ME-201

Continuum mechanics

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Cursus	Sem.	Type
Mechanical engineering	BA4	Obl.

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

Summary

Continuum conservation laws (e.g. mass, momentum and energy) will be introduced. Mathematical tools, including basic algebra and calculus of vectors and Cartesian tensors will be taught. Stress and deformation tensors will be applied to examples drawn from linear elastic solid mechanics.

Content

We begin with a detailed review of objectivity. An overview of known conservation laws, written for continua, is used to motivate the development of the stress tensor. Mathematical review of linear algebra and calculus applied to tensors, including the introduction of indicial notation as a shorthand. Kinematics of deformation and flow follow. Applications arising in Hookean elasticity complete our introduction to continuum mechanics.

Keywords

Kinematics, Dynamics, Solid, Fluid

Learning Prerequisites

Required courses

- Linear algebra
- Mechanics of structures I
- Mechanics of structures II
- Analysis III
- Analysis IV

Recommended courses

Important concepts to start the course

- A valid theory must be objective. We define an observer, and discuss objectivity in detail.
- All the same conservation laws introduced in prior coursework must be derived for continua. We provide these derivations by illustration.

Learning Outcomes

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

- Model and analytically solve problems of statics, structural stress analysis or simple mechanisms, S1

Transversal skills

- Assess one's own level of skill acquisition, and plan their on-going learning goals.

Teaching methods

Ex cathedra lectures and exercise sessions

Assessment methods

Two written tests during the semester with 55% and 45% contributions to the final grade

Supervision

Office hours	Yes
Assistants	Yes
Forum	No

Resources

Bibliography

John Botsis & Michel Deville, *Mécanique des milieux continus: une introduction*, Presses Polytechniques et Universitaires Romandes, Lausanne, Switzerland, 2006.
Barenblatt, G. I. *Flow Deformation and Fracture.* Cambridge, 2014.
Lai, Rubin and Krempl *An Introduction to Continuum Mechanics.* Amsterdam, 2010.
A class syllabus will provide up-to-

Ressources en bibliothèque

- Lai, Rubin and Krempl An Introduction to Continuum Mechanics
- Barenblatt, G. I. Flow Deformation and Fracture
- John Botsis & Michel Deville, Mécanique des milieux continus: une introduction

Notes/Handbook

Notes will be provided in .pdf format on the Moodle page following each lecture.

Moodle Link

- https://go.epfl.ch/ME-201

Prerequisite for

- incompressible fluid mechanics
- solid mechanics