

<<微分几何基础>>

图书基本信息

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前言

The present book aims to give a fairly comprehensive account of the fundamentals of differential manifolds and differential geometry. The size of the book influenced where to stop, and there would be enough material for a second volume (this is not a threat). At the most basic level, the book gives an introduction to the basic concepts which are used in differential topology, differential geometry, and differential equations. In differential topology, one studies for instance homotopy classes of maps and the possibility of finding suitable differentiable maps in them (immersions, embeddings, isomorphisms, etc.). One may also use differentiable structures on topological manifolds to determine the topological structure of the manifold (for example, see Smale [Sin 67]). In differential geometry, one puts an additional structure on the differentiable manifold (a vector field, a spray, a 2-form, a Riemannian metric, ad lib.) and studies properties connected especially with these objects. Formally, one may say that one studies properties invariant under the group of differentiable automorphisms which preserve the additional structure. In differential equations, one studies vector fields and their integral curves, singular points, stable and unstable manifolds, etc. A certain number of concepts are essential for all three, and are so basic and elementary that it is worthwhile to collect them together so that more advanced expositions can be given without having to start from the very beginnings. Those interested in a brief introduction could run through Chapters II, III, IV, V, VII, and most of Part III on volume forms, Stokes theorem, and integration. They may also assume all manifolds finite dimensional.

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内容概要

本书介绍了微分拓扑、微分几何以及微分方程的基本概念。

本书的基本思想源于作者早期的《微分和黎曼流形》，但重点却从流形的一般理论转移到微分几何，增加了不少新的章节。

这些新的知识为Banach和Hilbert空间上的无限维流形做准备，但一点都不觉得多余，而优美的证明也让读者受益不浅。

在有限维的例子中，讨论了高维微分形式，继而介绍了Stokes定理和一些在微分和黎曼情形下的应用。

给出了Laplacian基本公式，展示了其在浸入和浸没中的特征。

书中讲述了该领域的一些主要基本理论，如：微分方程的存在定理、唯一性、光滑定理和向量域流，包括子流形管状邻域的存在性的向量丛基本理论，微积分形式，包括经典2-形式的辛流形基本观点，黎曼和伪黎曼流形协变导数以及其在指数映射中的应用，Cartan-Hadamard定理和变分微积分第一基本定理。

目次：（第一部分）一般微分方程；微积分；流形；向量丛；向量域和微分方程；向量域和微分形式运算；Frobenius定理；（第二部分）矩阵、协变导数和黎曼几何：矩阵；协变导数和测地线；曲率；二重切线丛的张量分裂；曲率和变分公式；半负曲率例子；自同构和对称；浸入和浸没；（第三部分）体积形式和积分：体积形式；微分形式的积分；Stokes定理；Stokes定理的应用；谱理论。

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书籍目录

Foreword Acknowledgments PART General Differential Theory CHAPTER Differential Calculus
 1.Categories 2.Topological Vector Spaces 3.Derivatives and Composition of Maps 4.Integration
 and Taylor's Formula 5.The Inverse Mapping Theorem CHAPTER Manifolds 1.Atlases, Charts,
 Morphisms 2.Submanifolds, Immersions, Submersions 3.Partitions of Unity 4.Manifolds with
 Boundary CHAPTER Vector Bundles 1.Definition, Pull Backs 2.The Tangent Bundle 3.Exact
 Sequences of Bundles 4.Operations on Vector Bundles 5.Splitting of Vector Bundles CHAPTER
 Vector Fields and Differential Equations 1.Existence Theorem for Differential Equations 2.Vector Fields,
 Curves, and Flows 3.Sprays 4.The Flow of a Spray and the Exponential Map 5.Existence of Tubular
 Neighborhoods 6.Uniqueness of Tubular Neighborhoods CHAPTER Operations on Vector Fields and
 Differential Forms 1.Vector Fields, Differential Operators, Brackets 2.Lie Derivative 3.Exterior
 Derivative 4.The Poincare Lemma. 5.Contractions and Lie Derivative 6.Vector Fields and I-Forms
 Under Self Duality 7.The Canonical 2-Form 8.Darboux's Theorem CHAPTER The Theorem of
 Frobenius 1.Statement of the Theorem 2.Differential Equations Depending on a Parameter 3.Proof
 of the Theorem 4.The Global Formulation 5.Lie Groups and Subgroups PART Metrics, Covariant
 Derivatives, and Riemannian Geometry CHAPTER Metrics 1.Definition and Functoriality 2.The
 Hilbert Group 3.Reduction to the Hilbert Group 4.Hilbertian Tubular Neighborhoods 5.The
 Morse-Palais Lemma 6.The Riemannian Distance 7.The Canonical Spray CHAPTER Covariant
 Derivatives and Geodesics 1.Basic Properties 2.Sprays and Covariant Derivatives 3.Derivative
 Along a Curve and Parallelism 4.The Metric Derivative 5.More Local Results on the Exponential Map
 6.Riemannian Geodesic Length and Completeness CHAPTER curvature 1.The Riemann Tensor
 2.Jacobi Lifts. 3.Application of Jacobi Lifts to Texp 4.Convexity Theorems. 5.Taylor
 ExpansionsPART Volume Forms and IntegrationIndex

章节摘录

We shall recall briefly the notion of derivative and some of its useful properties. As mentioned in the foreword, Chapter VIII of Dieudonné's book or my books on analysis [La 83], [La 93] give a self-contained and complete treatment for Banach spaces. We summarize certain facts concerning their properties as topological vector spaces, and then we summarize differential calculus. The reader can actually skip this chapter and start immediately with Chapter II if the reader is accustomed to thinking about the derivative of a map as a linear transformation. (In the finite dimensional case, when bases have been selected, the entries in the matrix of this transformation are the partial derivatives of the map.) We have repeated the proofs for the more important theorems, for the ease of the reader. It is convenient to use throughout the language of categories. The notion of category and morphism (whose definitions we recall in 1) is designed to abstract what is common to certain collections of objects and maps between them. For instance, topological vector spaces and continuous linear maps, open subsets of Banach spaces and differentiable maps, differentiable manifolds and differentiable maps, vector bundles and vector bundle maps, topological spaces and continuous maps, sets and just plain maps. In an arbitrary category, maps are called morphisms, and in fact the category of differentiable manifolds is of such importance in this book that from Chapter II on, we use the word morphism synonymously with differentiable map (or p -times differentiable map, to be precise) . All other morphisms in other categories will be qualified by a prefix to indicate the category to which they belong.

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