

# Thermomechanics of continuous mediums

## In brief

> **Course language:** French

## Presentation

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### Learning objectives

The course is divided into two distinct parts

- Part 1: Compressible Fluid Mechanics
  - To acquire the knowledge necessary to understand compressible flows
  - To know the theoretical basis of compressible aerodynamics
  - Understand the main mechanisms induced by the effects of compressibility
  - Know how to calculate the characteristics of straight or oblique shock waves
  - Know how to calculate flows in Laval nozzles
- Part 2: Thermomechanical Behavior of Solid Materials
  - Know the main types of behavior of solids
  - Understand the thermodynamic framework underlying any behavior model
  - Know how to use the most common models

### Description of the programme

- Part 1: Compressible Fluid Mechanics
  - General introduction - examples of compressibility in aeronautics/space
  - Reminder of fluid mechanics
  - Effects of compressibility - Mach waves
  - Conservation of energy - Saint-Venant equations
  - Application to the study of the Laval nozzle - Straight shock
  - Oblique shocks and curved shocks
  - Meyer-Prandtl expansion
- Part 2: Thermomechanical behavior of solid materials
  - Thermoelasticity
  - Heat exchanger

- Thermoviscoelasticity
- Self-heating
- Elastoplasticity
- Metal forming

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## Generic central skills and knowledge targeted in the discipline

- Understand the basics of compressible fluid mechanics (C2)
- Understand the effects of compressibility, particularly in aeronautics and thermopropulsion (C2)
- Know how to calculate the characteristics of shock waves (C2)
- Understand the basics of thermomechanics of solids (C2)
- Know the main thermomechanical behaviors of solids (C2)

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## How knowledge is tested

- \* DS = Written evaluation of 2 x 1 h (85%)
- \* CC = un CR de TP (15 %)

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## Bibliography

- P.K. Kundu et I.M. Cohen, Fluid mechanics, 4e édition, Elsevier, 2010
- W.E. Carscallen et coll., Introduction to compressible fluid flow, CRC Press, 2014
- J. Lemaître et coll., Mécanique des matériaux solides, éd. Dunod, 2009

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## Teaching team

- Olivier Boiron
- Thierry Désoyer
- Dominique Eyheramendy
- Yannick Knapp

### Total des heures

CM	Master class	16h
TD	Directed work	12h
TP	Practical work	2h

## Useful info

Name responsible for EU

**Lead Instructor**

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