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Book Review: *Chaos in Dynamical Systems*

Chaos in Dynamical Systems. Edward Ott, Cambridge University Press, Cambridge, 1993.

This book is intended as a textbook in graduate courses for science and engineering students. The author appreciates well the demands a textbook has to meet and the book meets these demands ably. The book's emphasis on mathematical formulation is appropriate for a graduate-level course. The material covered in the book will equip a student substantially in pursuing the research literature. While detailed mathematical arguments have been presented for most of the material under discussion, the author has avoided proofs and discussions that are difficult or of largely technical interest. Instead, he follows the procedure of stating important results, when necessary motivating them, and explaining their significance. Material for further reading is invariably indicated when the discussion in the book itself is not complete. Overall, the author strikes a good balance among the mathematical formalism, easily accessible examples, and the necessity to state results that are essential to formulate the conceptual framework.

The author has steered away from the urge to be exhaustive in the coverage of topics and results; nevertheless, topics covered in the book are quite comprehensive. The book starts out with an introduction to the essential concepts of chaos through one-dimensional maps. This discussion, based largely on the logistic map, is systematic and thorough. Topics covered subsequently are the geometric aspects of chaos (the fractal, Hausdorff, and other dimensions of attractors, natural measure), dynamical properties of chaotic systems (stability of states, Lyapunov exponents, Kolmogorov–Sinai and information entropy, symbolic dynamics), chaotic transients, fractal basic boundaries, chaotic scattering, quasiperiodicity, chaos in Hamiltonian systems (integrability, the KAM theorem, destruction of KAM tori, classification of chaotic systems), chaotic transitions (period doubling, intermittency routes to chaos, crises), multifractals, and, briefly, quantum chaos. The book also includes discussions of experiments

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and topics relevant to the experimental study of chaos, such as delay coordinate embedding. Attention is given to computational methods, both in discussions and in the exercises, but the book makes no special effort to initiate the student into the art of computation.

The author has maintained a competent pedagogic style throughout. Most of the ideas are developed in the context of specific examples with are visited repeatedly to illustrate different aspects of chaos. While there are very frequent references to the literature (including very recent publications), the development of the material is very systematic and even. The exercises at the end of each chapter support the text and are helpful in digesting the material presented in the text. The book makes good use of appendices to provide background material and notes to suggest further reading.

The illustrative examples chosen lean decidedly in favor of maps. While the author makes a conscious effort to explain notions for both maps and dynamical systems, a more thorough probing of dynamical system examples might have been profitable. Similarly, the reviewer would like to have seen a more frequent use of counterexamples to illustrate and clarify some fundamental concepts.

In summary, the book deals with its chosen material at the right level of sophistication, is comprehensive in covering the important areas, maintains an even level of difficulty which is often important for a textbook, and presents the material in a coherent and systematic fashion. It will make an excellent textbook and anyone teaching a course on chaos should consider it. For students and researchers who have already studied the material in the book, it will be a valuable reference and a guide to the research literature.

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