

PhD in INGEGNERIA STRUTTURALE, SISMICA, GEOTECNICA / STRUCTURAL SEISMIC AND GEOTECHNICAL ENGINEERING - 40th cycle

THEMATIC Research Field: PHYSICS-BASED NUMERICAL SIMULATIONS FOR ENHANCED EARTHQUAKE GROUND MOTION ASSESSMENT AND ANALYSIS

Monthly net inco	me of PhDscholarship (max 36 months)		
€ 1500.0			
In case of a change of the welfare rates during the three-year period, the amount could be modified.			
Context of the research activity			
	With the advancement of high-performance computing, three-dimensional physics-based numerical simulations (PBS) have significantly progressed, and they started to play a key role in providing realistic region- and site- specific predictions of earthquake ground shaking and of its spatial variability. Based on the rigorous solution of the elastodynamics equation on large-scale domains, PBS provide ground motion time histories reflecting the physics of the whole seismic wave propagation problem, including the fault rupture, the source-to-site path and complex geological features (e.g. alluvial basins), providing insights		

Motivation and objectives of the research in this field

PBS are recognized by the scientific community as one of the most promising tools to face the knowledge gaps related to the sparsity of earthquake recordings, that often prevents a proper definition of seismic input, which may be particularly crucial for strategic and critical structures such as Nuclear Power Plants (NPPs). As a matter of fact, in spite of the continuous growth of high-quality datasets of strong motion records, paucity of records still persists in the near-source region, in moderate seismicity areas, like continental France, and in peculiar geological conditions (e.g. very soft soils or hard rock), and from spatially dense seismic arrays for spatial variability studies. The main objective of the PhD Thesis is to develop

into the complex interactions between the source process,

the propagation path and local site response.

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	advanced physics-based numerical simulation approaches for enahcning ground motion prediction tools and applications, with potential implications for the nuclear industry. The PhD research will contribute to the SIGMA3 international research program (Seimic Ground Motion Assessment 2024-2028), within the research collaboration between Politecnico di Milano and EDF.
Methods and techniques that will be developed and used to carry out the research	For the numerical simulation of earthquake ground motion, the high-performance spectral element code SPEED – SPectral Elements in Elastodynamics with Discontinuous Galerkin (https://speed.mox.polimi.it/), developed at Politecnico, will be used on the CINECA HPC infrastructures. The modeling for the test case in the Rhone Valley (Southern France) will benefit from data and knowledge collected and made available by EDF.
Educational objectives	 Generation and use of 3D PBS of earthquake ground motion to inform, support and enhance seismic hazard assessment studies in low-to-moderate seismicity regions (e.g. continental France); Provide region-specific earthquake ground motion shaking fields as well as site-specific ground motion accelerograms for engineering analyses, for earthquake scenarios scarcely covered by seismic records but relevant for seismic hazard and risk analyses of critical facilities; Testing ground motion modeling approaches on a hybrid dataset from records and simulations; Improve our understanding of the physical phenomena underlying ground motion features highlighted by empirical analyses; Make the link with the earthquake engineering needs by exploring Soil-Structure-Interaction modeling strategies.
Job opportunities	The candidate is expected to develop skills in the areas of engineering seismology, earthquake engineering and numerical modelling/analysis. This will allow him/her to



	have employment opportunities in academia and in public and private companies in the field of disaster risk reduction with specific focus on earthquakes-induced risks.
Composition of the research group	1 Full Professors 2 Associated Professors 0 Assistant Professors 0 PhD Students
Name of the research directors	C. Smerzini, R. Paolucci, I. Mazzieri, P. Traversa

Contacts	
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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	750.0 €	
By number of months	6	

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

Educational activities (purchase of study books and material, funding for participation to courses, summer schools, workshops and conferences): financial aid per PhD student per year The Ph.D. course supports the educational activities of its Ph.D. students with additional funding equal to 10% of the scholarship, starting from the first year.

Teaching assistantship: availability of funding in recognition of support to teaching activities by the PhD student There are various forms of financial aid for activities of support to the teaching practice. The PhD is encouraged to take part in these activities, within the limits allowed by the regulations.

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.