

<b>Intitulé de l'Unité d'Enseignement</b>	<b>Numerical methods for fluid mechanics</b>		<b>Code de l'UE</b>	NSF03
<b>Rédacteurs (principaux, 3 maxi) de l'UE</b>				
Nom, Prénom, qualité	Frederick HECHT			
Laboratoire ou équipe de recherche	UPMC			
Adresse				
Téléphone :				
e-mail:				
<b>Descriptif de l'UE</b>				
Volumes horaires globaux (CM + TD + TP+ autre...)	30H			
Nombre de crédits de l'UE	3 ECTS			
Spécialité où l'UE est proposée	Fluid mechanics			
Semestre où l'enseignement est proposé	S3			
Effectifs prévus (rentrée 2009)				

### Objective

The objective of the course is to bring the audience to a high level of understanding in numerical fluid dynamics with unstructured body fitted meshes. The course will focus mostly on finite volume and finite element methods for the Navier-Stokes equations, incompressible and compressible with or without turbulence models. Mesh generation will be covered as well. The content of well known softwares like Fluent will also be analyzed. Numerical illustrations and exercises will be conducted with our in house opensource software freefem++.

### Lecturers

Olivier Pironneau, Laboratoire Jacques-Louis Lyons, Université Pierre et Marie Curie and Institut Universitaire de France  
[olivier.pironneau@upmc.fr](mailto:olivier.pironneau@upmc.fr)  
Frédéric Hecht, Laboratoire Jacques-Louis Lyons, Université Pierre et Marie Curie  
[hecht@ann.jussieu.fr](mailto:hecht@ann.jussieu.fr)

### Content

Stokes' equations and the difficulties explained on a uniform finite difference grid. Variational formulations for the incompressible Navier-Stokes equations. Mesh generation and adaptation. A convection-diffusion finite element approximation and pressure projection solver. A Finite Volume Method for the Compressible Navier-Stokes equations. Difficulties and solutions for the k-epsilon turbulence model; wall laws and weak form of the boundary conditions.

**Requirements :** Fundamental notions for partial differential equations and for numerical analysis. Knowledge of a computer programming language will help.