

# Waves in mechanics



ECTS credits  
2 credits



Semester  
Fall

## In brief

> **Course language:** French

## Presentation

### Prerequisites

Continuum mechanics (1st year [Mechanics](#) course)

### Learning objectives

- Discover the wide range of common phenomena related to waves and vibrations
- Be able to understand dynamic phenomena in mechanics (solid, fluid and acoustic)
- Know how to distinguish between the notions of wave and vibration and know the formalisms involved
- Master the basic theoretical tools related to these notions
- Know how to use numerical tools to solve different types of problems

### Description of the programme

- Lecture review and introduction to wave and vibration phenomena in different media
- Introduction of the time dimension in continuum mechanics and consequences
  - Notion of wave
  - Wave formalism
  - Different types of wave equations and solutions
- Introduction of boundary conditions
  - Standing waves, vibrations
  - Eigenmodes
- Tools and methods
  - Buckingham's Pi theorem and applications

- Fourier transform, DFT, Shannon criterion
- CFL condition
- Introduction to nonlinear acoustics
  - Constitutive equations in the nonlinear non-viscous case
  - Constitutive equations in the viscous nonlinear case
  - Applications of nonlinear acoustics

---

## Generic central skills and knowledge targeted in the discipline

- Know how to model dynamic problems
- Know how to identify the characteristic parameters of a problem
- Know how to define the methodology to solve a dynamic problem
- Know how to identify complex dynamic phenomena such as instability or chaos

---

## How knowledge is tested

- CC1: Reports on practical works (50%)
- CC2: Scientific report on a given subject (50%)

---

## Bibliography

- Billingham, J., & King, A. (2001). Wave Motion (Cambridge Texts in Applied Mathematics). Cambridge: Cambridge University Press.  
[doi:10.1017/CBO9780511841033](https://doi.org/10.1017/CBO9780511841033)
- G. B. Whitham, "Linear and Nonlinear Waves," John Wiley & Sons Inc., Hoboken, 1999. [doi:10.1002/9781118032954](https://doi.org/10.1002/9781118032954)
- Sirven, Les ondes : du linéaire au non linéaire, Dunod, 1999.

---

## Teaching team

- Bruno Cochelin
- Daniel Mazzoni

### Total des heures

		24h
CM	Master class	8h
TD	Directed work	8h
TP	Practical work	8h

## Useful info

Name responsible for EU

**Lead Instructor**

Daniel Mazzoni

✉ [daniel.mazzoni@centrale-med.fr](mailto:daniel.mazzoni@centrale-med.fr)