

Waves in mechanics

# Waves in mechanics



#### In brief

> Course langage: French

## Presentation

### Prerequisites

Continuum mechanics (1<sup>st</sup> 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



#### Waves in mechanics

- -- 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.
- G. B. Whitham, "Linear and Nonlinear Waves," John Wiley & Sons Inc., Hoboken, 1999. 🔀 doi:10.1002/9781118032954
- · Sirven, Les ondes : du linéaire au non linéaire, Dunod, 1999.

#### Teaching team

- Bruno Cochelin
- Daniel Mazzoni

#### Total des heures

Master class	8h
Directed work	8h
Practical work	8h
	Master class Directed work Practical work

## Useful info

24h



### Name responsible for EU

#### Lead Instructor

Daniel Mazzoni ■ daniel.mazzoni@centrale-med.fr