INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

**DPT GENIE MECANIQUE**
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# Numerical analysis

## Numerical Methods for Modeling in Mechanics

### IDENTIFICATION

CODE : GM-5-S2-EC-MEMN2
ECTS : 3.0

### HOURS

| | |
|---|---|
| Lectures : | 0.0 h |
| Seminars : | 30.0 h |
| Laboratory : | 0.0 h |
| Project : | 0.0 h |
| Teacher-student contact : | 30.0 h |
| Personal work : | 10.0 h |
| Total : | 40.0 h |

### ASSESSMENT METHOD

2 written tests and Report

### TEACHING AIDS

### TEACHING LANGUAGE

English

### CONTACT

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### AIMS

The aim of this class is to give future engineers some detailed insight in the numerical methods applied for mechanical problems.

### CONTENT

1. MultiGrid Methods: system of equations obtained from discretising a differential equation on a (regular) grid. Fast solution using MG, implementation.
2. Molecular Dynamics: approximation order in time , choice of interaction laws, conservation of discrete quantities, boundary conditions.
3. Approximation of the contact prolem under small and large strains using finite element methods: lagrangian and augmented lagrangiian, numerical approximation. Application through the COMSOL software.
4. Coupled models: principal difficulties, applied to fluid-structure interaction, ALE method. Application through the COMSOL software.

### BIBLIOGRAPHY

- Numerical Recipes in C: Press, Teukolsky, Vetterling, Flannery
- The Art of Computer Programming: Knuth
- Multilevel Methods in Lubrication: Venner, Lubrecht
- The finite element method for solid an structural mechanics, Zienkiewicz, Taylor
- Nonlinear finite elements for continua and structures, Belytschko, Liu, Moran
- Contact problems in elasticity: a study of variational inequalities and finite element methods. Kikuchi, Oden
- Computational contact and impact mechanics. Laursen