Instabilities and Turbulence

Subject area: Mechanical Engineering

University:	L'X
Level:	MA1
Teaching mode:	online
Instructor(s):	Christophe Josserand

Short description

Turbulence is at the heart of many physical, environment and industrial flows. Turbulence is generally a consequence of numerous instabilities arising on laminar flows as the dynamics evolves. This course aims to introduce the physical mechanisms from flow instability, and chaos dynamics to turbulence flows and modelling. The emphasis throughout the class will be to provide the mathematical frameworks and tools in order to describe these flows.

Full description

Learning outcomes

• deducing fixed points in dynamical systems
• performing the linear stability analysis in dynamical systems and flows
• understanding nonlinear dynamics and the chaos transition
• fluid flow analysis in stready regimes in the incompressible Navier-Stokes equations framework
• understanding the transition to turbulence
• understanding the statistical description of turbulence
• deducing the challenges of turbulence modelling
• investigating turbulence models, from Reynolds Averaged Navier-Stokes equations (RAND) to Large Eddy Simulations (LES) ones
• understanding the structure of the turbulent boundary layer
• obtaining a general understanding on the modern challenges in turbulence and stability analysis"

General information

Contact hours per week:	4 hours
Total workload:	50 hours (in student hours for the whole course)
ECTS credits:	5

Language:	English
Course start date:	19 September 2022
Course end date:	09 December 2022
Add. info about start date:	The course should start the week of September 19, 2022
Weekly teaching day/time:	
Time zone:	CET (Denmark, Germany, France, Netherlands, Switzerland, Czech Republic)
Further information:	
Prerequisites:	Fluid mechanics (basic concepts)
Activities and methods:	Lectures, Practices
Presence on campus:	

Final examination

Form:	written
Date:	12 December 2022
Location/format:	online
Re-sit possibility:	
Transcript available:	end of the semester and generally 8 weeks after the exam.
Add. info/requirements:	

Registration

To register for this course, follow the registration requirements of your **home university** as specified here: www.euroteq.eu/courses-registration.

Administration

Number of places:	24
Minimum participants:	
Internal course code:	MEC555
Contact:	exchange-international@polytechnique.fr

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