

MATH-429 : Representation Theory II

Lie algebras

This is a standard course on Lie groups, Lie algebras and their representations (see the week-by-week list of topics at the end of this document).

Time and place

- Lecture: Wednesdays 08:15-10:00 in MA A1 10
- Exercise Session: Wednesdays 10:15-12:00 in MA A1 10

Instructors

- Lecturer: Andrei Neguț
- Teaching Assistant: Niccolò Giacomini

Grading: 85% written final exam (date TBD)

15% mid-semester written assignment (date TBD)

Moodle: <https://go.epfl.ch/MATH-429>

Every week before class, you may find on Moodle the lecture notes for the upcoming class, as well as the problem sheet to be used in the upcoming exercise session. We also use the Ed Discussion forum, and we encourage people to ask questions publicly (either anonymously or not).

Prerequisites: MATH-211 (group theory)

MATH-314 (representation theory I - finite groups)

MATH-322 (differential geometry II - smooth manifolds)

Textbooks: Lecture notes will be provided; for additional help, we suggest

- J. Humphreys, “Introduction to Lie Algebras and Representation Theory”

- W. Fulton, J. Harris, “Representation Theory: A first course”
- D. Bump, “Lie Groups”
- A. Baker, “Matrix Groups: An Introduction to Lie Group Theory”

Language: English.

List of topics (subject to slight changes):

1. (Feb 18): Lie groups and Lie algebras
2. (Feb 25): Representations of Lie groups and Lie algebras
3. (Mar 4): Compact Lie groups. Complexification and real forms
4. (Mar 11): The Lie group - Lie algebra correspondence
5. (Mar 18): The representation theory of \mathfrak{sl}_2
6. (Mar 25): The PBW theorem. Solvable and nilpotent Lie algebras
7. (Apr 1): Radicals and forms. Reductive and semisimple Lie algebras
8. (Apr 15): Abstract properties of semisimple Lie algebras
9. (Apr 22): Explicit description of semisimple Lie algebras
10. (Apr 29): Abstract root systems
11. (May 6): Dynkin diagrams and classification
12. (May 13): Semisimple Lie algebras by generators and relations
13. (May 20): Representation theory of semisimple Lie algebras
14. (May 27): Characters and the Weyl character formula