

# MNA

## Méthodes Numériques Avancées

### Advanced Numerical Methods

14, 16, 21, 23, 28, 30 January & 4, 6 February

### Objectives

The course covers several numerical methods to solve time-dependent partial differential equations using finite elements and stabilisation.

Advanced methods for turbulence modeling, multiphase flows, complex fluid flows and aerothermal modelling of complex systems will be given.

Finally, the course will be completed by error estimator needed for anisotropic parallel mesh adaptation.

### Program

#### I. Numerical methods

- ▶ Mesh adaptation
- ▶ Parallel computing and HPC
- ▶ Convection Diffusion Reaction: stabilized finite element method
- ▶ Navier-Stokes: stabilized finite element method
- ▶ Error estimators and meshing

#### II. Numerical modeling

- ▶ Deep Reinforced Learning for Fluid Mechanics
- ▶ Flow control and optimization
- ▶ Newtonian and Non-Newtonian Fluids
- ▶ Turbulence modeling
- ▶ Two fluid flows

### Team

- Elie Hachem
- Aurélien Larcher
- Youssef Mesri
- Thierry Coupez
- Jeremie Bec
- Rudy Valette
- Philippe Meliga
- Franck Pignoneau
- Jonathan Viquerat
- Patrice Laure

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30 h

Courses & Exercises

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### Evaluation

Final exam & Participation in classes