

MATH-496

**Computational linear algebra**

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

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

**Remark**

pas donné en 2024-25

**Summary**

This is an introductory course to the concentration of measure phenomenon - random functions that depend on many random variables tend to be often close to constant functions.

**Content**

Concentration of measure plays an important role in probability theory, statistics, probabilistic combinatorics, analysis etc, but is also on its own a beautiful topic. The basic examples of the concentration of measure phenomena are the following:

- 1) The visual distance of a  $N$ -dimensional unit sphere is only of order  $N^{-0.5}$ : or in other words more than 99% of the measure on the sphere lies at the distance of  $O(N^{-0.5})$  of a fixed hyperplane through the origin.
- 2) The suprema of a centred Gaussian process  $G(t)$  even with a possibly infinite index set  $T$  is always concentrated around its expected value with a Gaussian tail that only depends on the highest variance among the Gaussians  $G(t)$ .

In this course we will try to understand these two slightly puzzling examples and related phenomena.

Topics discussed include: suprema of Gaussian and empirical processes, log-Sobolev inequalities and the entropy method, isoperimetry and other geometrical examples.

This course is accessible to motivated 3rd year students.

**Keywords**

log-Sobolev inequalities, isoperimetry, entropy

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

Mathematics Bachelor's level knowledge of analysis, linear algebra and probability (for example, the Bloc "Science de Base" in EPFL Mathematics Bachelor's program).

**Teaching methods**

Lectures + exercise classes

**Assessment methods**

Oral exam

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.

## Resources

### Bibliography

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### Ressources en bibliothèque

- [Probability in high dimension / Handel van](#)
- [Concentration Inequalities: A Nonasymptotic Theory of Independence / Boucheron](#)