LMECA2131

2014-2015

Introduction to nonlinear solid mechanics.

5.0 credits	30.0 h + 30.0 h	2q

Teacher(s) :	Doghri Issam ;
Language :	Français
Place of the course	Louvain-la-Neuve
Inline resources:	> http://icampus.uclouvain.be/claroline/course/index.php?cid=LMECA2131
Main themes :	Most of the nonlinear phenomena studied in this course are briefly described hereafter. Numerous materials, when sollicited beyond a certain limit, witness irreversible deformations which are either sensitive to the loading rate (viscoplasticity) or insensitive (plasticity). However, rubber-like materials can sustain large deformations while remaining elastic (but nonlinear). Large deformations are encountered in metal forming applications. Large displacements and rotations are often observed for thin structures or elongated beams. Damage and fracture phenomena, under ductile (important plasticity), brittle (little or no plasticity) or fatigue (cyclic loadings) conditions are important in practice because they are potentially dangerous. One needs either to avoid them or take them into account in order to evaluate the residual life of a structure or a mechanical component.
Aims :	In consideration of the reference table AA of the program " Master's degree civil engineer mechanics ", this course contributes to the development, to the acquisition and to the evaluation of the following experiences of learning: -- AA1.1, AA1.2, AA1.3 -- AA2.1, AA2.4, AA2.5 -- AA3.1, AA3.2, -- AA4.1, AA4.2, AA4.3, AA4.4 -- AA5.2, AA5.4, -- AA5.6 -- AA6.2, AA6.3 Mathematical modeling and numerical simulation of nonlinear phenomena in solid mechanics (examples: plasticity, viscoplasticity, nonlinear elasticity, large deformations, displacements and rotations, damage, fracture, etc.) *The contribution of this Teaching Unit to the development and command of the skills and learning outcomes of the programme(s) can be accessed at the end of this sheet, in the section entitled "Programmes/courses offering this Teaching Unit".*
Evaluation methods :	Final grade: 50% written examination and 50% project.
Teaching methods :	Project: use a commercial finite element software to solve a given problem, or develop a small standalone computer code to implement a given algorithm.
Content :	Chap. 1 Small deformation elasto-plasticity and elasto-viscoplasticity. Chap. 2 Large displacements, deformations and rotations. Chap. 3 Finite strain nonlinear elasticity. Chap. 4 Finite strain elasto-plasticity and elasto-viscoplasticity. Chap. 5 Finite element-based numerical algorithms in small deformations. Chap. 6 Finite element-based numerical algorithms in finite strains. Chap. 7 Damage mechanics and fracture.
Bibliography :	Book (suggested, not compulsory) : I. Doghri, "Mechanics of Deformable Solids- Linear, nonlinear, analytical and computational aspects", Springer, Berlin, 2000.
Cycle and year of study :	> Master [120] in Mathematical Engineering > Master [120] in Civil Engineering > Master [120] in Mechanical Engineering > Master [120] in Electro-mechanical Engineering > Master [120] in Chemical and Materials Engineering

Faculty or entity in charge:	MECA