# Thermomechanics of continuous mediums

## In brief

**Course langage:** French

# Presentation

## 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

## 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)

## How knowledge is tested

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

## 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

## Teaching team

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

| **Total des heures** | | **30h** |
|---|---|---|
| CM | Master class | 16h |
| TD | Directed work | 12h |
| TP | Practical work | 2h |

# Useful info

## Name responsible for EU

**Lead Instructor**
Olivier Boiron
olivier.boiron@centrale-med.fr