

# Advanced non linear and computational structural and solid mechanics



ECTS  
6 credits



Component  
INSTITUT  
NATIONAL  
DES SCIENCES  
APPLIQUEES  
TOULOUSE



Number of  
hours  
51h

## Presentation

### Description

Programme (detailed contents):

Use limitations of first order analysis (linear analysis)

Non linear geometry

Local buckling: buckling, Lateral buckling, Lateral torsional buckling

Global buckling : Rayleigh-Timoshenko method

Non linear behaviour of materials

Yielding : constitutive laws and criteria, cross-section yielding, limit analysis of structures

Viscoelasticity: constitutive laws, stress relaxation and creep. Long term strain calculation using Laplace transform

Finite Element Method

Variational formulation, Principe of virtual power

Discretization

Assembly of system matrices and computation

Element properties

BEAM

PLATE-SHELL

SOLID

Stationary analysis, dynamic analysis (eigenvalue calculation), buckling

### Objectives

At the end of this module, the student will have understood and be able to explain (main concepts):

The use limitations of the linear mechanic

The different phenomena of buckling corresponding to different scales : cross-section, members, global structure

Analysis of structures with plastic hinges

Viscoelastic analysis, constitutive model of viscoelasticity, application to creep, stress relaxation and calculation of long-term strain

The structure modelling using Finite Element Method

Elements properties : BEAM, PLATE and SHELL, SOLID

The student will be able to:

Calculate the global buckling of structure

Calculate the local buckling of structural members

Calculate the ultimate load bearing capacity using plastic hinge method

Calculate a structure using Finite Element Software

---

## Pre-requisites

Structural analysis and engineering

## Useful info

---

### Place

➤ Toulouse