CES7AA - CES9AA MATERIAL FORMING

CES7AA - CES9AA Material forming	ECTS Credits : 4 Duration : 36 hours	Semester : S7 or S9

Person(s) in charge :

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Keywords :

Mechanics - Process - Elasticity - Plasticity - flow rule - calculation methods

Prerequisites : Mathematics and Physics (bachelor)

Objective : Present, analyse and optimize the main forming processes

Program and content :

To shape something, the most common processes consist of plastically deforming the material under high pressure. It is necessary to choose the right process and optimize the parameters to make sure that a minimum amount of energy is used.
The goal of this course is to give future engineers the basic principles for analyzing the behavior of a solid during forming operations, to define the equations describing its mechanical evolution and to give the means for solving these equations. This involves, in particular, learning to
make the simplifying assumptions required for rapidly estimating first order quantities.

- **Stress and strain:** physical origin and formalism - Mohr diagram - boundary conditions.
  Applications: stability of a gravity dam - breaking of a shaft in torsion - deformation gauges.
- **Elasticity:** Hooke's law - study of simple cases (plane or symmetrical problems) - introduction to Finite Elements simulations
  Applications: shrink fitting a ring on a shaft - design of precision parts for satellites - steam generators for nuclear plants (finite element simulations).
- **Plasticity:** elastic limit - plasticity criteria - flow rule - friction models - slices method - upper bound method - introduction to Finite Elements simulations
  Applications: forging scrap metal - bending a bar - rolling flat products - spinning long products - drawing wires - enlarging a pipe - stamping metal sheets - ironing drink cans

Abilities:

Levels	Description and operational vocabulary
Know	How to shape and dimension an object considering aesthetic criteria but above all the possible plastic deformations in order to design and optimize an industrial process.
Understand	
Apply	Notion of stress, small deformations, formalism Shaping processes
Analyse	Calculation methods and simplifying assumptions Analyse the results so as to optimise the process
Summarise	Be able to write down a technical report on a case study
Assess	

Évaluations :

☑ Written test	☑ Continuous Control	☐ Oral report	☐ Project	☑ Written report