



## ACOUSTIQUE MUSICALE

### MUSICAL ACOUSTICS

Lecturers: Michel ROGER, Marc JACOB, Sébastien OLLIVIER

| Lecturers : 18 | TC : 6 | PW : 0.0 | Autonomy : 4 | Study : 4 | Project : 0.0 | Language : MI

#### Objectives

---

Introduction to musical acoustics and its applications (instrument making, music, digital audio). Physical and perceptive aspects of musical signals will be studied. Musical instruments are designed to generate sounds the frequencies of which can be accurately controlled. Studying and modelling their physics allow to highlight how sound can be generated. We will model acoustical and mechanical resonators, free oscillations, and self-sustained oscillations of wind and bowed string instruments. Electro-acoustic analogies will be introduced and applied to the modelling of microphones, loudspeakers or resonators.

**Keywords :** Musical acoustics, self-sustained oscillations, nonlinear acoustics, physical modelling synthesis, electroacoustics, signal processing

---

#### Programme

- Introduction to musical acoustics Properties of musical sounds (signal, physics, perception)
- Classification of musical instruments from the physical viewpoint Free oscillations musical instruments (percussions, piano, plucked string, ...)
- Wind instruments (resonators, brass, reed, flute, ...), bowed string, self-sustained oscillations (stability, bifurcations, ...)
- Electroacoustic analogy, application to acoustic resonators and electroacoustic devices

#### Learning outcomes

- Have a basic knowledge of musical acoustics
- Analyse musical sound signals
- Understand the basics of sound generation mechanisms and the modelling approaches

#### Independent study

**Objectifs :** Study of a scientific problem related to music or sound design (measurements, data analysis, sound synthesis, or psychoacoustic tests).  
Subjects can be related to the instruments played by the students.

**Méthodes :** 3 TD, 1 BE (modelling, simulations, experiment, synthesis, listening tests)

#### Core texts

A. Chaigne et J. Kergomard, *ACOUSTIQUE DES INSTRUMENTS DE MUSIQUE*, Belin, 2008  
N.H. Fletcher and T. Rossing *THE PHYSICS OF MUSICAL INSTRUMENTS*, Springer, 2008  
M. Castallengo *ECOUTE MUSICALE ET ACOUSTIQUE*, Eyrolles, 2015

#### Assessment

Note = N1 (50%) knowledge + N2 (50%) know-how

- N1: Written exam
- N2 : Case study (BE) Report