(Free) Introduction to the Modern Theory of Dynamical Systems (Encyclopedia of Mathematics and its Applications)

# Introduction to the Modern Theory of Dynamical Systems (Encyclopedia of Mathematics and its Applications)

*Anatole Katok, Boris Hasselblatt*
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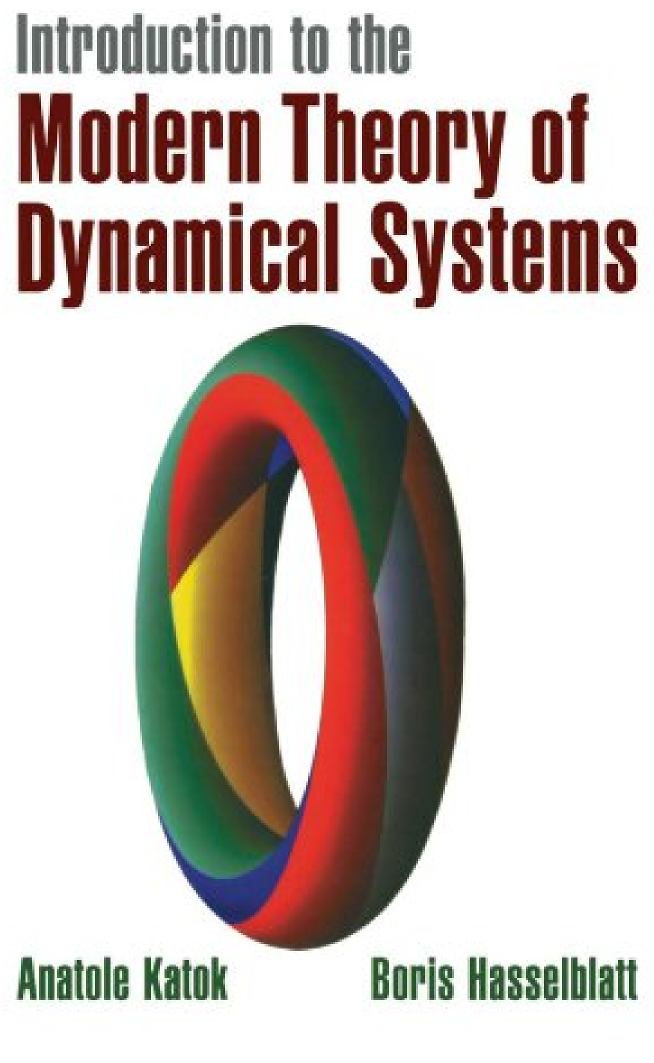




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**Anatole Katok, Boris Hasselblatt : Introduction to the Modern Theory of Dynamical Systems (Encyclopedia of Mathematics and its Applications)** before purchasing it in order to gage whether or not it would be worth my time, and all praised Introduction to the Modern Theory of Dynamical Systems (Encyclopedia of Mathematics and its Applications):

0 of 2 people found the following review helpful. a comprehensive introductionBy NaradaAlmost everything you want to know about dynamical systems is introduced in this book. The writing style is clear (if, of necessity, terse), plenty of examples are given, what's not to like?The one problem with this book is that it is at a level where it is really aimed at people starting to do research in the field, and those people are often better off looking up original references, especially as dynamical systems is a very young field, and so there is not the generation gap you would get by learning about determinants from Sylvester or equations from Legendre, or whatever (not that Sylvester and Legendre should not be read...), so perhaps a more useful book would be an "annotated bibliography", such as (in a different field) A History of the Theory of Investments: My Annotated Bibliography (Wiley Finance)0 of 1 people found the following review helpful. Five StarsBy KIIt's very good.14 of 15 people found the following review helpful. Great book with lots of detailBy Dr. Lee D. CarlsonThis book is a comprehensive overview of modern dynamical systems that covers the major areas. The authors begin with an overview of the main areas of dynamics: ergodic theory, where the emphasis is on measure and information theory; topological dynamics, where the phase space is a topological space and the "flows" are continuous transformations on these spaces; differentiable dynamics where the phase space is a smooth manifold and the flows are one-parameter groups of diffeomorphisms; and Hamiltonian dynamics, which is the most physical and generalizes classical mechanics. Noticeably missing in the list of references for individuals contributing to these areas are Churchill, Pecelli, and Rod, who have done interesting work in the area of both topological and Hamiltonian mechanics. No doubt size and time constraints forced the authors to make major omissions in an already sizable book. Some elementary examples of dynamical systems are given in the first chapter, including definitions of the more important concepts such as topological transitivity and gradient flows. The authors are careful to distinguish between topologically mixing and topological transitivity. This (subtle) difference is sometimes not clear in other books. Symbolic dynamics, so important in the study of dynamical systems, is also treated in detail. The classification of dynamical systems is begun in Chapter 2, with equivalence under conjugacy and semi-conjugacy defined and characterized. The very important Smale horseshoe map and the construction of Markov partitions are discussed. The authors are careful to distinguish the orbit structure of flows from the case in discrete-time systems. Chapter 3 moves on to the characterization of the asymptotic behavior of smooth dynamical systems. This is done with a detailed introduction to the zeta-function and topological entropy. In symbolic dynamics, the topological entropy is known to be uncomputable for some dynamical systems (such as cellular automata), but this is not discussed here. The discussion of the algebraic entropy of the fundamental group is particularly illuminating. Measure and ergodic theory are introduced in the following chapter. Detailed proofs are given of most of the results, and it is good to see that the authors have chosen to include a discussion of Hamiltonian systems, so important to physical applications. The existence of invariant measures for smooth dynamical systems follows in the next chapter with a good introduction to Lagrangian mechanics. Part 2 of the book is a rigorous overview of hyperbolicity with a very insightful discussion of stable and unstable manifolds. Homoclinicity and the horseshoe map are also discussed, and even though these constructions are not useful in practical applications, an in-depth understanding of them is important for gaining insight as to the behavior of chaotic dynamical systems. Also, a very good discussion of Morse theory is given in this part in the context of the variational theory of dynamics. The third part of the book covers the important area of low dimensional dynamics. The authors motivate the subject well, explaining the need for using low dimensional dynamics to gain an intuition in higher dimensions. The examples given are helpful to those who might be interested in the quantization of dynamical systems, as the number-theoretic constructions employed by the author are similar to those used in "quantum chaos" studies. Knot theorists will appreciate the discussion on kneading theory. The authors return to the subject of hyperbolic dynamical systems in the last part of the book. The discussion is very rigorous and very well-written, especially the sections on shadowing and equilibrium states. The shadowing results have been misused in the literature, with many false statements about their applicability. The shadowing theorem is proved along with the structural stability theorem. The authors give a supplement to the book on Pesin theory. The details of Pesin theory are usually time-consuming to get through, but the authors do a good job of explaining the main ideas. The multiplicative ergodic theorem is proved, and this is nice since the proof in the literature is difficult.

This book provides a self-contained comprehensive exposition of the theory of dynamical systems. The book begins with a discussion of several elementary but crucial examples. These are used to formulate a program for the general study of asymptotic properties and to introduce the principal theoretical concepts and methods. The main theme of the second part of the book is the interplay between local analysis near individual orbits and the global complexity of the orbit structure. The third and fourth parts develop the theories of low-dimensional dynamical systems and hyperbolic dynamical systems in depth. The book is aimed at students and researchers in mathematics at all levels from advanced undergraduate and up.

"...well written and clear...a valuable reference for engineers and mechanicians." H.W. Haslach Jr., Applied Mechanics s"The book is a pleasure to read." Edoh Amiran, Mathematical s"The notes section at the end of the book is complete and quite helpful. There are hints and answers provided for a good percentage of the problems in the book. The problems range from fairly straightforward ones to results that I remember reading in research papers over the last 10-20 years....I recommend the text as an exceptional reference..." Richard Swanson, SIAM From the Back CoverThis book provides the first self-contained comprehensive exposition of the theory of dynamical systems as a core mathematical discipline closely intertwined with most of the main areas of mathematics. The authors introduce and rigorously develop the theory while providing researchers interested in applications with fundamental tools and paradigms. The book begins with a discussion of several elementary but fundamental examples. These are used to formulate a program for the general study of asymptotic properties and to introduce the principal theoretical concepts and methods. The main theme of the second part of the book is the interplay between local analysis near individual orbits and the global complexity of the orbits structure. The third and fourth parts develop in depth the theories of low-dimensional dynamical systems and hyperbolic dynamical systems. The book is aimed at students and researchers in mathematics at all levels from advanced undergraduate up. Scientists and engineers working in applied dynamics, nonlinear science, and chaos will also find many fresh insights in this concrete and clear presentation. It contains more than four hundred systematic exercises.About the AuthorAnatole Katok is Raymond N. Shibley Professor of Mathematics at Pennsylvania State University.fm.author_biographical_note2