A Lie group is a group with the additional structure of a differentiable manifold for which the group operation is differentiable. The name Lie group comes from the Norwegian mathematician M. Sophus Lie (1842-1899) who was the first to study these groups systematically in the context of symmetries of partial differential equations.

The theory of Lie groups and their representations plays a vital role in the description of symmetries in Physics (quantum physics, elementary particles), Geometry and Topology, and Number Theory (automorphic forms).

In this course we will begin by studying the basic properties of Lie groups. Much of the structure of a connected (real) Lie group and its Lie subgroups is captured by its Lie algebra, which may be defined as the algebra of left invariant vector fields.

After this introduction we will study nilpotent, solvable and compact Lie groups. Examples are the groups of strictly upper triangular, upper triangular groups, and the unitary, orthogonal and symplectic groups. We will study the representation theory of such groups, and some examples from harmonic analysis.

The final part of the course will be devoted to algebraic groups, and their representation theory. In particular we will focus on real and p-adic reductive groups, and finite Chevalley groups.

Prerequisites: A knowledge of algebra, analysis and differential geometry at an advanced undergraduate level. Lie algebras 649 is also very useful.

REFERENCES


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