MATH-502

Distribution and interpolation spaces

Braun Mathias

Cursus	Sem.	Type
Ing.-math	MA1, MA3	Opt.
Mathématicien	MA1, MA3	Opt.

Language of teaching	English
Credits	5
Session	Winter
Semester	Fall
Exam	Oral
Workload	150h
Weeks	14
Hours	**4 weekly**
Courses	2 weekly
Exercises	2 weekly
Number of positions	

Remark

Cours donné en alternance tous les deux ans

Summary

The goal of this course is to give an introduction to the theory of distributions and cover the fundamental results of Sobolev spaces including fractional spaces that appear in the interpolation theory. Those notions are central to the study of partial differential equations (PDE).

Content

Part 1: Toplogy and functional spaces. Fundamental theorems on Banach spaces, weak topology, weak * topology, reflexive spaces, separable spaces.
Part 2: Distributions. Topological vector spaces, distributions: differentiation, restriction, localisation, convolution, tempered distributions and Fourier transform.
Part 3: Sobolev spaces. Extension operators, Sobolev embedding theorem, Sobolev inequality, Poincaré inequality, dual Sobolev space, Hilbert-Sobolev spaces, fractional derivatives, fractional Sobolev spaces.

Keywords

Distributions, Sobolev Spaces, Interpolation Spaces

Learning Prerequisites

Required courses

- MATH-200: Analysis III
- MATH-205: Analysis IV
- MATH-303: Measure and integration

Recommended courses

- MATH-302: Functional analysis I

Learning Outcomes

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

- Demonstrate proficiency in statements
- Identify use and role of the assumptions
- Recognize which concepts and results could be used in a given context
- Describe concepts and proofs
- Apply theory to specific examples

Teaching methods

Lectures + Exercises

Assessment methods

Oral
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

Assistant.e.s	Yes

Resources

Bibliography

"*Théorie des distributions*," Laurent Schwartz.
"*Analyse fonctionnelle. Théorie et applications*," Haïm Brezis.
"*Functional analysis, Sobolev spaces and partial differential equations*," Haïm Brezis.
"*Cours d'analyse. Théorie des distributions et analyse de Fourier*," Jean-Michel Bony.
"*Sobolev Spaces*," Robert A. Adams and John J. F. Fournier.
"*Elliptic Partial Differential Equations of Second Order*," David Gilbarg and Neil S. Trudinger.
"*Partial differential equations*," Lawrence C. Evans.
"*An introduction to Sobolev spaces and interpolation spaces*," Luc Tartar.
"*An introduction to harmonic analysis*," Yitzhak Katznelson.

Ressources en bibliothèque

- Elliptic Partial Differential Equations of Second Order / Gilbarg
- Théorie des distributions / Schwartz
- Functional analysis, Sobolev spaces and partial differential equations / Brezis
- Cours d'analyse / Bony
- Partial differential equations / Evans
- Analyse fonctionnelle / Brezis
- An introduction to Sobolev spaces and interpolation space / Tartar
- An introduction to harmonic analysis / Katznelson
- Sobolev Spaces / Adams

Moodle Link

- https://go.epfl.ch/MATH-502