

Leonid Polterovich

**The Geometry of the Group
of Symplectic Diffeomorphisms**

Birkhäuser

The Geometry Of The Group Of Symplectic Diffeomorphism Lectures In Mathematics Eth Zaarich

Albert A Gayle



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The Geometry of the Group of Symplectic Diffeomorphism Leonid Polterovich, 2012-12-06 The group of Hamiltonian diffeomorphisms $\text{Ham}(M, \omega)$ of a symplectic manifold (M, ω) plays a fundamental role both in geometry and classical mechanics. For a geometer at least under some assumptions on the manifold M this is just the connected component of the identity in the group of all symplectic diffeomorphisms. From the viewpoint of mechanics $\text{Ham}(M, \omega)$ is the group of all admissible motions. What is the minimal amount of energy required in order to generate a given Hamiltonian diffeomorphism ϕ ? An attempt to formalize and answer this natural question has led H. Hofer [Ho90] to a remarkable discovery. It turns out that the solution of this variational problem can be interpreted as a geometric quantity namely as the distance between ϕ and the identity transformation. Moreover this distance is associated to a canonical biinvariant metric on $\text{Ham}(M, \omega)$. Since Hofer's work this new geometry has been intensively studied in the framework of modern symplectic topology. In the present book I will describe some of these developments. Hofer's geometry enables us to study various notions and problems which come from the familiar finite dimensional geometry in the context of the group of Hamiltonian diffeomorphisms. They turn out to be very different from the usual circle of problems considered in symplectic topology and thus extend significantly our vision of the symplectic world.

The Geometry of the Group of Symplectic Diffeomorphisms Leonid Polterovich, 2001 The group of symplectic diffeomorphisms of a symplectic manifold plays a fundamental role both in geometry and classical mechanics. What is the minimal amount of energy required in order to generate a given mechanical motion? This variational problem admits an interpretation in terms of a remarkable geometry on the group discovered by Hofer in 1990. Hofer's geometry serves as a source of interesting problems and gives rise to new methods and notions which extend significantly our vision of the symplectic world. In the past decade this new geometry has been intensively studied in the framework of symplectic topology with the use of modern techniques such as Gromov's theory of pseudo holomorphic curves, Floer homology and Guillemin-Sternberg-Lerman theory of symplectic connections. Furthermore it opens up the intriguing prospect of using an alternative geometric intuition in dynamics. The book provides an essentially self contained introduction into these developments and includes recent results on diameter geodesics and growth of one parameter subgroups in Hofer's geometry as well as applications to dynamics and ergodic theory. It is addressed to researchers and students from the graduate level onwards.

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

Morse Theoretic Methods in Nonlinear Analysis and in Symplectic Topology Paul Biran, Octav Cornea, François Lalonde, 2006-02-12 The papers collected in this volume are contributions to the 43rd session of the Seminaire de mathematiques superieures SMS on Morse Theoretic Methods in Nonlinear Analysis and Symplectic Topology This session took place at the Universite de Montreal in July 2004 and was a NATO Advanced Study Institute ASI The aim of the ASI was to bring together young researchers from various parts of the world and to present to them some of the most significant recent advances in these areas More than 77 mathematicians from 17 countries followed the 12 series of lectures and participated in the lively exchange of ideas The lectures covered an ample spectrum of subjects which are reflected in the present volume Morse theory and related techniques in infinite dimensional spaces Floer theory and its recent extensions and generalizations Morse and Floer theory in relation to string topology generating functions structure of the group of Hamiltonian diffeomorphisms and related dynamical problems applications to robotics and many others We thank all our main speakers for their stimulating lectures and all participants for creating a friendly atmosphere during the meeting We also thank Ms Diane Belanger our administrative assistant for her help with the organization and Mr Andre Montpetit our technical editor for his help in the preparation of the volume

Perspectives in Analysis, Geometry, and Topology Ilia Itenberg, Burglind Jöricke, Mikael Passare, 2011-12-14 The articles in this volume are invited papers from the Marcus Wallenberg symposium and focus on research topics that bridge the gap between analysis geometry and topology The encounters between these three fields are widespread and often provide impetus for major breakthroughs in applications Topics include new developments in low dimensional topology related to invariants of links and three and four manifolds Perelman's spectacular proof of the Poincare conjecture and the recent advances made in algebraic complex symplectic and tropical geometry

Spectral Invariants with Bulk, Quasi-Morphisms and Lagrangian Floer Theory Kenji Fukaya, Yong-Geun Oh, Hiroshi Ohta, Kaoru Ono, 2019-09-05 In this paper the authors first develop various enhancements of the theory of spectral invariants of Hamiltonian Floer homology and of Entov Polterovich theory of spectral symplectic quasi states and quasi morphisms by incorporating bulk deformations i.e deformations by ambient cycles of symplectic manifolds of the Floer homology and quantum cohomology Essentially the same kind of construction is independently carried out by Usher in a slightly less general context Then the authors explore various applications of these enhancements to the symplectic topology especially new construction of symplectic quasi states quasi morphisms and new Lagrangian intersection results on toric and non toric manifolds The most novel part of this paper is its use of open closed Gromov Witten Floer theory and its variant involving closed orbits of periodic Hamiltonian system to connect spectral invariants with bulk deformation symplectic quasi states quasi morphism to the Lagrangian Floer theory with bulk

deformation The authors use this open closed Gromov Witten Floer theory to produce new examples Using the calculation of Lagrangian Floer cohomology with bulk they produce examples of compact symplectic manifolds which admits uncountably many independent quasi morphisms They also obtain a new intersection result for the Lagrangian submanifold in The Breadth of Symplectic and Poisson Geometry Jerrold E. Marsden, Tudor S. Ratiu, 2007-07-03 The invited papers in this volume are written in honor of Alan Weinstein one of the world's foremost geometers Contributions cover a broad range of topics in symplectic and differential geometry Lie theory mechanics and related fields Intended for graduate students and working mathematicians this text is a distillation of prominent research and an indication of future trends in geometry mechanics and mathematical physics **The Group of Hamiltonian Homeomorphisms and C0-symplectic Topology** Stefan Müller, 2008 Symplectic Twist Maps: Global Variational Techniques Christophe Gole, 2001-11-22 This book concentrates mainly on the theorem of existence of periodic orbits for higher dimensional analogs of Twist maps The setting is that of a discrete variational calculus and the techniques involve Conley Zehnder Morse Theory They give rise to the concept of ghost tori which are of interest in the dimension 2 case ghost circles The debate is oriented somewhat toward the open problem of finding orbits of all in particular irrational rotation vectors **Journal of the Korean Mathematical Society**, 2009

The Geometry Of The Group Of Symplectic Diffeomorphism Lectures In Mathematics Eth Zaarich Book Review: Unveiling the Magic of Language

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