ME-342

Introduction to turbomachinery

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Cursus	Sem.	Type
Mechanical engineering minor	E	Opt.
Mechanical engineering	BA6	Opt.

Language of teaching	English
Credits	3
Session	Summer
Semester	Spring
Exam	Written
Workload	90h
Weeks	14
Hours	**3 weekly**
Courses	2 weekly
Exercises	1 weekly
Number of positions	

Summary

The course provides a foundational understanding of turbomachines, covering their classification, fundamental principles of fluid mechanics and key performance parameters. It delves into coordinate systems, velocity analysis, and the application of conservation laws to turbomachinery.

Content

This course provides a comprehensive introduction to fluid mechanics and turbomachinery, beginning with fundamental principles before progressing to more specialized topics.
Students will first learn the essential equations governing fluid flow, including the conservation of mass, energy, and momentum. They will explore flow characteristics in pipes, the differences between laminar and turbulent flow, and how to calculate energy losses in both straight pipes and complex piping systems. The course also covers vortex phenomena and thrust generation in certain types of turbomachinery, laying the groundwork for understanding fluid motion and its effects.
Building on these foundations, students will then be introduced to the basic principles of turbomachines. They will learn how and why turbomachines work, the differences between turbines and pumps, and the importance of minimizing energy losses. The course will also cover blade design, the selection of appropriate turbomachines for specific applications, and the fundamentals of scaling machines from prototypes to various sizes.
By the end of the course, students will have the necessary knowledge to analyze fluid flow in engineering systems and advance to more specialized work in turbomachinery design, development, and research.

Keywords

Energy equation, energy conversion, internal flow, turbomachine axial-, mixed-, and radial-flow velocity triangle, angular momentum, shaft torque, Euler turbomachine equation, shaft power, centrifugal pump, pump performance curve, overall efficiency, system equation, head-rise coefficient, power coefficient, flow coefficient, pump scaling laws, specific speed, impulse turbine, reaction turbine, pelton wheel

Learning Prerequisites

Required courses

Fluid mechanics (for GM)
Thermodynamics and energetics I

Learning Outcomes

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

- Explain how and why a turbomachine works

- Explain the basic differences between a turbine and a pump
- Recognize the importance of minimizing loss in a turbomachine
- Analyze turbomachine blades shape
- Solve basic energy equations for turbomachinery applications
- Design class of turbomachines for a particular application
- Derive thrust of a blade
- Apply energy equations to a complete system

Transversal skills

- Demonstrate the capacity for critical thinking

Teaching methods

Lectures with slides and exercises

Assessment methods

Written exam (during the exam period)

Resources

Moodle Link

- https://go.epfl.ch/ME-342