

MASTER - Physique appliquée et ingénierie physique

Mécanique numérique en ingénierie (MNI) - Computational engineering

Pré-requis recommandés

- **Mention(s) de licence(s) conseillée(s) pour accéder au M1 :**
 - [Sciences pour l'ingénieur](#) ;
 - Génie mécanique ;
 - [Physique](#).
- **Autres pré-requis (disciplines, matières, enseignements, recommandés) :**
 - Mécanique des fluides ;
 - Mécanique des structures ;
 - Langage de programmation ;
 - Anglais.

Langue du parcours		Anglais	
ECTS		120 ECTS	
Volume horaire			
TP : 0h	TD : 0h	CI : 0h	CM : 0h
Formation initiale			Oui
Formation continue			Non
Apprentissage			Non
Contrat de professionnalisation			Non
Stage : (durée en semaines)			20

Objectifs du parcours

Numerical modelling for industrial applications is a rapidly growing discipline, which brings together the power of computers and the biological, chemical and physical sciences. Computer based simulations and their related visualisations play a key role in industrial applications, environmental or biomechanical investigations.

This training aims to train graduates in engineering and science able to master the scientific approaches for numerical computations in industrial engineering, environmental tales and biomechanics. This program also wants to demonstrate how computational engineering is used effectively in solving real-world problems.

Compétences à acquérir

In this program the student will learn:

- the knowledge of the basics of fluids mechanics and solid mechanical laws, mathematics and numerical modelling;
- to use discretisation methods for the equations governing physical processes (programming language and numerical techniques);
- to use simulation tools (commercial solvers, research codes or free software) in industry (Computational fluid dynamics, computational solid mechanics, computational biomechanics, computational chemical engineering, civil engineering);
- to visualise data and generate meshes around complex geometries;
- to develop numerical tools to understand physical phenomena and propose optimised solutions;
- to solve numerically any problems in the fields of fluids mechanics, solid mechanics, heat and mass transfer, biomechanics or civil engineering.

Poursuite d'études

- PhD student.

Stage et projet tutoré

- 20 semaines (minimum) - 26 semaines (= 6 mois) maximum.

Contact

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Master 1 - Mécanique numérique en ingénierie (MNI) - Computational engineering

Semestre 1 - MNI

	ECTS	CM	CI	TD	TP	TE	Stage
UE 1 - Semestre 1 - Project management and communication (Gestion de projet et communication)	3 ECTS	10 h		16 h			
Project management and communication (Gestion de projet et communication)		10 h		16 h			
UE 2 - Semestre 1 - Numerical resolution techniques for engineering (Techniques de résolution numérique pour l'Ingénierie)	6 ECTS	26 h		18 h	16 h		
Numerical resolution techniques (Techniques de résolution numérique)		18 h		18 h			
Practical work on numerical resolution techniques (TP de techniques de résolution numérique)		8 h			16 h		
UE 3 - Semestre 1 - Languages (Langues)	3 ECTS			16 h		60 h	
Anglais - S1 Master				16 h		60 h	
UE 4 - Semestre 1 - Mathematical methods for physics	3 ECTS	14 h		10 h			
Mathematical methods for physics		14 h		10 h			
UE 5 - Semestre 1 - Computational fluid dynamics, incompressible flows	3 ECTS	14 h		10 h			
Computational fluid dynamics, incompressible flows		14 h		10 h			
UE 6 - Semestre 1 - Material modelling and simulations I: elasticity, visco-elasticity and creep	3 ECTS	14 h		10 h			
Material modelling and simulations I: elasticity, visco-elasticity and creep		14 h		10 h			
UE 7 - Semestre 1 - Modelling of mechanical systems	3 ECTS	14 h		10 h	8 h		
Modelling of mechanical systems		14 h		10 h	8 h		
UE 8 - Semestre 1 - Constitutive laws for rheological fluids	3 ECTS	8 h		16 h			
Constitutive laws for rheological fluids		8 h		16 h			
UE 9 - Semestre 1 - Material modelling and simulations II: plasticity, visco-plasticity and damage	3 ECTS	14 h		10 h			
Material modelling and simulations II: plasticity, visco-plasticity and damage		14 h		10 h			

Semestre 2 - MNI

	ECTS	CM	CI	TD	TP	TE	Stage
UE 1 - Semestre 2 - Introduction of simulation of Multiphysics (Introduction à la simulation multiphysique)	3 ECTS	10 h			20 h		
Simulation of Multiphysics (simulation multiphysique)		10 h					
Practical work of simulation of Multiphysics (TP de simulation multiphysique)					20 h		
UE 2 - Semestre 2 - Study and research work (Travail d'étude et de recherche)	6 ECTS				80 h		
Study and research work (Travail d'étude et de recherche)					80 h		
UE 3 - Semestre 2 - Finite elements for mechanical and thermal systems	3 ECTS	16 h			16 h		
Finite elements							
Thermal systems							
UE 4 - Semestre 2 - Computational fluid dynamics, compressible flows	3 ECTS	14 h		10 h			
Computational fluid dynamics, compressible flows		14 h		10 h			
UE 5 - Semestre 2 - Turbulence modelling	3 ECTS	14 h		10 h			
Turbulence modelling		14 h		10 h			
UE 6 - Semestre 2 - Parallelisation, big data, data processing	3 ECTS	14 h		10 h			
Parallelisation, big data, data processing		14 h		10 h			
UE 7 - Semestre 2 - Composite materials and homogenization techniques	3 ECTS	14 h		10 h			
Composite materials and homogenization techniques		14 h		10 h			
UE 8 - Semestre 2 - Measurement and identification	3 ECTS	8 h			16 h		
Measurement and identification		8 h			16 h		
UE 9 - Semestre 2 - Computational methods for structural dynamics, shock and vibration	3 ECTS	14 h		10 h			
Computational methods for structural dynamics, shock and vibration		14 h		10 h			

Master 2 - Mécanique numérique en ingénierie (MNI) - Computational engineering

Semestre 3 - MNI

	ECTS	CM	CI	TD	TP	TE	Stage
UE 1 - Semestre 3 - Quality assurance (Assurance qualité)	3 ECTS	14 h		10 h			
Quality assurance (Assurance qualité)		14 h		10 h			
UE 2 - Semestre 3 - Language (Langues)	3 ECTS			16 h		60 h	
Anglais - S3 Master				16 h		60 h	
UE 3 - Semestre 3 - Applied computational engineering for heat and mass transfer	3 ECTS		24 h				
Applied computational engineering for heat and mass transfer			24 h				
UE 4 - Semestre 3 - Development and use of simulation tools for chemical engineering	3 ECTS		24 h				
Development and use of simulation tools for chemical engineering			24 h				
UE 5 - Semestre 3 - Advanced use of computational solid mechanics codes, CSM project	3 ECTS		16 h		36 h		
Advanced use of computational solid mechanics codes, CSM project			16 h		36 h		
UE 6 - Semestre 3 - Visualization and grid generation	3 ECTS		24 h				
Visualization and grid generation			24 h				
UE 7 - Semestre 3 - Advanced use of computational fluid mechanics codes, CFD project	3 ECTS		16 h		48 h		
Advanced use of computational fluid mechanics codes, CFD project			16 h		48 h		
UE 8 - Semestre 3 - Advanced computation in bio-mechanics	3 ECTS		24 h				
Advanced computation in bio-mechanics			24 h				
UE 9 - Semestre 3 - Free software in CFD	3 ECTS		24 h				
Free software in CFD			24 h				
UE 10 - Semestre 3 - Applied computational engineering for bio-mechanics	3 ECTS		24 h				
Applied computational engineering for bio-mechanics			24 h				

Semestre 4 - MNI

	ECTS	CM	CI	TD	TP	TE	Stage
UE 1 - Semestre 4 - Internship search and preparation (Recherche et préparation de stage)	3 ECTS				24 h		
Internship search and preparation (Recherche et préparation de stage)					24 h		
UE 2 - Semestre 4 - Internship (Stage)	24 ECTS						20 sem
Internship (Stage)							20 sem
UE 3 - Semestre 4 - Internship valorisation (Valorisation de stage)	3 ECTS				24 h		
Internship valorisation (Valorisation de stage)					24 h		