41 papers, which represent the cornerstones of the theory of deterministic chaos. Most of them were published during the period 1980-1983 when the basic questions of possible scenarios leading to chaos and characterization of strange attractors were formulated and possible ways of their solutions were proposed and investigated. Some relevant older papers are also included. The choice of papers underlines the general idea of the collection - to emphasize the general properties of chaotic behaviour (such as universal roads to chaos, self-similarity and universal broad-band spectra), which are to a great extent independent of the particular dynamical system exhibiting this behaviour.

Introductory part of the book consist of an introduction by the editor and four now classical papers: [*D. Ruelle*, *Math. Intell.* 2, 126-140 (1980; [Zbl 0487.58014](#)); *M. J. Feigenbaum*, *Order in chaos*, *Proc. int. Conf., Los Alamos/N.M.* 1982, *Physica* 7D, 16-39 (1983; [Zbl 0556.34046](#)); *R. M. May*, *Alkalmazott Mat. Lapok* 8, 427-446 (1982; [Zbl 0527.58025](#)); *J.-P. Eckmann*, *Rev. Mod. Phys.* 53, 643-654 (1981)]. In this part the basic notions of theory of deterministic chaos are explained and illustrated. The following part includes twelve papers. It reviews experimental observations of the deterministic chaos in the various fields ranging from fluid mechanics through chemical, optical, and electrical systems to biology.

The third part consists of five papers on the theoretical aspects of deterministic chaos. Qualitative universality of chaos in one dimension is analysed in the paper by *N. Metropolis*, *M. L. Stein* and *P. R. Stein* [*J. Comb. Theory, Ser. A* 15, 25-44 (1973; [Zbl 0259.26003](#))]. Two papers by *M. J. Feigenbaum* concerning universal metric properties of nonlinear transformations [*J. Stat. Phys.* 21, 669-706 (1979; [Zbl 0515.58028](#)); *Commun. Math. Phys.* 77, 65-86 (1980; [Zbl 0465.76050](#))] are reprinted together with *O. E. Lanford's* computer-assisted proof of Feigenbaum's conjectures [*Bull. Am. Math. Soc., New Ser.* 6, 427-434 (1982; [Zbl 0487.58017](#))]. This section is closed by the paper of *M. Nauenberg* and *J. Rudnick* on universality and power spectrum at the onset of chaos [*Phys. Rev. B* 24, 493-495 (1981)].

The following two parts are devoted to relatively special topics: influence of noise on chaotic systems and intermittency. Among eleven papers reprinted here the reader finds several devoted to scaling properties of systems with noise and to properties of their power spectra. The paper by *Y. Pomeau* and *P. Manneville* on intermittent transition to turbulence in dissipative dynamical systems [*Commun. Math. Phys.* 74, 189-197 (1980)], where the scenario bearing now their names was introduced, is reprinted here. The sixth and seventh parts are focused on problems encountered in chaotic systems with dimension higher than one. The papers by *E. N. Lorenz* [*J. Atmos. Sci.* 20, 130 (1963)] and *M. Hénon* [*Commun. Math. Phys.* 50, 69-77 (1976)], where classical chaotic systems bearing now the names of the authors were introduced, are reprinted in this section together with a general paper by *P. Collet*, *J.-P. Eckmann* and *H. Koch* [*J. Stat. Phys.* 25, 1-14 (1981; [Zbl 0521.58041](#))] and other six papers. Although a lot is known about higher dimensional chaos, it is apparent from the papers reprinted that it is this area where many problems remain open and where the most interesting results should be expected.

The concluding part contains an author index and a list of 260 references which is a good starting point for further studies in the realm of chaos.

Reviewer: I.Dvorak

MSC:

- [37D45](#) Strange attractors, chaotic dynamics of systems with hyperbolic behavior
- [39A12](#) Discrete version of topics in analysis
- [00A69](#) General applied mathematics
- [01A75](#) Collected or selected works; reprintings or translations of classics
- [00A79](#) Physics

Cited in **1** Review
Cited in **7** Documents

Keywords:

deterministic chaos, strange attractors; bifurcations; scaling intermittency; period doubling scenarios; power spectra