Smooth Ergodic Theory and Its Applications

AMS Summer Research Institute on Smooth Ergodic Theory and Its Applications (1999 : University of Washington)

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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, and measure-theoretic entropy).Smooth ergodic theory also provides a foundation for numerous applications throughout mathematics (e.g., Riemannian geometry, number theory, Lie groups, and partial differential equations), as well as other sciences. 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.

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