

Physics 198: Differential Geometry and Lie Groups

In 100 Words

Keshav Balwant Deoskar

kdeoskar@berkeley.edu

These is a small document to complement the lectures for the UC Berkeley DeCal 'Physics 198: Differential Geometry and Lie Groups for Physics Students'. I try to explain every concept we will encounter in less than 100 words. The order in which topics are discussed may be slightly different from the main text.

This template is based heavily off of the one produced by [Kevin Zhou](#).

Contents

1	Manifolds	2
1.1	Topological Manifolds	2
1.2	Chart	2
1.3	Atlas	2
1.4	Smooth Structure	2

1 Manifolds

1.1 Topological Manifolds

- spaces that look like euclidean space.

Topological Spaces which satisfy three requirements.

- **Locally Euclidean:** at each point, we can find a small neighborhood U along with a bijection φ between U and an open subset of \mathbb{R}^n .
- **Hausdorff:** All points are distinct in the sense that given a pair of points p, q we can find open sets O_p, O_q so that $p \in O_p, q \in O_q$ and O_p, O_q are disjoint.
- **Second Countable:** the topology has a basis, and the basis is countable.

1.2 Chart

- an area + a mapping (same as in geography)

An open set U centered around a point on the manifold along with a bijection $\phi : U \rightarrow \phi(U) \subseteq_{\text{open}} \mathbb{R}^n$.

1.3 Atlas

- a collection of charts (same as in geography)

Just... a set of charts.

1.4 Smooth Structure

-