

MATH-534 : Representation Theory III

Quantum groups

This is a course on quantum groups, their representations and their R -matrices, all done in the language of Hopf algebras. The main application of this theory will be the construction of link invariants, such as the Jones polynomial (see the week-by-week list of topics at the end of this document).

Time and place

- Lecture: Tuesdays 13:15-15:00 in CO 017
- Exercise Session: Tuesdays 15:15-17:00 in CO 017

Instructors

- Lecturer: Andrei Neguț
- Teaching Assistant: Shivang Jindal

Grading: 85% written final exam (date TBD)
15% mid-semester written assignment (date TBD)

Moodle: <https://go.epfl.ch/MATH-534>

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-429 (representation theory II - Lie algebras)

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

- S. Majid, “Foundations of Quantum Group Theory”
- C. Kassel, “Quantum Groups”

- A. Klimyk, K. Schmüdgen, “Quantum Groups and Their Representations”
- J. Jantzen, “Lectures on Quantum Groups”
- G. Lusztig, “Introduction to Quantum Groups”

Language: English.

List of topics (subject to slight changes):

1. (Feb 17): Hopf algebras.
2. (Feb 24): Reminder on the representation theory of \mathfrak{g} .
3. (Mar 3): The quantum enveloping algebra $U_q\mathfrak{g}$.
4. (Mar 10): The algebra of functions on a Lie group $\mathcal{O}(G)$.
5. (Mar 17): The quantum group $\mathcal{O}_q(G)$.
6. (Mar 24): The duality between $U_q\mathfrak{g}$ and $\mathcal{O}_q(G)$.
7. (Mar 31): A basis of $U_q\mathfrak{g}$.
8. (Apr 14): The representation theory of $U_q\mathfrak{g}$.
9. (Apr 21): Tensor products and R -matrices.
10. (Apr 28): Drinfeld doubles.
11. (May 5): The universal R -matrix of $U_h\mathfrak{g}$.
12. (May 12): Knots, links and braids.
13. (May 19): Invariants and quantum groups.
14. (May 26): Ribbons and Hopf algebras.