

MATH-492

Representation theory of semisimple lie algebras

Cursus	Sem.	Type
Ing.-math	MA2, MA4	Opt.
Mathématicien	MA2	Opt.

Language of teaching	English
Credits	5
Session	Summer
Semester	Spring
Exam	Written
Workload	150h
Weeks	14
Hours	4 weekly
Lecture	2 weekly
Exercises	2 weekly
Number of positions	

Remark

Cours donné en alternance tous les deux ans (pas donné en 2021-22)

Summary

We will establish the major results in the representation theory of semisimple Lie algebras over the field of complex numbers, and that of the related algebraic groups.

Content

Highest weight theory
 Universal enveloping algebra
 Construction of irreducible representations
 Weyl's degree formula
 Freudenthal's formula.

If time permits, construction of Chevalley groups and simple algebraic groups.

Learning Prerequisites**Required courses**

Theorie des Groupes, Anneaux et corps, Algebres de Lie semisimples

Important concepts to start the course

The classification of complex semisimple Lie algebras. Root systems.

Learning Outcomes

By the end of the course, the student must be able to:

- Construct irreducible representations of a given highest weight
- Formulate main results on the representation theory
- Sketch proofs of some main results
- Carry out routine calculations
- Compute dimensions of weight spaces and modules

Transversal skills

- Assess one's own level of skill acquisition, and plan their on-going learning goals.
- Continue to work through difficulties or initial failure to find optimal solutions.
- Demonstrate the capacity for critical thinking
- Use a work methodology appropriate to the task.
- Plan and carry out activities in a way which makes optimal use of available time and other resources.

Teaching methods

Lectures

Expected student activities

Exercises, extra reading, presentation of exercises.

Assessment methods

In addition to a final exam, part of the grade will be based upon student presentation of some course material during the exercise sessions or corrected written homework assignments, or both.

Dans le cas de l'art. 3 al. 5 du Règlement de section, l'enseignant décide de la forme de l'examen qu'il communique aux étudiants concernés.

Supervision

Office hours	Yes
Assistants	Yes

Resources

Bibliography

James Humphreys : Introduction to Lie algebras and Representation Theory.

Bourbaki, Lie algebras and Lie groups, Chapters 1 - 3.

Ressources en bibliothèque

- [Introduction to Lie algebras and Representation Theory / Humphreys](#)
- [Lie algebras and Lie groups / Bourbaki](#)