1SC2510 – Modeling, simulations and experiments

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Department: DÉPARTEMENT MÉCANIQUE ENERGÉTIQUE PROCÉDÉS
Language of instruction: ANGLAIS
Campus: CAMPUS DE PARIS - SACLAY
Workload (HEE): 40
On-site hours (HPE): 22,50

Description

The objective of this course is to provide students with a modelling approach through numerical simulation and/or experimentation, in the fields of fluid mechanics or solid mechanics.
By giving a model that will be adapted to the description of specific phenomenon, the students will have to set up a numerical or experimental approach that will answer the initial objective while managing physical uncertainties. They will finally implement their methodology, using an iterative process between the model and the acquired data (experimental or numerical).

Quarter number
ST2

Prerequisites (in terms of CS courses)
no prerequisite

Syllabus
For this course, the students will have to choose at the beginning of the sequence two activities among the four proposed:

- numerical simulation in fluid mechanics: students will use MATLAB and Ansys Fluent to simulate basic engineering flows, like channel flow or flow past a cylinder.
- numerical simulation in solid mechanics: the students will use COMSOL multiphysics in order to compare models as well as different types of geometry, in the scope of deriving conception rules.
- experiments in fluid mechanics: the students will measure forces and velocities in fluid flows (liquid or gaseous) using diagnostics based on different physical principles (particle image velocimetry, hot wire, dynamometer, Pitot probe). Acquisition and data analysis will be done using NI LabView and Matlab.

- experiments in solid mechanics: Students will have to use a mechanical test machine to identify certain parameters of the law of behaviour (linear elasticity model) of a material of their choice (steel, aluminium, bone tissue, wood...).

Class components (lecture, labs, etc.)
This course takes place in the form of two sessions of 3x3h+1h30 workshops.

Grading
The evaluation is based on the work performed during classes. A report or a presentation is required for the evaluation, which will be evaluated mid-term. Attendance is mandatory, and any unjustified absence will lead to penalties to the final mark.

Resources
Teaching team :
-Numerical simulation : Ann-Lenaig Hamon, Camille Gandiolle (Solid mechanics), Morgan Chabanon (Fluid mechanics).
-Experiments: Jan Neggers (Solid mechanics), Antoine Renaud (Fluid mechanics).

Experimental rooms of MMSMAT and EM2C laboratories.
Numerical tools COMSOL Multiphysics (Solid mechanics), Matlab et Ansys Fluent (Fluid mechanics).

Learning outcomes covered on the course
Being able to use numerical tool or experimental diagnostic to validate or build a model.