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**Smooth Ergodic
Theory and
Its Applications**

**Anatole Katok
Rafael de la Llave
Yakov Pesin
Howard Weiss
Editors**



American Mathematical Society

Smooth Ergodic Theory And Its Applications

A. B. Katok



Smooth Ergodic Theory And Its Applications:

Smooth Ergodic Theory and Its Applications A. B. Katok, 2001 During the past decade there have been several major new developments in smooth ergodic theory which have attracted substantial interest to the field from mathematicians as well as scientists using dynamics in their work In spite of the impressive literature it has been extremely difficult for a student or even an established mathematician who is not an expert in the area to acquire a working knowledge of smooth ergodic theory and to learn how to use its tools Accordingly the AMS Summer Research Institute on Smooth Ergodic Theory and Its Applications Seattle WA had a strong educational component including ten mini courses on various aspects of the topic that were presented by leading experts in the field This volume presents the proceedings of that conference Smooth ergodic theory studies the statistical properties of differentiable dynamical systems whose origin traces back to the seminal works of Poincare and later many great mathematicians who made contributions to the development of the theory The main topic of this volume smooth ergodic theory especially the theory of nonuniformly hyperbolic systems provides the principle paradigm for the rigorous study of complicated or chaotic behavior in deterministic systems This paradigm asserts that if a non linear dynamical system exhibits sufficiently pronounced exponential behavior then global properties of the system can be deduced from studying the linearized system One can then obtain detailed information on topological properties such as the growth of periodic orbits topological entropy and dimension of invariant sets including attractors as well as statistical properties such as the existence of invariant measures asymptotic behavior of typical orbits ergodicity mixing decay of correlations This volume serves a two fold purpose first it gives a useful gateway to smooth ergodic theory for students and nonspecialists and second it provides a state of the art report on important current aspects of the subject The book is divided into three parts lecture notes consisting of three long expositions with proofs aimed to serve as a comprehensive and self contained introduction to a particular area of smooth ergodic theory thematic sections based on mini courses or surveys held at the conference and original contributions presented at the meeting or closely related to the topics that were discussed there Introduction to Smooth Ergodic Theory Luís Barreira, Yakov Pesin, 2023-04-28 This book is the first comprehensive introduction to smooth ergodic theory It consists of two parts the first introduces the core of the theory and the second discusses more advanced topics In particular the book describes the general theory of Lyapunov exponents and its applications to the stability theory of differential equations the concept of nonuniform hyperbolicity stable manifold theory with emphasis on absolute continuity of invariant foliations and the ergodic theory of dynamical systems with nonzero Lyapunov exponents A detailed description of all the basic examples of conservative systems with nonzero Lyapunov exponents including the geodesic flows on compact surfaces of nonpositive curvature is also presented There are more than 80 exercises The book is aimed at graduate students specializing in dynamical systems and ergodic theory as well as anyone who wishes to get a working knowledge of smooth ergodic theory and to learn how to use its tools It can also be used as a source for special topics courses on nonuniform

hyperbolicity The only prerequisite for using this book is a basic knowledge of real analysis measure theory differential equations and topology although the necessary background definitions and results are provided In this second edition the authors improved the exposition and added more exercises to make the book even more student oriented They also added new material to bring the book more in line with the current research in dynamical systems Ergodic Theory Cesar E. Silva,Alexandre I. Danilenko,2023-07-31 This volume in the Encyclopedia of Complexity and Systems Science Second Edition covers recent developments in classical areas of ergodic theory including the asymptotic properties of measurable dynamical systems spectral theory entropy ergodic theorems joinings isomorphism theory recurrence nonsingular systems It enlightens connections of ergodic theory with symbolic dynamics topological dynamics smooth dynamics combinatorics number theory pressure and equilibrium states fractal geometry chaos In addition the new edition includes dynamical systems of probabilistic origin ergodic aspects of Sarnak s conjecture translation flows on translation surfaces complexity and classification of measurable systems operator approach to asymptotic properties interplay with operator algebras

Dynamics, Ergodic Theory and Geometry Boris Hasselblatt,2007-09-24 Based on the subjects from the Clay Mathematics Institute Mathematical Sciences Research Institute Workshop titled Recent Progress in Dynamics in September and October 2004 this volume contains surveys and research articles by leading experts in several areas of dynamical systems that have experienced substantial progress One of the major surveys is on symplectic geometry which is closely related to classical mechanics and an exciting addition to modern geometry The survey on local rigidity of group actions gives a broad and up to date account of another flourishing subject Other papers cover hyperbolic parabolic and symbolic dynamics as well as ergodic theory Students and researchers in dynamical systems geometry and related areas will find this book fascinating The book also includes a fifty page commented problem list that takes the reader beyond the areas covered by the surveys to inspire and guide further research *Ergodic Theory and Negative Curvature* Boris Hasselblatt,2017-12-15 Focussing on the mathematics related to the recent proof of ergodicity of the Weil Petersson geodesic flow on a nonpositively curved space whose points are negatively curved metrics on surfaces this book provides a broad introduction to an important current area of research It offers original textbook level material suitable for introductory or advanced courses as well as deep insights into the state of the art of the field making it useful as a reference and for self study The first chapters introduce hyperbolic dynamics ergodic theory and geodesic and horocycle flows and include an English translation of Hadamard s original proof of the Stable Manifold Theorem An outline of the strategy motivation and context behind the ergodicity proof is followed by a careful exposition of it using the Hopf argument and of the pertinent context of Teichmüller theory Finally some complementary lectures describe the deep connections between geodesic flows in negative curvature and Diophantine approximation Handbook of Dynamical Systems A. Katok,B. Hasselblatt,2005-12-17 This second half of Volume 1 of this Handbook follows Volume 1A which was published in 2002 The contents of these two

tightly integrated parts taken together come close to a realization of the program formulated in the introductory survey Principal Structures of Volume 1A The present volume contains surveys on subjects in four areas of dynamical systems Hyperbolic dynamics parabolic dynamics ergodic theory and infinite dimensional dynamical systems partial differential equations Written by experts in the field The coverage of ergodic theory in these two parts of Volume 1 is considerably more broad and thorough than that provided in other existing sources The final cluster of chapters discusses partial differential equations from the point of view of dynamical systems

Lyapunov Exponents and Smooth Ergodic Theory Luis Barreira, Ya. B. Pesin, 2002 This self contained book is a systematic introduction to smooth ergodic theory The topics discussed include the general abstract theory of Lyapunov exponents and its applications to the stability theory of differential equations stable manifold theory absolute continuity and the ergodic theory of dynamical systems with nonzero Lyapunov exponents including geodesic flows The authors consider several nontrivial examples of dynamical systems with nonzero Lyapunov exponents to illustrate some basic methods and ideas of the theory The reader needs a basic knowledge of real analysis measure theory differential equations and topology The authors present basic concepts of smooth ergodic theory and provide complete proofs of the main results They also state some more advanced results to give readers a broader view of smooth ergodic theory This volume may be used by those non experts who wish to become familiar with the field

Combinatorial Constructions in Ergodic Theory and Dynamics A. B. Katok, 2003 Ergodic theory studies measure preserving transformations of measure spaces These objects are intrinsically infinite and the notion of an individual point or of an orbit makes no sense Still there are a variety of situations when a measure preserving transformation and its asymptotic behavior can be well described as a limit of certain finite objects periodic processes The first part of this book develops this idea systematically Genericity of approximation in various categories is explored and numerous applications are presented including spectral multiplicity and properties of the maximal spectral type The second part of the book contains a treatment of various constructions of cohomological nature with an emphasis on obtaining interesting asymptotic behavior from approximate pictures at different time scales The book presents a view of ergodic theory not found in other expository sources It is suitable for graduate students familiar with measure theory and basic functional analysis

Elements of Dynamical Systems Anima Nagar, Riddhi Shah, Shrihari Sridharan, 2022-11-11 This book stems from lectures that were delivered at the three week Advanced Instructional School on Ergodic Theory and Dynamical Systems held at the Indian Institute of Technology Delhi from 4-23 December 2017 with the support of the National Centre for Mathematics National Board for Higher Mathematics Department of Atomic Energy Government of India The book discusses various aspects of dynamical systems Each chapter of this book specializes in one aspect of dynamical systems and thus begins at an elementary level and goes on to cover fairly advanced material The book helps researchers be familiar with and navigate through different parts of ergodic theory and dynamical systems

A Vision for Dynamics in the 21st Century Danijela

Damjanovic, Boris Hasselblatt, Andrey Gogolev, Yakov Pesin, 2024-02-08 A large international conference celebrated the 50 year career of Anatole Katok and the body of research across smooth dynamics and ergodic theory that he touched In this book many leading experts provide an account of the latest developments at the research frontier and together set an agenda for future work including an explicit problem list This includes elliptic parabolic and hyperbolic smooth dynamics ergodic theory smooth ergodic theory and actions of higher rank groups The chapters are written in a readable style and give a broad view of each topic they blend the most current results with the developments leading up to them and give a perspective on future work This book is ideal for graduate students instructors and researchers across all research areas in dynamical systems and related subjects

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