

Geometry on Manifolds

Riemannian Metrics, Symplectic Forms, Contact Structures

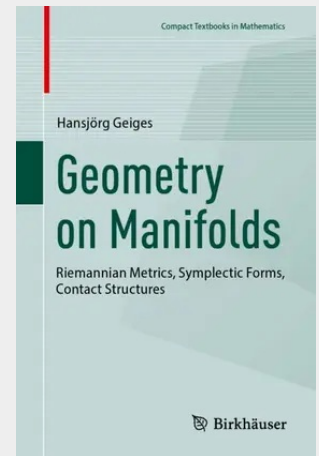
This first course on differential geometry includes not only Riemannian manifolds, but also symplectic and contact geometry. Rather than treating these three fields of geometry as separate subjects, this text emphasises common features by organising the material according to ideas and methods shared by the three fields.

Specifically, this text highlights how certain concepts, such as structure-preserving vector fields or variational characterisations of curves adapted to a given geometric structure, find their analogous expressions in the respective field of geometry. For example, Frobenius integrability, which is primarily relevant for contact geometry, is discussed together with the classification of flat Riemannian manifolds, which requires very similar arguments.

Another case in point is the discussion of transformation groups (isometries, symplectomorphisms, contactomorphisms) and the corresponding Lie algebras. Two equivalent ways to construct this Lie algebra structure are described: from the usual Lie bracket of vector fields on the manifold, restricted to the subalgebra of structure-preserving ones, or from the right-invariant vector fields on the transformation group.

This book also provides a concise introduction to manifolds, vector bundles, differential forms and tensors. As a result, it contains more material than can be covered in a single semester, and it is possible to teach various courses from it, depending on the background knowledge one may want to assume. Many examples and exercises are integrated into the richly illustrated text, making the book suitable for self-study.

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