



# European Master of Science in **Advanced Solid Mechanics**

The University of Lille and Polytech'Lille (France)



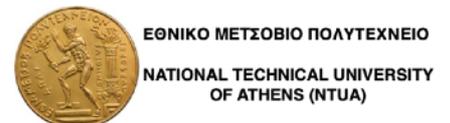
Centrale Lille (France)



Catholic University of Louvain (UCLouvain, Belgium)



National Technical University of Athens (NTUA, Greece)



Wrocław University of Science and Technology (WUST, Poland)



The University of Calabria (Cosenza, Italy)

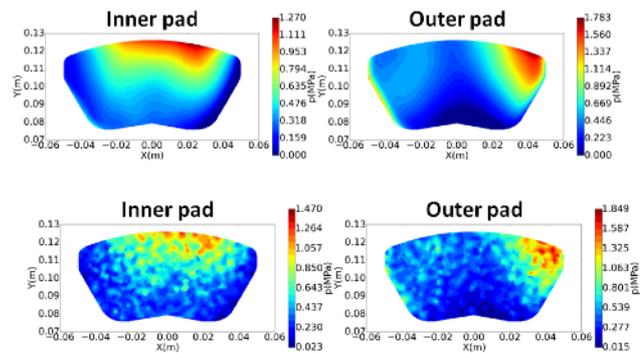
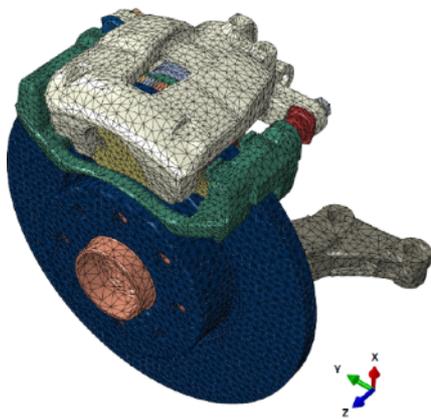


## A joint initiative

The Erasmus Mundus Joint Master Degree STRAINS is a **2-year master programme of excellence in English** for students wishing to develop their knowledge and skills in the field of **solid mechanics for the modeling of materials and structures**.

It was built by a consortium of six acknowledged European Universities and associated partners. The disciplinary opening is given by the student mobility. The programme leads to the award of a recognized joint diploma.

The master is aimed to give thorough **theoretical, experimental and numerical tools** for solving advanced engineering problems, especially emphasizing the dialogue between these three aspects.



Modelling of an automotive brake system

## Objectives

Solid mechanics studies the behavior of solid materials, and in particular, their motion and deformation under the action of forces, temperature changes, phase changes, and other external or internal agents.

Solids manifest themselves through a wide range of applications, like **Manufacturing** (material innovation, additive manufacturing), **Civil engineering structures**, **Transport** (air, land, space), **Health** (biomechanics, pharmaceuticals), **Environment** (contamination, sustainable development), **Energy** (mainly renewable energies), **Food industry** (processing methods). Thus, solid mechanics is fundamental for mechanical, civil, aerospace, nuclear, and biomedical engineering, for geology, and for many branches of physics, such as materials science. Given the significant increase in knowledge in all these fields today, there is a need for highly qualified managers and engineers with advanced skills in solid mechanics.

## A programme of excellence

The European Master of Science in Advanced Solid Mechanics (STRAINS) focuses on modelling (theoretical, numerical or experimental), [from conceptualization to realization](#), based on high-level scientific theories, of [cutting-edge experimentation](#), increasingly resting on imaging and intensive use of [high-performance computing](#).

It paves the way to access both the job market, through early and frequent exposure to the world of industry thanks to the [network of industrial partners](#), and doctoral studies, through a total immersion in the codes, atmosphere and methods of [international research](#).

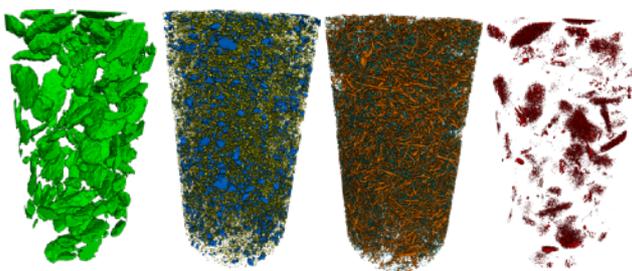
## A very flexible mobility scheme

Openness in disciplines is ensured by thematic complementarity and a strong mobility of students with [four main specializations](#):

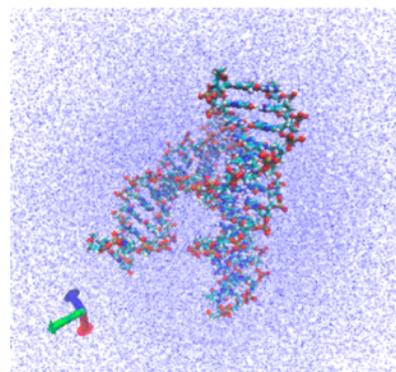
- ***Computational Mechanics***
- ***Mechanics of Materials***
- ***Mechanics of Structures***
- ***Material Design***

It differs from the classic tree structure of many international training courses. The Master's degree aims at motivated students who have a scientific maturity and a clear vision of their professional career. They are thus encouraged to increase their autonomy and to play an active role in forming the learning process.

The award of a [joint diploma](#), rather than national diplomas, demonstrates the homogeneity of the international curriculum.



3D view of Internal structure of materials  
by the X-ray micromograph



DNA junction model

# Associated partners

The STRAINS Master programme has developed an active cooperation with a range of partners from outside academia: a variety of industries, laboratories, research centres and technological networks. Associated partners contribute to the curriculum of the Master programme and participate in the governance of the project (academic board, advisory board). This network will offer students the opportunity [to get in touch with the professional world](#) with concrete study cases and work approaches; and will open opportunities.

<p>Aristotle University of Thessaloniki</p> 	<p>BIC</p> 	<p>Fincantieri SI S.P.A</p> 
<p>Keller Polska SP. ZO.O</p> 	<p>Hohai University</p> 	<p>Korea University</p> 
<p>MSC Software Belgium (e-Xstream engineering)</p> 	<p>Newsoft SAS</p> 	<p>Niki Mepe Computer Technologie</p> 
<p>Railenium</p> 	<p>Safran Aircraft Airlines</p> 	<p>Sisem S.R.L.</p> 
<p>University degli studi di Pavia</p> 	<p>University of Leeds</p> 	

# Master mobility



The "STRAINS" master's program offers mobility across 5 European sites: Athens (Greece), Cosenza (Italy), Lille (France), Louvain-la-Neuve (Belgium) and Wrocław (Poland). The general principle of mobility is summarized in the figure.

In short, semester 1 dedicated to basic knowledge is carried out exclusively at the Lille campus. Thereafter, a pre-orientation semester (semester 2) is established at the Louvain-la-Neuve, Wrocław and Cosenza campuses at the student's free choice. Semester 3 is dedicated to the specialization where students can go to any of the 5 sites. Finally, the master thesis can be carried out anywhere. The objective is for the students to do at least 2 mobilities within their course.

## List of courses

### Semester 1 (common basis)

University of Lille/Centrale Lille	
Mathematical Tools for Engineering	5 ECTS
Numerical Methods in Engineering	5 ECTS
Continuum Mechanics	5 ECTS
Constitutive Laws	5 ECTS
Dynamics and Vibrations	5 ECTS
Experimental Mechanics	5 ECTS

## Semester 2 (pre-orientation)

Computational Mechanics (The University of Calabria at Cosenza)		Mechanics of Materials and Structures (Wroclaw University of Science and Technology)		Manufacturing and Mechanics of Materials (Catholic University of Louvain)	
Earthquake Engineering	6 ECTS	Functional analysis - application to boundary value problems	5 ECTS	Material selection	5 ECTS
Computational Mechanics	6 ECTS	Analytical Mechanics	5 ECTS	Mechanics of Materials	5 ECTS
Structural Dynamics	6 ECTS	Modeling of multibody systems	5 ECTS	Mechanics of composite Materials	5 ECTS
Nonlinear Structural Analysis	6 ECTS	Design of Engineering materials	5 ECTS	Plasticity and metal forming	5 ECTS
Structural Analysis and Design	6 ECTS	Probabilistic methods in engineering	5 ECTS	Calculation of planar structures	5 ECTS
		Artificial intelligence in engineering	5 ECTS	Project in Mechanical design II	5 ECTS

## Semester 3 (specialization)

The University of Calabria		National Technical University of Athens		Wroclaw University of Science and Technology		University of Lille/Centrale Lille		Catholic University of Louvain	
		<i>Elective modules (6 among 9)</i>		<i>Elective modules (6 among 10)</i>		<i>Elective modules (6 among 9)</i>			
Advanced Structural Design	6 ECTS	Advanced Plastic Analysis of frames	5 ECTS	Risk Assessment in Geotechnics — Implementation of Random Field Theory	5 ECTS	Extended methods for Finite Element modeling	5 ECTS	Advanced Manufacturing Technologies	5 ECTS
Foundations Engineering	9 ECTS	Advanced Structural Dynamics	5 ECTS	Mathematical Homogenization and Micromechanics	5 ECTS	Geomaterials and porous media	5 ECTS	Deformation and fracture of materials	5 ECTS
Theory of Structures	9 ECTS	Boundary Elements	5 ECTS	Advanced Geoengineering	5 ECTS	Rubbing contact: coupling and multi scale effects	5 ECTS	Rheology	5 ECTS
Steel Structures	6 ECTS	Load Carrying Behavior of Structural Systems	5 ECTS	Advanced steel-concrete composite construction	5 ECTS	Advanced experimental and numerical dialogue	5 ECTS	Welding	5 ECTS
		Applied Structural Analysis of Framed and Shell Structures	5 ECTS	Advanced Soil Mechanics and Soil-Structure Interaction	5 ECTS	Advanced Composite materials	5 ECTS	Mechanical design in biomedical engineering	5 ECTS
		Non-linear Finite Element Analysis of Structures	5 ECTS	Fracture Mechanics	5 ECTS	Fatigue of materials and structures	5 ECTS	Vehicle system dynamics	5 ECTS
		Stochastic Finite Elements	5 ECTS	Laboratory identification of composite microstructure	6 ECTS	Limit analysis and shakedown	5 ECTS		
		Theory of Shells	5 ECTS	Advanced nano materials	7 ECTS	Damage Mechanics	5 ECTS		
		Structural optimization	5 ECTS	Reliability and Maintenance Theory and Engineering	6 ECTS	Biomechanics	5 ECTS		
				Inventive Engineering	6 ECTS				

# How to apply

Applicants must hold a [Bachelor of Science or Engineering degree in Mechanics, Mechanical Engineering, Civil Engineering](#), or equivalent with a strong background in Mechanics, Physics and Mathematics.

The application must contain: a complete curriculum vitae, a motivation letter, 2 original letters of recommendation, certified copies of the diploma and full academic transcripts including certified translations into English and an official document proving the class rank.

All students must provide evidence of their proficiency in English through one of the following documents: a recent TOEFL Certificate: minimum score: 570 points (paper) or 87 points (internet), a recent IELTS Certificate: minimum score: 6.5, a recent Certificate of a University Language Centre testifying that the student masters the necessary knowledge of English to function academically (specify CEF-level / minimum CEF-level B2) and a recent Cambridge English certificate: Cambridge English First (FCE) - Grade A or B.

The application must be submitted in English on <http://master-strains.eu/>.

If you are preselected, you will be invited to pass an interview in English by video conference or phone, with two members of the selection committee, in order to assess your motivations, the fit between your project and the STRAINS objectives, and to test your knowledge of English.

Candidates selected for admission to the STRAINS Master send all requested supporting documents (certified copies) by post within 2 weeks after notification of the results. Admission is validated after verification of hard copies.

## Calendar ➤



## Selection procedure

The selection is performed in two successive waves:

- In the first session (February-March 2021), the selection committee evaluates the applications containing scholarship requests. The non-selected candidates will be offered to join the STRAINS Master without a scholarship.
- The second session (April-May 2021) is opened for applicants not requesting a scholarship.

### Evaluation criteria

- In addition to the English level, the academic background and ranking are the most important criteria.
- Gender balance will be considered in the enrollment procedure: not more than two candidates may come from the same country, and no less than 40% must be female candidates. To comply with these restrictions some candidates may be removed from the main list and replaced by the next ranked candidates in the reserve list. The Programme Board is committed to the elimination of unlawful discrimination and to the promotion of equal opportunities for all.

## Contacts

**Responsible of the Master:**

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**Master secretariat:**

[master-strains@univ-lille.fr](mailto:master-strains@univ-lille.fr)

**Website:** <http://master-strains.eu/>

