

# Dynamics of structures

## Lecturer

Arnaud DERAEMAEKER (Coordinator)

## Course mnemonic

CNST-H420

## ECTS credits

4 credits

## Language(s) of instruction

English

## Course period

Second term

## Course content

The course studies the time dependent behavior of constructions and buildings excited by dynamic forces. The course starts with the analysis of systems with one, two and several degrees of freedom, with and without damping, and also deals with simple continuous structures (beams and bars). Signal analysis and measurement instruments are also presented. The course continues with a short description of the origin of earthquakes and their interaction with civil structures. Then, basics on wave propagation are presented, as another aspect of the dynamic behavior of structures. Examples of structural health monitoring based on elastic wave and vibration techniques are discussed.

## Objectives (and/or specific learning outcomes)

The students will learn how to model time dependant dynamic behavior of structures. Emphasis is put on the ability to derive simple models from real complex structures and to compute their dynamic response due to different types of excitations.

The students will also develop a deep understanding of the effects of vibrations (positive or negative) on structures, the measurement techniques, and the methods to exploit dynamic signals to characterize properties of structures or determine their state of health.

## Pre-requisites and co-requisites

### Course having this one as pre-requisit

MEMO-H501 | Master thesis civil engineering | 24 crédits

## Teaching method and learning activities

The course consists in 12 lectures of 2 hours for the theoretical part. A deeper understanding of the theoretical concepts is achieved through the participation to 24 hours of exercise sessions in the form of a group project. The project consists in the study of the role of dynamics and vibrations in everyday life (sport equipment, loudspeakers, ambient vibrations).

## Contribution to the teaching profile

This teaching unit contributes to the following competences:

- In-depth knowledge and understanding of exact sciences with the specificity of their application to engineering
- Reformulate complex engineering problems in order to solve them (simplifying assumptions, reducing complexity)
- Correctly report on research or design results in the form of a technical report or in the form of a scientific paper
- Present and defend results in a scientifically sound way, using contemporary communication tools, for a national as well as for an international professional or lay audience
- Collaborate in a (multidisciplinary) team
- Combine computational modelling methods and experimental techniques to tackle complex structural and material analysis problems

## References, bibliography and recommended reading

- H. Bachmann, Vibration problems in Structures, Birkhauser Verlag, 1995
- Inman, D.J - Engineering vibrations. Prentice Hall, 3d Edition, 2007 -Géradin M., Rixen D. Mechanical Vibrations - Theory and Application to Structural Dynamics. John Wiley & Sons, second edition, 1997

## Other information

### Contact(s)

Arnaud Deraemaeker (adaraema@ulb.ac.be)

## Evaluation method(s)

Other

### Evaluation method(s) (additional information)

The evaluation consists in an oral examination as well as the evaluation of the project report and oral presentation.

### Main language(s) of evaluation

English

## Programmes

Programmes proposing this course at the  
Brussels School of Engineering

MA-IRCN | **Master of science in Civil Engineering** | finalité  
Professional/unit 1

