MG1970
Design of Mechanical Structures Laboratory

Professor: Véronique Aubin

Language of instruction: French – **Number of hours**: 30 – **ECTS**: 2

Prerequisites: Basic knowledge of continuum mechanics: stress, strain, elasticity

Period:	S5	November to December	IN15DXP, FEP5DXP
	S6	between February and June	IN16DXP, SEP6DXP

Course Objectives

Teach scientific experimental methodology:

- how to define the problem precisely and the model that should be used
- how to set up the experiments
- how to discuss the experimental results and compare them with other sources
- how to take into account safety issues

On completion of the course, students should be able to

- perform and analyse mechanical tests and observe the microstructure
- be able to discuss the validity of experimental results
- discuss the links between the microstructure of materials with the macroscopical mechanical properties
- compare results of numerical simulation to experimental observations

Course Contents

This laboratory course deals with the experimental study of the mechanical behavior of several materials and their effects on the design of complex structures simulated with a numerical tool.

The students can choose one of the following subjects:

- fabrication of a composite material, study of the associated experimental mechanical behavior and design of a mechanical part
- fabrication of concrete, study of the associated experimental mechanical behavior, analysis of the stress heterogeneities by photoelasticimetry and finite element ananlysis
- study of the experimental mechanical behavior of a cardboard sheet and design of a bridge, experimental validation
- experimental study of a steel, influence of thermal treatments on the microstructure and link to the mechanical behavior
- experimental study of an aluminum, mechanical characterization using digital image correlation, comparison with numerical simulation
- experimental study of a biological material, the bone, analysis of its microstructure and porosity, characterization of the mechanical behaviour by compression tests and nano-indentation

The analysis of the experimental results is complemented with numerical results from a finite element software using Comsol or Abaqus.

Course Organization

Labwork: 27 hr, Exam: 3 hr

Teaching Material and Textbooks

Documents from the Mechanics Course (MG1100) + Scientific articles

Evaluation

Practical work (40%), behavior (20%), oral defense (25%) and scientific poster (25%).