

## <<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

版权说明：本站所提供下载的PDF图书仅提供预览和简介，请支持正版图书。

更多资源请访问：<http://www.tushu007.com>

## <<现代动力系统理论导论>>

### 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 advanced 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.

## <<现代动力系统理论导论>>

### 作者简介

编者：(美国)卡托克 (Katok A.)

# <<现代动力系统理论导论>>

## 书籍目录

preface  
 0. introduction  
 1. principal branches of dynamics  
 2. flows, vector fields, differential equations  
 3. time-one map, section, suspension  
 4. linearization and localization  
 part 1 examples and fundamental concepts  
 1. first examples  
 1. maps with stable asymptotic behavior  
 contracting maps; stability of contractions; increasing interval  
 maps  
 2. linear maps  
 3. rotations of the circle  
 4. translations on the torus  
 5. linear flow on the torus and completely integrable systems  
 6. gradient flows  
 7. expanding maps  
 8. hyperbolic toral automorphisms  
 9. symbolic dynamical systems  
 sequence spaces; the shift transformation; topological markov  
 chains; the  
 .perron-frobenius operator for positive matrices  
 2. equivalence, classification, and invariants  
 1. smooth conjugacy and moduli for maps equivalence and moduli;  
 local analytic linearization; various types of moduli  
 2. smooth conjugacy and time change for flows  
 3. topological conjugacy, factors, and structural stability  
 4. topological classification of expanding maps on a circle  
 expanding maps; conjugacy via coding; the fixed-point method  
 5. coding, horseshoes, and markov partitions  
 markov partitions; quadratic maps; horseshoes; coding of the toral  
 automor- phism  
 6. stability of hyperbolic total automorphisms  
 7. the fast-converging iteration method (newton method) for  
 the  
 conjugacy problem  
 methods for finding conjugacies; construction of the iteration  
 process  
 8. the poincare-siegel theorem  
 9. cocycles and cohomological equations  
 3. principal classes of asymptotic topological invariants  
 1. growth of orbits  
 periodic orbits and the-function; topological entropy; volume  
 growth; topo-logical complexity: growth in the fundamental group;  
 homological growth

## <<现代动力系统理论导论>>

2. examples of calculation of topological entropy  
isometries; gradient flows; expanding maps; shifts and topological markov chains; the hyperbolic toral automorphism; finiteness of entropy of lipschitz maps; expansive maps
3. recurrence properties
4. statistical behavior of orbits and introduction to ergodic theory
  1. asymptotic distribution and statistical behavior of orbits  
asymptotic distribution, invariant measures; existence of invariant measures; the birkhoff ergodic theorem; existence of symptotic distribution; ergod-icity and unique ergodicity; statistical behavior and recurrence; measure-theoretic somorphism and factors
  2. examples of ergodicity; mixing  
rotations; extensions of rotations; expanding maps; mixing; hyperbolic total automorphisms; symbolic systems
  3. measure-theoretic entropy  
entropy and conditional entropy of partitions; entropy of a measure-preserving transformation; properties of entropy
  4. examples of calculation of measure-theoretic entropy  
rotations and translations; expanding maps; bernoulli and markov measures; hyperbolic total automorphisms
  5. the variational principle
  5. systems with smooth invariant measures and more examples
    1. existence of smooth invariant measures  
the smooth measure class; the perron-frobenius operator and divergence; criteria for existence of smooth invariant measures; absolutely continuous invariant measures for expanding maps; the moser theorem
    2. examples of newtonian systems  
the newton equation; free particle motion on the torus; the mathematical pendulum; central forces
    3. lagrangian mechanics  
uniqueness in the configuration space; the lagrange equation; lagrangian systems; geodesic flows; the legendre transform
    4. examples of geodesic flows  
manifolds with many symmetries; the sphere and the toms; isometrics of the hyperbolic plane; geodesics of the hyperbolic plane; compact factors; the dynamics of the geodesic flow on compact hyperbolic surfaces
    5. hamiltonian systems  
symplectic geometry; cotangent bundles; hamiltonian vector fields and flows; poisson brackets; integrable systems
    6. contact systems  
hamiltonian systems preserving a 1-form; contact forms
    7. algebraic dynamics: homogeneous and affine systems
- part 2 local analysis and orbit growth

## <<现代动力系统理论导论>>

### 6.local hyperbolic theory and its applications

#### 1. introduction

#### 2. stable and unstable manifolds

hyperbolic periodic orbits; exponential splitting; the hadamard-perron theorem; proof of the hadamard-perron theorem; the inclination lemma

#### 3. local stability of a hyperbolic periodic point

the hartman-grobman theorem; local structural stability

#### 4. hyperbolic sets

definition and invariant cones; stable and unstable manifolds; closing lemma and periodic orbits; locally maximal hyperbolic sets

#### 5. homoclinic points and horseshoes

general horseshoes; homoclinic points; horseshoes near homoclinic points

#### 6. local smooth linearization and normal forms

jets, formal power series, and smooth equivalence; general formal analysis; the hyperbolic smooth case

#### 7.transversality and genericity

##### 1. generic properties of dynamical systems

residual sets and sets of first category; hyperbolicity and genericity

##### 2. genericity of systems with hyperbolic periodic points

transverse fixed points; the kupka-smale theorem

##### 3. nontransversality and bifurcations

structurally stable bifurcations; hopf bifurcations

##### 4. the theorem of artin and mazur

#### 8.orbitgrowtharisingfromtopology

##### 1. topological and fundamental-group entropies

##### 2. a survey of degree theory

motivation; the degree of circle maps; two definitions of degree for smooth maps; the topological definition of degree

##### 3. degree and topological entropy

##### 4. index theory for an isolated fixed point

##### 5. the role of smoothness: the shub-sullivan theorem

##### 6. the lefschetz fixed-point formula and applications

##### 7. nielsen theory and periodic points for toral maps

#### 9.variational aspects of dynamics

##### 1. critical points of functions, morse theory, and dynamics

##### 2. the billiard problem

##### 3. twist maps

definition and examples; the generating function; extensions; birkhoff periodic orbits; global minimality of birkhoff periodic orbits

##### 4. variational description of lagrangian systems

##### 5. local theory and the exponential map

##### 6. minimal geodesics

## <<现代动力系统理论导论>>

7. minimal geodesics on compact surfaces

part 3 low-dimensional phenomena

10. introduction: what is low-dimensional dynamics?

motivation; the intermediate value property and conformality; vet

low-dimensional and low-dimensional systems; areas of

low-dimensional dynamics

11. homeomorphisms of the circle

1. rotation number

2. the poincare classification

rational rotation number; irrational rotation number; orbit types

and measurable classification

12. circle diffeomorphisms

1. the denjoy theorem

2. the denjoy example

3. local analytic conjugacies for diophantine rotation number

4. invariant measures and regularity of conjugacies

5. an example with singular conjugacy

6. fast-approximation methods

conjugacies of intermediate regularity; smooth cocycles with wild  
coboundaries

7. ergodicity with respect to lebesgue measure

13. twist maps

1. the regularity lemma

2. existence of aubry-mather sets and homoclinic orbits

aubry-mather sets; invariant circles and regions of  
instability

3. action functionals, minimal and ordered orbits

minimal action; minimal orbits; average action and minimal  
measures; stable sets for aubry-mather sets

4. orbits homoclinic to aubry-mather sets

5. nonexistence of invariant circles and localization of  
aubry-mather sets

14. flows on surfaces and related dynamical systems

1. poincare-bendixson theory

the poincare-bendixson theorem; existence of transversals

2. fixed-point-free flows on the torus

global transversals; area-preserving flows

3. minimal sets

4. new phenomena

the cherry flow; linear flow on the octagon

5. interval exchange transformations

definitions and rigid intervals; coding; structure of orbit

closures; invariant measures; minimal nonuniquely ergodic interval  
exchanges

6. application to flows and billiards

classification of orbits; parallel flows and billiards in  
polygons

## <<现代动力系统理论导论>>

### 7. generalizations of rotation number

rotation vectors for flows on the torus; asymptotic cycles;  
fundamental class and smooth classification of area-preserving flows

### 15. continuous maps of the interval

1. markov covers and partitions
2. entropy, periodic orbits, and horseshoes
3. the sharkovsky theorem
4. maps with zero topological entropy
5. the kneading theory
6. the tent model

### 16. smooth maps of the interval

1. the structure of hyperbolic repellers
2. hyperbolic sets for smooth maps
3. continuity of entropy
4. full families of unimodal maps

### part 4 hyperbolic dynamical systems

### 17. survey of examples

1. the smale attractor
2. the da (derived from anosov) map and the plykin attractor  
the da map; the plykin attractor
3. expanding maps and anosov automorphisms of nilmanifolds
4. definitions and basic properties of hyperbolic sets for flows
5. geodesic flows on surfaces of constant negative curvature
6. geodesic flows on compact riemannian manifolds with negative sectional curvature

### 7. geodesic flows on rank-one symmetric spaces

### 8. hyperbolic julia sets in the complex plane

rational maps of the riemann sphere; holomorphic dynamics

### 18. topological properties of hyperbolic sets

1. shadowing of pseudo-orbits
2. stability of hyperbolic sets and markov approximation
3. spectral decomposition and specification  
spectral decomposition for maps; spectral decomposition for flows;  
specification

### 4. local product structure

### 5. density and growth of periodic orbits

### 6. global classification of anosov diffeomorphisms on tori

### 7. markov partitions

### 19. metric structure of hyperbolic sets

### 1. holder structures

the invariant class of holder-continuous functions; holder  
continuity of conjugacies; holder continuity of orbit equivalence  
for flows; holder continuity and differentiability of the unstable  
distribution; holder continuity of the jacobian

### 2. cohomological equations over hyperbolic dynamical systems



## <<现代动力系统理论导论>>

the livschitz theorem; smooth invariant measures for anosov diffeomorphisms; time change and orbit equivalence for hyperbolic flows; equivalence of torus extensions

20. equilibrium states and smooth invariant measures

1. bowen measure

2. pressure and the variational principle

3. uniqueness and classification of equilibrium states

uniqueness of equilibrium states; classification of equilibrium states

4. smooth invariant measures

properties of smooth invariant measures; smooth classification of anosov diffeomorphisms on the torus; smooth classification of contact anosov flows on 3-manifolds

5. margulis measure

6. multiplicative asymptotic for growth of periodic points

local product flow boxes; the multiplicative asymptotic of orbit growth supplement

s. dynamical systems with nonuniformly hyperbolic behavior

by anatole katok and leonard mendoza

1. introduction

2. lyapunov exponents

cocycles over dynamical systems; examples of cocycles; the multiplicative ergodic theorem; oseledec-pesin e-reduction theorem; the rue!le inequality

3. regular neighborhoods

existence of regular neighborhoods; hyperbolic points, admissible manifolds, and the graph transform

4. hyperbolic measures

preliminaries; the closing lemma; the shadowing lemma; pseudo-markov covers; the livschitz theorem

5. entropy and dynamics of hyperbolic measures

hyperbolic measures and hyperbolic periodic points; continuous

measures and transverse homoclinic points; the spectral

decomposition theorem; entropy, horseshoes, and periodic points for hyperbolic measures

appendix

a. background material

1. basic topology

topological spaces; homotopy theory; metric spaces

2. functional analysis

3. differentiable manifolds

differentiable manifolds; tensor bundles; exterior calculus; transversality

4. differential geometry

5. topology and geometry of surfaces

6. measure theory

basic notions; measure and topology

## <<现代动力系统理论导论>>

7. homology theory

8. locally compact groups and lie groups

notes

hints and answers to the exercises

references

index

## &lt;&lt;现代动力系统理论导论&gt;&gt;

## 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.

## <<现代动力系统理论导论>>

### 编辑推荐

《现代动力系统理论导论(影印版)》由世界图书出版公司出版。

## <<现代动力系统理论导论>>

### 版权说明

本站所提供下载的PDF图书仅提供预览和简介，请支持正版图书。

更多资源请访问:<http://www.tushu007.com>