

Preface

The main objective of this book is to give a broad unified introduction to the study of *dimension* and *recurrence* in hyperbolic dynamics. It includes a discussion of the foundations, main results, and main techniques in the rich interplay of four main areas of research: *hyperbolic dynamics*, *dimension theory*, *multifractal analysis*, and *quantitative recurrence*. It also gives a panorama of several selected topics of current research interest. This includes topics on irregular sets, variational principles, applications to number theory, measures of maximal dimension, multifractal rigidity, and quantitative recurrence.

The book is directed to researchers as well as graduate students who wish to have a global view of the theory together with a working knowledge of its main techniques. It can also be used as a basis for graduate courses in dimension theory of dynamical systems, multifractal analysis (together with a discussion of several special topics), and pointwise dimension and recurrence in hyperbolic dynamics. I hope that the book may serve as a fast entry point to this exciting and active field of research, and also that it may lead to further developments.

The material is organized in four parts: dimension theory; multifractal analysis: core theory; multifractal analysis: further developments; and hyperbolicity and recurrence. With the exception of some basic well-known statements, all the results are included with detailed proofs, many of them simplified or rewritten specifically for the book. Furthermore, the text is self-contained. In particular, all the necessary notions and results from hyperbolic dynamics, symbolic dynamics, ergodic theory, dimension theory, and the thermodynamic formalism are recalled along the way, mostly without proofs but with appropriate references. I emphasize that each chapter can essentially be read independently.

Since the theory is so vast, in order to present a global view of the topics under discussion, but still keep the size of the book under control, I had to make a careful selection of material. Certainly, this selection also reflects a personal taste, undoubtedly biased towards my own interests. This causes some interesting topics to be barely mentioned, particularly when their study mostly requires techniques of a different nature from the ones consistently used in the book. Other topics are unfortunately not yet at a stage of development that makes it reasonable to include them in a monograph of this nature. I chose rather to present a sufficiently global view of the theory and to avoid introducing additional techniques that may well play an important role in the theory but as of now are still under development. The most notable example of this nature is the study of the dimension of invariant sets of nonconformal maps (both invertible and noninvertible) which, in spite of several important developments, still lacks today a completely satisfactory approach in its most general version. To include these topics would increase unreasonably the size of the book, even more when roughly two thirds of the material already appears here for the first time in book form. As a compromise, I added detailed notes about these and other topics at appropriate places in the book, together with references for further reading.

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