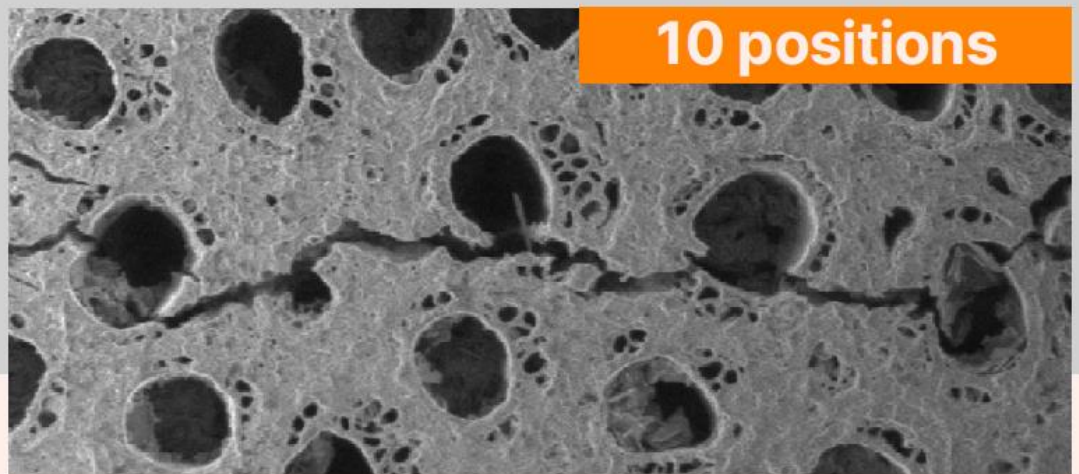


Track in **Computational Mechanics (CM)**

PhD Program in Systems Science



10 positions

DEADLINE APPLICATION

July 27th,
2022
12 p.m.

CM offers an interdisciplinary doctoral training for graduates who wish to specialize in the research of innovative **numerical simulation methods**, developing digital twins to predict the **behavior of materials**, components, or processes throughout their operational life. The study plan integrates **solid and fluid mechanics, applied mathematics, numerical analysis and computer science**. Through a network of international collaborations, CM prepares researchers and professionals capable of analyzing and proposing solutions to frontier research topics of highly industrial, economic and social interest.

ONLINE APPLICATION FORM

The IMT School for Advanced Studies Lucca's **multidisciplinary PhD Programs** aim at providing research skills and tools to address complex issues of the 21st century. The IMT School is looking for bright students to recruit through **competitive and open procedures**. English is the official language of the School, the full time PhD positions consist of a **3-year studentship, free housing** in its accessible **campus** in the historical town of **Lucca**, free access to the **canteen, library** and other facilities on campus, additional funds for research and international mobility. Candidates must get their Master's degree or equivalent by October 31, 2022. Enrollment: early November 2022.

Why a PhD in Systems Science with specialization in Computational Mechanics?

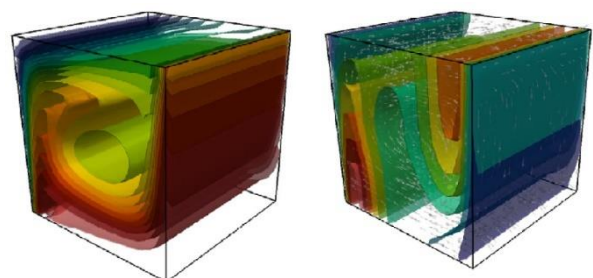
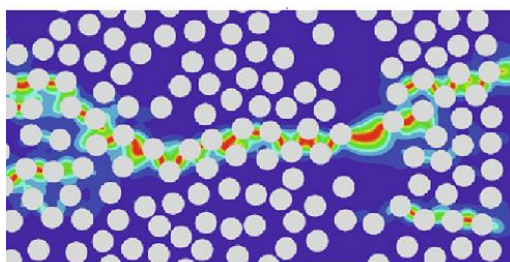
Numerical simulations are playing an increasingly important role in scientific investigations and industrial innovation. The ability to study a full range of physical and temporal scales using virtual models allows today to rapidly explore innovative technological solutions, simulate the behavior of complex biological or artificial systems, devise new production processes, optimize components and discover new materials with innovative properties. This trend towards digitalization is also having an increasingly significant impact on industrial competitiveness, where not only virtual prototyping based on numerical simulations is considered the cornerstone to reduce the time and costs required by experimentation for the development of new reliable and high-quality products, but digital twins are developed to predict the behavior of components or processes throughout their operational life.

The development of numerical simulation tools is an activity that requires skills that come from different fields: mechanics, fundamental to select the most suitable physical models, mathematics, necessary to formalize the models in governing equations and subsequently to identify the most suitable solution algorithms, computer science, which finally allows the implementation of such algorithms in efficient and robust programs. Compared to traditional doctoral programs mainly focused on one of these disciplines, the Track in *Computational Mechanics* (CM) offers a markedly interdisciplinary doctoral training for graduates who wish to specialize in the research and development of innovative numerical simulation methods for the analysis of complex systems of high technological interest or for their application to frontier topics.

The study plan builds on a series of foundational courses to provide a solid background in applied mathematics, numerical analysis, computer science, mechanics, dynamic systems and control, machine learning techniques. These courses are complemented by advanced courses and specialized research seminars to address a wide variety of complex engineering problems concerning:

- Computational solid and fluid mechanics;
- Computational Materials Science;
- Tribology and surface engineering;
- Computational mechanics of fracture and damage;
- Coupled problems (multi-scale and multi-physics);
- Fluid-structure interaction;
- Problems in biomechanics and bioengineering;
- Problems of shape optimization and automatic control for mechanics;
- Data-driven models;
- Machine learning and artificial intelligence algorithms in computational mechanics;
- Numerical efficiency techniques for large-scale problems;
- Reliability and durability of composites and heterogeneous materials;
- Characterization and simulation of metamaterials;
- Integrated technical-economic analysis of the life cycle of materials;
- Recycled materials and hybrid composites;
- Applications to renewable energies (hydrogen, photovoltaics, etc.);
- Quantitative methods for cultural heritage (compatibility of materials for restoration, archaeometry techniques, etc.).

See also <http://musam.imtlucca.it/> for more details on the current research activities.



How is the study program structured?

The CM track, coordinated by Prof. Marco Paggi, <https://www.imtlucca.it/it/marco.paggi>, offers a specialized preparation on computational methods, providing a high level of preparation, which is not normally possible to get during undergraduate studies, that is strongly requested for by both academic and non-academic jobs. At the same time, through the attendance of basic courses, candidates will be exposed to the techniques and methodologies developed in contiguous disciplinary fields, fully realizing a unique interdisciplinary training. Overall, the advanced training offered allows students to broaden their range of skills, considerably improving their ability to tackle frontier research problems within their disciplinary field successfully. The student composes his or her study plan by selecting courses from a basket of basic and advanced courses offered by the School, as well as of courses related to soft skills that are useful for the training of a researcher, see <https://www.imtlucca.it/sites/default/files/2022-23-course-list.pdf>.

Courses are usually attended from November 2022 till July 2023. The PhD candidate will work on his research topic under the supervision of the researchers of the research unit MUSAM <http://musam.imtlucca.it>. Co-supervision by external professors is also possible. Graduation is possible after 3 years. As an average, PhD students in CM graduate in 3 years and a half.

Why studying in Italy at the IMT School for Advanced Studies Lucca?

The IMT School for Advanced Studies is in Lucca (Italy), a historical city in the Tuscany Region, well-connected by the airports in Pisa and Florence. IMT stands for *Institutions, Markets, Technologies*, and it is one of the 6 public schools for advanced studies in Italy, focusing on post-graduate studies.

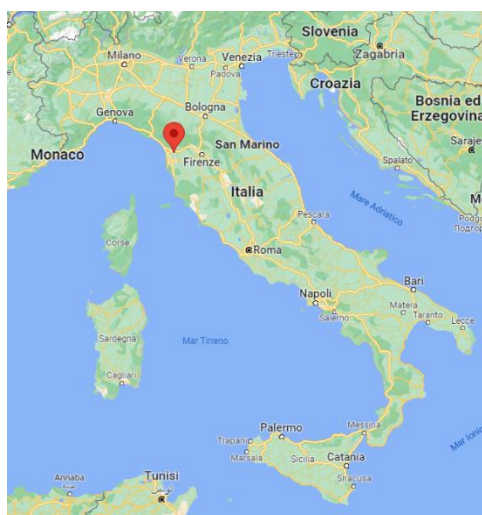
All the courses and research activities are held in English. We had PhD students from Spain, China, India, Brasil, Nigeria, and Italy (Palermo, Lecce, Firenze, Pisa, Viareggio, Siena, Grosseto).

Your research will benefit from the interdisciplinary project "Scientific computing for natural and social sciences and applications: methodological and technological development" coordinated by the IMT School for Advanced Studies Lucca and in cooperation with the other schools for advanced studies in Italy, and also from other regional, national and international projects.

Moreover, the doctoral program includes a research period abroad generally lasting no less than 6 months. To this aim, a wide network of prestigious scientific collaborations can be exploited, see a list here: <http://musam.imtlucca.it/#Collaborations>

With some universities, double degree agreements are already in place, to earn a PhD in Italy and also in the other country. Additional agreements can be put in place based on co-supervisions and scientific needs.

Key figures: 160 ISI publications (2014-2022) in top journals (CMAME, IJSS, JMPS, Comp. Mech., Scientific Reports, etc.), 33% co-authored by PhD students and 75% stemming from international cooperations, see <http://musam.imtlucca.it/#Achievements>



Lucca



The mid-1500s city walls of Lucca (4.2 km long)



A view of the campus inside the city walls

Scholarship

The scholarship amount is 16,243.00 Euros/year and shall be disbursed in monthly installments. For any research or training activities at universities or research centers abroad, the scholarship amount is increased by 50% for the first 9 months. Scholarships are subject to the payment of social security contributions (INPS) managed separately, with two-thirds paid by the Administration and one third by the scholarship recipient. Admitted candidates who have already benefited from a PhD scholarship in Italy cannot be assigned another one. The scholarship has a duration of 3 years. Possible additional support to cover the time requested to finalize your thesis could be provided.

Research money of 4,500 Euro is available for the participation to conferences, seasonal schools, and other research activities. Additional research funds can be provided based on the active research projects.

Facilities and benefits

All PhD students who are granted a scholarship have free accommodation in the residential facilities of the School for the entire official duration of the program (3 years), except for periods spent off campus for study and/or research. All PhD students are offered free meals (lunch and dinner) at the School canteen located on campus for the entire official duration of the Program (3 years).

Experimental facilities in the MUSAM-Lab (<https://www.imtlucca.it/en/ricerca/laboratori/musam-lab>), founded in 2013 with the support of two grants from the European Research Council, are available. Collaborations with laboratories in other universities and research centers are also possible.



View of the MUSAM-Lab



Are there any teaching duties?

No, your focus will be your own research. Of course, it is possible to deliver seminars for the school, open also online to researchers from other universities, and you can voluntarily cooperate as a teaching assistant in some courses, if you would like to have some teaching experience in your CV.

Which profiles are we looking for?

Prospective students should preferably have a background in engineering, mathematics, computer science, physics, statistics or a related field. Potential students are encouraged to propose their own research topics. We are looking for highly motivated people.

Career opportunities

The CM track prepares researchers and professionals capable of analyzing and proposing solutions to various real problems of industrial, economic and social interest, making them qualified to work in high-profile professional roles within universities and research centers. Virtual testing and digital twins are some key enabling technologies for the digital transformation of industry, and are therefore of high value for the job market (industry, services, public and private research laboratories, study centers, regulatory centers, consulting firms, and the public sector).

So far, alumni and former collaborators had an excellent placement in universities and in R&D departments of companies, see http://musam.imtlucca.it/former_people.html

How to apply

Applications for the PhD Program can only be submitted electronically. Applicants must fill out the online application form (<https://pica.cineca.it/imtlucca/imtlucca-phd-2022/>, selecting “manage your application”), providing personal data and attaching the required documents. Applications cannot be submitted after the deadline of the **27th of July 2022, at 12:00 pm CEST**.

Applicants must select the desired PhD Program/Track for which they wish to apply. The full list of documents to be uploaded is detailed here: <http://www.imtlucca.it/it/file/239293/download?token=BaigSfXc>

Candidates are eligible provided that they obtain their degree by no later than **October 31, 2022**.

The research statement must include a summary of the candidate's academic background, scientific knowledge, research experience, ideas for future research projects, and motivations for pursuing a PhD study at the IMT School.

Candidates admitted to the interview (in person or online, based on your choice) will be notified during the last week of August 2022. **Interviews will take place during the first week of September 2022** (exact date to be confirmed). The starting of the activities will take place on **November 2, 2022**.

For further information, please contact Prof. Marco Paggi, marco.paggi@imtlucca.it