Título: Lectures On Fractal Geometry And Dynamical Systems

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Sinopsis

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Both fractal geometry and dynamical systems have a long history of development and have provided fertile ground for many great mathematicians and much deep and important mathematics. These two areas interact with each other and with the theory of chaos in a fundamental way: many dynamical systems (even some very simple ones) produce fractal sets, which are in turn a source of irregular "chaotic" motions in the system. This book is an introduction to these two fields, with an emphasis on the relationship between them.

The first half of the book introduces some of the key ideas in fractal geometry and dimension theory--Cantor sets, Hausdorff dimension, box dimension--using dynamical notions whenever possible, particularly one-dimensional Markov maps and symbolic dynamics. Various techniques for computing Hausdorff dimension are shown, leading to a discussion of Bernoulli and Markov measures and of the relationship between dimension, entropy, and Lyapunov exponents.

In the second half of the book some examples of dynamical systems are considered and various phenomena of chaotic behaviour are discussed, including bifurcations, hyperbolicity, attractors, horseshoes, and intermittent and persistent chaos. These phenomena are naturally revealed in the course of our study of two real models from science--the FitzHugh-Nagumo model and the Lorenz system of differential equations.

This book is accessible to undergraduate students and requires only standard knowledge in calculus, linear algebra, and differential equations. Elements of point set topology and measure theory are introduced as needed.

This book is a result of the MASS course in analysis at Penn State University in the fall semester of 2008.

This volume is published in cooperation with the Mathematics Advanced Study Semesters.