

Experimental methods



ECTS credits
2 credits



Semester
Fall

In brief

> **Course language:** French

Presentation

Prerequisites

none

Learning objectives

The objective of this module on experimental methods is twofold:

On the one hand, to give students an overview of the issues related to metrology in the context of mechanics (i.e., specific measurements of stress, velocity, temperature, etc.). This is done within the framework of two courses of four hours each: one focused on measurement techniques, the other on data and signal processing.

On the other hand, through 4 sessions of practical work, we will discover and study, theoretically and experimentally, original physical phenomena: jet instabilities, surface wave propagation, turbulent boundary layers, and the efficiency of a water wheel.

The general objectives of this course are :

- * to know the main measurement techniques in mechanics
 - * To know the main sources of metrological error,
 - * To know how to interpret experiments
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Description of the programme

Course Content:

- * Normative aspects of a measurement.
- * Characteristics and performance of a measurement chain.
- * Acquisition and processing of digital data.
- * Strain measurements in solids (strain gauges, stereo correlation).
- * Stress measurements in fluids (pressure measurements, friction measurements).
- * Velocity measurements in fluids (pressure probes, hot wire or film anemometry, laser doppler velocimetry, particle image velocimetry).
- * Temperature measurement (for fluids and solids), physical probes (thermocouple, etc.), thermography, and laser-induced fluorescence.
- * Processing techniques applied to surface wave measurements in a basin.
- * Filtering.
- * Modal decomposition.
- * Time-frequency analysis.

Practical work content:

- * Study of the instabilities of Plateau-Rayleigh (formation of drops in a liquid jet).
- * Study, in a hydraulic channel, of the run-up of a soliton on a vertical wall.
- * Study of a turbulent boundary layer by hot wire anemometry.
- * Study of the performance of a hydraulic wheel.

Generic central skills and knowledge targeted in the discipline

- * Know how to analyze an experimental measurement problem.
- * Know how to determine the ad hoc features of the measuring system being used.
- * Know the main measurement techniques used in mechanics and master their advantages and disadvantages.
- * Know the main data processing methods.

How knowledge is tested

TP : practical work: restitution of reports, 100%.

Bibliography

1. Rathakrishnan, E. (2020). *Instrumentation, Measurements, and Experiments in Fluids* (2nd ed.). CRC Press.
2. Kutz, M. (2015). *Mechanical Engineers' Handbook* (4th ed.). Wiley.

Teaching team

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Sustainable Development Goal



Sustainable cities and communities



Affordable and clean energy

Total des heures

0h