



PhD in INGEGNERIA STRUTTURALE, SISMICA, GEOTECNICA / STRUCTURAL SEISMIC AND GEOTECHNICAL ENGINEERING - 39th cycle

**THEMATIC Research Field: DEVELOPMENT OF HIGH-PERFORMANCE COMPUTING
METHODS FOR THE SIMULATION OF FREE-SURFACE FLUID-STRUCTURE INTERACTION
PROBLEMS**

Monthly net income of PhDscholarship (max 36 months)

€ 1195.5

In case of a change of the welfare rates during the three-year period, the amount could be modified.

Context of the research activity

**Motivation and objectives of the research
in this field**

Borsa parzialmente finanziata da (scholarship partially supported by):

**CN-HPC: CENTRO NAZIONALE PER HPC, BIG DATA
E QUANTUM COMPUTING**

CUP D43C22001240001 - Decreto di concessione D.D.
1031 del 17/06/2022

Bando D. D. 3138 del 12/16/2021 rettificato con D.D.
3175 del 18/12/2021

Avviso pubblico per presentazione Proposte di intervento per il Potenziamento di strutture di ricerca e creazione di "campioni nazionali" di R&S su alcune Key Enabling Technologies da finanziare nell'ambito del Piano Nazionale di Ripresa e Resilienza, Missione 4 Componente 2 Investimento 1.4 "Potenziamento strutture di ricerca e creazione di "campioni nazionali di R&S" su alcune Key Enabling Technologies - finanziato dall'Unione europea - NextGenerationEU".

The objective of this project is to develop highly efficient numerical approaches for solving interaction problems between free-surface non-Newtonian fluids and



	<p>structures. These phenomena are critical in various industrial applications, such as cartoon packaging production and 3D printing, as well as in environmental problems, including e.g. landslide-structure interactions. Exploiting state-of-the-art high-performance computing techniques, an effective numerical simulation tool will be developed, enabling the solution of real-scale engineering problems with a level of detail never experienced before. The project will be developed in the framework of the "Italian Research Center on High-Performance Computing, Big Data and Quantum Computing".</p>
<p>Methods and techniques that will be developed and used to carry out the research</p>	<p>This research primarily focuses on the theoretical development and implementation of innovative numerical simulation approaches, involving advancements in existing computational methodologies, such as the Finite Element Method (FEM), Virtual Element Method (VEM), and Particle Finite Element Method (PFEM). Particular attention will be given to optimizing the efficiency of the numerical tools to facilitate the simulation of very large-scale problems. To this purpose, high-performance computing techniques (e.g., MPI) and accelerating tools (e.g., graphics processing units (GPUs)) will be tested, and the most effective solution will be adopted.</p>
<p>Educational objectives</p>	<p>Since the proposed research project will be developed in the framework of the "Italian Research Center on High-Performance Computing, Big Data and Quantum Computing", the candidate will have the opportunity to collaborate with a large number of laboratories and research groups in Italy. Moreover, industries and in international research centers will be involved in the project. The candidate will acquire specialized knowledge of innovative numerical techniques. He/She is expected to become prepared to tackle complex problems and to develop effective innovative solution procedures.</p>
<p>Job opportunities</p>	<p>In R&D departments of large companies and research centers, there is a growing need for individuals with specific expertise in computational mechanics and high-performance computing. In addition, engineering companies are increasingly seeking expertise in modelling</p>



	complex, multiphysics engineering problems using new and unconventional approaches.
Composition of the research group	1 Full Professors 1 Associated Professors 0 Assistant Professors 5 PhD Students
Name of the research directors	Massimiliano Cremonesi

Contacts	
massimiliano.cremonesi@polimi.it phone +39 02 2399 6230 http://cremonesi.faculty.polimi.it/	

Additional support - Financial aid per PhD student per year (gross amount)	
Housing - Foreign Students	--
Housing - Out-of-town residents (more than 80Km out of Milano)	--

Scholarship Increase for a period abroad	
Amount monthly	597.76 €
By number of months	0

Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information

List of Universities, Companies, Agencies and National or International Institutions that are cooperating in the research

- Universitat Politecnica de Catalunya – Barcelona
- Université Paris-Saclay - Paris
- Tetra Pak Packaging Solution - Modena

Educational activities

The Ph.D. course supports the educational activities of its Ph.D. students with an additional funding equal to 10% of the scholarship, starting from the first year.

Teaching assistanship

Ph.D. students are encouraged to apply upon prior authorization to the calls to support teaching activities at the undergraduate and Master levels at Politecnico, and they are paid for that. Teaching assistantship will be limited up to about 80 hours, maximum half of them devoted to teaching and classroom activities and the rest to support classworks and exams.



Computer availability

Each Ph.D. student has his/her own computer for individual use.

Desk availability

Each Ph.D. student has his/her own desk, cabinet and locker.