

ME-445

Aerodynamics

Mulleners Karen

Cursus	Sem.	Type
Mechanical engineering minor	H	Opt.
Mechanical engineering	MA1, MA3	Opt.
Space technologies minor	H	Opt.

Language of teaching	English
Credits	4
Session	Winter
Semester	Fall
Exam	Written
Workload	120h
Weeks	14
Hours	4 weekly
Lecture	2 weekly
Exercises	2 weekly
Number of positions	

Summary

This course will provide the fluid dynamic background to understand how air flows around two- and three-dimensional wings and bodies and to understand and calculate the aerodynamics forces and moments acting on the objects as a result of the air flow.

Content

INTRODUCTION:

- Basic concepts
- Definitions
- Fundamental equations

STEADY INVISCID INCOMPRESSIBLE FLOWS

- Potential flow
- Infinite wing theory

- Finite wing theory

UNSTEADY AERODYNAMICS

VISCOUS INCOMPRESSIBLE FLOWS

- Drag
- Boundary layers and flow separation
- Flow control

Learning Outcomes

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

- Describe the physical behaviour of a flow in scientific terms, AH1
- Link flow behaviour with non-dimensional parameters (e.g. Reynolds and Mach numbers), AH2
- Describe the physical differences between laminar and turbulent flows, AH4
- Describe in detail the physical phenomena associated with the interaction of a flow with a solid wall (as a function of its characteristics, e.g. roughness), AH5
- Describe flow in simple geometries, such as over a flat plate, in a tube, or around a sphere or airfoil, AH9
- Work out / Determine the flight characteristics from a wing shape and choose a wing shape to provide the desired flight characteristics, AH10
- Describe 3D effects resulting, for example, from a finite wing span or behind a blunt body, AH11
- Solve analytically or numerically the potential flow around an airfoil, AH19

Transversal skills

- Write a scientific or technical report.
- Summarize an article or a technical report.

Teaching methods

In-person lectures
Exercise sessions

Expected student activities

Attendance and participation in lectures and exercise sessions.
Group project on airfoil characterisation during the semester.

Assessment methods

Written examination (70%)
Airfoil characterisation project with written report during the semester (30%)

Supervision

Office hours	No
Assistants	Yes
Forum	No

Resources

Virtual desktop infrastructure (VDI)

No

Ressources en bibliothèque

- [Aerodynamics for engineering students / Houghton](#)
- [Fundamentals of Aerodynamics / Anderson](#)

Moodle Link

- <https://go.epfl.ch/ME-445>

Videos

- <https://mediaspace.epfl.ch/channel/ME-445%2BAerodynamics/30095>