Physics 198: Differential Geometry and Lie Groups

Notes

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These are a compilation of notes based on which (some of the) lectures for 'Physics 198: Differential Geometry and Lie Groups for Physics Students' will be given. These notes are largely based on the primary reference to the class, namely "*Differential Geometry and Lie Groups for Physicists*" by Marián Fecko, and cover topics in roughly the same order as in the book.

Contents

1 Lie Groups

In physics, we can learn a great deal from studying the symmetries of *continuous* systems.

2   Representations of Lie Groups and Lie Algebras

What is a Representation?

- To understand what a group really *is*, it can be very enlightening to study what the group *does* i.e. to study **group actions**. This refers to how the elements of a group act on some other space of objects (could be another group, a vector space, a topological space, smooth manifold, etc.)

- The case of vector spaces is and specifically the group actions which act *linearly* on a *linear space* is particularly important. Essentially, such maps which characterize the behavior of a group are called its **Representations**.