

|             |                 |    |
|-------------|-----------------|----|
| 5.0 credits | 30.0 h + 30.0 h | 2q |
|-------------|-----------------|----|

|                              |   |
|------------------------------|---|
| Teacher(s) :                 | Doghri Issam ;  |
| Language :                   | Français  |
| Place of the course          | Louvain-la-Neuve  |
| Main themes :                | Most of the nonlinear phenomena studied in this course are briefly described hereafter. Numerous materials, when solicited 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 :                       | Mathematical modeling and numerical simulation of nonlinear phenomena in solid mechanics (examples: plasticity, viscoplasticity, nonlinear elasticity, large deformations, displacements and rotations, damage, fracture, etc.)<br><br><i>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".</i>   |
| Content :                    | Chap. 1 Small deformation elasto-plasticity and elasto-viscoplasticity.<br>Chap. 2 Large displacements, deformations and rotations.<br>Chap. 3 Finite strain nonlinear elasticity.<br>Chap. 4 Finite strain elasto-plasticity and elasto-viscoplasticity.<br>Chap. 5 Finite element-based numerical algorithms in small deformations.<br>Chap. 6 Finite element-based numerical algorithms in finite strains.<br>Chap. 7 Damage mechanics and fracture.   |
| Other infos :                | - Pre-requisites :<br>one course among: Continuum Mechanics, Theory of Elasticity, Strength of Materials;<br>and one course among: Finite Element Method, Numerical Analysis, Programming.<br><br>- Other information :<br>Project: use a commercial finite element software to solve a given problem, or develop a small standalone computer code to implement a given algorithm.<br>Final grade: 50% written examination and 50% project.<br><br>- Book (suggested, not compulsory) : I. Doghri, "Mechanics of Deformable Solids- Linear, nonlinear, analytical and computational aspects", Springer, Berlin, 2000.   |
| Cycle and year of study :    | <a href="#">&gt; Master [120] in Chemical and Materials Engineering</a><br><a href="#">&gt; Master [120] in Mathematical Engineering</a><br><a href="#">&gt; Master [120] in Mechanical Engineering</a><br><a href="#">&gt; Master [120] in Electro-mechanical Engineering</a><br><a href="#">&gt; Master [120] in Civil Engineering</a>  |
| Faculty or entity in charge: | MECA  |