

<<现代动力系统理论导论>>

图书基本信息

书名：<<现代动力系统理论导论>>

13位ISBN编号：9787510032929

10位ISBN编号：751003292X

出版时间：2011-4

出版单位：世界图书出版公司

作者：卡托克 编

页数：802

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内容概要

this 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 orbit 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 ad-vanced undergraduate up. scientists and engineers working in applied dynamics, non-linear science, and chaos will also find many fresh insights in this concrete and clear presentation. it contains more than four hundred systematic exercises.

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作者简介

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by anatole katok and leonard mendoza

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章节摘录

版权页：插图：The purpose of this chapter is to introduce the variational approach to dynamics, that is, to show how interesting orbits in some dynamical systems can be found as special critical points of functionals defined on appropriate auxiliary spaces of potential orbits. This idea goes back to the variational principles in classical mechanics (Maupertuis, d'Alembert, Lagrange, etc.). The classical continuous-time case presents certain difficulties related to infinite-dimensionality of the spaces of potential orbits. In order to demonstrate the essential features of this approach and to avoid those difficulties we start in Section 2 with a model geometric problem describing the motion of a point mass inside a convex domain. Then we consider in Section 3 a more general class of area-preserving two-dimensional dynamical systems, twist maps, which possesses the essential features of that example, but covers many other interesting situations. The main result there is Theorem 9.3.7, which guarantees existence of infinitely many periodic orbits with a special behavior for any twist map. At least as important as that result itself is the machinery involving the action functional (9.3.7) for the periodic problem, which will be extended in Chapter 13 to give results about nonperiodic orbits. Furthermore, after developing the necessary local theory, the approach can then be refined to study continuous-time systems as well, although we only carry out the program for geodesic flows, where the action functional has a particularly clear geometric interpretation. An important ingredient here is to reduce the global problem to a finite-dimensional one by considering "broken geodesics" (cf. the proof of Theorem 9.5.8). We concentrate our attention in Sections 6 and 7 on describing the invariant set consisting of globally minimal geodesics, that is, geodesics which on the universal cover are length-minimizing segments between any two of their points. There are two principal conclusions: Theorem 9.6.7 connects the geometrical complexity of the manifold measured by the growth of the volume of balls on the universal cover with the dynamical complexity of the geodesic flow measured by the topological entropy.

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