

MATH-647

Topics on the Euler and Navier-Stokes equations

Colombo Maria

Cursus	Sem.	Type
Mathematics		Opt.

Language of teaching	English
Credits	2
Session	
Exam	Oral presentation
Workload	60h
Hours	34
Lecture	22
Exercises	12
Number of positions	

Frequency

Only this year

Remark

Fall semester

Summary

This topics course focuses on recent and classical fundamental results on the Euler and Navier-Stokes equations, such as global existence of weak solutions, (non)uniqueness results, blow-ups, partial regularity, anomalous dissipation.

Content

The course regards the mathematical theory of the three-dimensional Euler and Navier-Stokes equations. It provides self-contained proofs of some of the most significant results in the area, many of which can only be found in research papers. The first part of the course is dedicated to Elgindi's result on blow-up of solutions of 3D Euler. The second part of the course, include a selection of topics between the following list: the existence of global-in-time Leray-Hopf weak solutions for Navier-Stokes and the local existence of strong solutions; the conditional local regularity results of Prodi-Serrin; the partial regularity results of Caffarelli, Kohn, and Nirenberg; nonuniqueness results obtained via convex integration or instability; anomalous dissipation.

Keywords

Navier-Stokes equations, Euler equations

Learning Prerequisites**Required courses**

Solid foundations in all analysis courses, including PDEs I and II and functional analysis I and II, is expected.

Learning Outcomes

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

- Work out / Determine with certain solutions of the Navier-Stokes equations, assessing their uniqueness, expected regularity and blow up properties.

Resources**Bibliography**

Books "The Navier-Stokes equations in the 21st century" by Lemarrié-Rieussiet, "The incompressible Euler and Navier-Stokes equations" by Bedrossian and Vicol.

Ressources en bibliothèque

- [The Navier-Stokes equations in the 21st century / Rieussiet](#)
- [The incompressible Euler and Navier-Stokes equations / Bedrossian](#)

Moodle Link

- <https://go.epfl.ch/MATH-647>