

MATH-429

**Lie groups**

Michel Philippe

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

Contact language	English
Credits	5
Session	Summer
Semester	Spring
Exam	Oral
Workload	150h
Weeks	14
<b>Hours</b>	<b>4 weekly</b>
Lecture	2 weekly
Exercises	2 weekly
<b>Number of positions</b>	

**Summary**

We will discuss the basic structure of Lie groups and of their associated Lie algebras along with their finite dimensional representations and with a special emphasis on matrix Lie groups.

**Content**

- Matrix Lie groups, Lie algebras and the exponential map. Exemples.
- Morphisms of Lie groups and morphisms of Lie algebras.
- Representations theory of compact groups: the Peter Weyl theorem.
- Representations of compact Lie groups and compact Lie algebras
- Representations of Lie groups and their Lie algebras via Weyl's unitary trick

**Keywords**

Lie groups, Lie algebras, Classical groups

**Learning Prerequisites****Required courses**

MATH-211

**Recommended courses**

MATH-302

MATH-303

MATH-322

MATH-319

**Learning Outcomes**

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

- Define the main concepts introduced in the course
- state the theorems covered in the course and give the main ideas of their proofs
- apply the results covered in the course to examples
- deduce properties of a Lie group from the structure of its Lie algebra

**Teaching methods**

ex-cathedra teaching, exercise classes

### Expected student activities

- Participation to the course the course
- Active participation to the exercise sessions and to the resolution of exercises

### Assessment methods

Assignments, oral exam

Dans le cadre 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	No
Assistants	Yes
Forum	No

### Resources

#### Bibliography

"Introduction to Smooth Manifolds", John M. Lee

"Introduction to the Theory of Lie Groups", Roger Godement

"Matrix Groups: An Introduction to Lie Group Theory", Andrew Baker

"Lie Groups", Daniel Bump

"Lie groups, beyond an introduction", Anthony Knapp

#### Ressources en bibliothèque

- [Introduction to Smooth Manifolds / Lee](#)
- [Lie groups, beyond an introduction / Knapp](#)
- [Lie Groups / Bump](#)
- [Introduction to the Theory of Lie Groups / Godement](#)
- [Matrix Groups / Baker](#)

#### Moodle Link

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