ANMS 2023 Spring

Méthodes Numériques Avancées et Simulation
Advanced Numerical Methods and Simulation

Lecturers

Elie Hachem
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Rudy Valette
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Franck Pigeonneau
Jonathan Viquerat

Schedule

42h Courses + Labs

Week 02

10. January	I/E201b
12. January	I/E102

Week 03

17. January	I/E201b
19. January	I/E102

Week 04

24. January	I/E201b
26. January	I/E201b

Week 05

31. January	I/E102
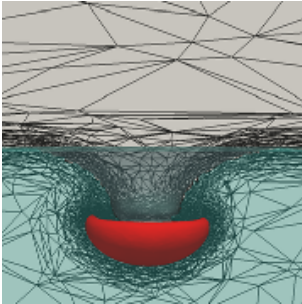
Objectives

The course covers several numerical methods to solve time-dependent Partial Differential Equations using adaptive stabilized finite elements.
Advanced methods for turbulence modelling, multiphase flows, complex fluid flows, and aerothermal modelling of complex systems will be introduced.
Finally, the course will be completed by *a posteriori* error estimation techniques needed for anisotropic parallel mesh adaptation.

Course content

1. Numerical methods
   — Parallel computing and HPC
   — Convection Diffusion Reaction : stabilized finite elements
   — Navier-Stokes : variational multiscale approaches
   — Mesh adaptation
   — Error estimators and anisotropic remeshing
2. Modelling and simulation
   — Turbulence modelling
   — Two-fluid flows
   — Newtonian and Non-Newtonian Fluids
   — Flow control and optimization
   — Deep Reinforced Learning for Fluid Mechanics

Evaluation

The course is evaluated based on the results obtained during numerical simulation labs and a final written examination covering the theoretical arguments developed during the lectures :

Lab exercises	25%
Examination	75%