
pre02138652**Choe, Geon Ho****Computational ergodic theory.** (English)

Algorithms and Computation in Mathematics 13. Berlin: Springer. xix, 453 p. \$ 89.95; EUR 69.95/net; £54.00; sFr 123.50 (2005). [ISBN 3-540-23121-8/hbk]

This substantial book contains a basic course in ergodic theory and related ideas in smooth ergodic theory, low-dimensional dynamics, recurrence and data compression. The title is unduly modest: it might better be described as ‘Ergodic theory with a huge number of examples illustrated using a computer’. In particular, the results presented here are developed rigorously and often proved; where the proof is not given or only sketched references are provided to the literature. The novel feature is that essentially all the results are illustrated with well-chosen examples and attractive pictures and graphs. Thus, for example, after proving that an ergodic circle rotation is not mixing, this is illustrated by a pair of graphs showing the failure of convergence of the inner-product for a pair of explicit functions as opposed to the Cesàro convergence due to ergodicity. In addition to many familiar pictures, the reader is repeatedly presented with imaginative illustrations (often using the ‘pointillism’ of simply plotting orbits) of results usually taught without numerical examples. Some measure of the extent of this effort to illustrate results is shown by the fact that there are some 250 figures.

The other – related – theme of the book is careful explanation of theory and attempts to orient the reader in new subjects. Thus there are tables presenting ‘dictionaries’ for translation between measure theory, probability theory and information theory. Little background is assumed, and in particular (from one angle) there is a section of basic Maple commands and (from another) there are sections of mathematical background without proofs on topology, measure theory, character theory and Perron-Frobenius theory much in the spirit of the introductory chapter of [*P. Walters* Graduate Texts in Mathematics, Vol. 79. (New York - Heidelberg -Berlin: Springer-Verlag) (1982; [Zbl 0475.28009](#))].

Ergodic theory and dynamical systems is part of mathematics because it contains real theorems and profound proofs; on the other hand it sometimes seems too eager to generate beautiful pictures while shirking the difficult responsibility to explain rigorously what is being seen. This book does a good job of putting that pedagogical tension into a good balance: this is a rigorous subject, to which the computer can be a useful pedagogical servant. As a companion to a course aimed either at motivating students lacking the mathematical background for ergodic theory, or to a regular ergodic theory course with some additional details filled in by the lecturer or additional material, this book is highly recommended. It does a uniquely good job of explaining what the statements in ergodic theory mean numerically when applied to simple examples.

Some additional references could usefully be added to the book: for Chapters 12 and 14, the lecture notes of Weiss [CBMS Regional Conference Series in Mathematics 95. Providence, RI: American Mathematical Society. (2000)]; as preparatory reading in a related spirit, the book of [*A. Berger*, Chaos and chance. An introduction to stochastic aspects of dynamics. de Gruyter Textbook. (Berlin: de Gruyter). (2001; [Zbl 0984.37001](#))].

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Classification :

***37A05** Measure-preserving transformations

68W30 Symbolic computation and algebraic computation

Cited in ...