
Contents

Preface to the Second Edition	ix
Preface to the First Edition	xiii
Part 1. The Core of the Theory	
Chapter 1. Examples of Hyperbolic Dynamical Systems	3
§1.1. Anosov diffeomorphisms	4
§1.2. Anosov flows	9
§1.3. Hyperbolic sets	14
§1.4. The Smale–Williams solenoid	20
§1.5. The Katok map of the 2-torus	22
§1.6. Area-preserving diffeomorphisms with nonzero Lyapunov exponents on surfaces	33
§1.7. A volume-preserving flow with nonzero Lyapunov exponents	39
§1.8. A slow-down of the Smale–Williams solenoid	43
Chapter 2. General Theory of Lyapunov Exponents	45
§2.1. Lyapunov exponents and their basic properties	45
§2.2. The Lyapunov and Perron irregularity coefficients	50
§2.3. Lyapunov exponents for linear differential equations	54
§2.4. Forward and backward regularity. The Lyapunov–Perron regularity	66
§2.5. Lyapunov exponents for sequences of matrices	73

Chapter 3. Cocycles over Dynamical Systems	81
§3.1. Cocycles and linear extensions	82
§3.2. Lyapunov exponents and Lyapunov–Perron regularity for cocycles	87
§3.3. Examples of measurable cocycles over dynamical systems	93
Chapter 4. The Multiplicative Ergodic Theorem	97
§4.1. Lyapunov–Perron regularity for sequences of triangular matrices	98
§4.2. Proof of the Multiplicative Ergodic Theorem	105
§4.3. Normal forms of cocycles	110
§4.4. Regular neighborhoods	115
Chapter 5. Elements of the Nonuniform Hyperbolicity Theory	119
§5.1. Dynamical systems with nonzero Lyapunov exponents	120
§5.2. Nonuniform complete hyperbolicity	129
§5.3. Regular sets	132
§5.4. Nonuniform partial hyperbolicity	139
§5.5. Hölder continuity of invariant distributions	141
Chapter 6. Lyapunov Stability Theory of Nonautonomous Equations	147
§6.1. Stability of solutions of ordinary differential equations	148
§6.2. Lyapunov absolute stability theorem	153
§6.3. Lyapunov conditional stability theorem	158
Chapter 7. Local Manifold Theory	163
§7.1. Local stable manifolds	164
§7.2. An abstract version of the Stable Manifold Theorem	168
§7.3. Basic properties of stable and unstable manifolds	178
Chapter 8. Absolute Continuity of Local Manifolds	187
§8.1. Absolute continuity of the holonomy map	189
§8.2. A proof of the Absolute Continuity Theorem	197
§8.3. Computing the Jacobian of the holonomy map	203
§8.4. An invariant foliation that is not absolutely continuous	205
Chapter 9. Ergodic Properties of Smooth Hyperbolic Measures	207
§9.1. Ergodicity of smooth hyperbolic measures	207
§9.2. Local ergodicity	216
§9.3. The entropy formula	222

Chapter 10. Geodesic Flows on Surfaces of Nonpositive Curvature	237
§10.1. Preliminary information from Riemannian geometry	238
§10.2. Definition and local properties of geodesic flows	240
§10.3. Hyperbolic properties and Lyapunov exponents	242
§10.4. Ergodic properties	248
§10.5. The entropy formula for geodesic flows	253
Chapter 11. Topological and Ergodic Properties of Hyperbolic Measures	257
§11.1. Hyperbolic measures with local product structure	258
§11.2. Periodic orbits and approximations by horseshoes	263
§11.3. Shadowing and Markov partitions	264
Part 2. Selected Advanced Topics	
Chapter 12. Cone Techniques	271
§12.1. Introduction	271
§12.2. Lyapunov functions	273
§12.3. Cocycles with values in the symplectic group	277
Chapter 13. Partially Hyperbolic Diffeomorphisms with Nonzero Exponents	279
§13.1. Partial hyperbolicity	280
§13.2. Systems with negative central exponents	283
§13.3. Foliations that are not absolutely continuous	285
Chapter 14. More Examples of Dynamical Systems with Nonzero Lyapunov Exponents	291
§14.1. Hyperbolic diffeomorphisms with countably many ergodic components	291
§14.2. The Shub–Wilkinson map	301
Chapter 15. Anosov Rigidity	303
§15.1. The Anosov rigidity phenomenon. I	303
§15.2. The Anosov rigidity phenomenon. II	311
Chapter 16. C^1 Pathological Behavior: Pugh’s Example	317
Bibliography	323
Index	331