



PhD in ARCHITETTURA, INGEGNERIA DELLE COSTRUZIONI E AMBIENTE COSTRUITO / ARCHITECTURE, BUILT ENVIRONMENT AND CONSTRUCTION ENGINEERING - 40th cycle

**PNRR 630 Research Field: MONITORING OF CIVIL INFRASTRUCTURES USING INSAR
DATA**

Monthly net income of PhDscholarship (max 36 months)
€ 1400.0
In case of a change of the welfare rates during the three-year period, the amount could be modified.

Context of the research activity	
<p>Motivation and objectives of the research in this field</p>	<p>Satellite-based Synthetic Aperture Radar Interferometry (InSAR) monitoring represents a promising supplement to traditional structural health monitoring methods, offering a non-invasive solution that eliminates the need for sensor installations and provides extensive spatial coverage. The European Ground Motion Service (EGMS), developed by the European Space Agency under the Copernicus program, marks a significant advancement in monitoring capabilities. Based on InSAR technology, EGMS (https://egms.land.copernicus.eu/) utilizes data from Sentinel-1 satellites and employs techniques such as persistent scatterer and distributed scatterer InSAR to generate displacement maps covering the European territory.</p> <p>The research will be dedicated to carrying out research activities in the field of evaluation and implementation of services for the classification, surveillance, and monitoring of road infrastructure and the surrounding territory by InSAR satellite techniques using EGMS data. The following project is co-financed under Ministerial Decree No. 630 of April 24, 2024, which allocates funds for PhD scholarships for the academic year 2024/2025 from the PNRR, Mission 4, Component 2 "From Research to Business" - Investment 3.3 "Introduction of innovative</p>



	<p>PhDs that meet the innovation needs of companies and promote the hiring of researchers by companies".</p>
<p>Methods and techniques that will be developed and used to carry out the research</p>	<p>InSAR technology uses at least two SAR images taken at different times over the same area to create an interferogram, which allows for deriving displacement data for reflective Measurement Points (MPs). Displacements are measured along the Line of Sight (LOS) between the satellite sensor and the ground target. Applying InSAR in civil infrastructure monitoring poses challenges, particularly in interpreting outcomes due to the non-homogeneous spatial distribution of MPs and the limited availability of LOS measurements from both ascending and descending orbits for the same point. A comprehensive 3D deformation field can be reconstructed by combining LOS measurements from at least three non-parallel directions or integrating in-situ measurements. This process involves separately processing datasets from the same location and time period to obtain LOS displacements measurements for each viewing geometry, typically from the ascending and the descending orbits. Assumptions about structural behaviour, implying planar deformation, are necessary, though identifying the deformation plane and integrating datasets adds complexity. Spatial resampling algorithms enhance understanding by extending displacements data to areas without radar targets, while temporal resampling ensures values from different geometries correspond to the same time. These resampling processes introduce uncertainty, which must be considered when interpreting the results. The research project will address these challenges, proposing a procedure to process freely accessible InSAR data from the EGMS.</p> <p>This PhD scholarship includes study and research periods in a company of six (6) months, and periods for research activities abroad authorized by the academic board of six (6) months.</p> <p>The projects will be carried out in collaboration with the company S.I.N.A. S.p.A. (https://www.sina.it/).</p>
<p>Educational objectives</p>	<p>The Candidate will acquire expertise in monitoring and management of civil structures and infrastructures based</p>



	on InSAR satellite data. Besides this, it is expected that the candidate will develop a publication record in recognized international journals and conferences and transversal skills related to communication and project management.
Job opportunities	The Candidate will have wide employment possibilities in academia, R&D departments of companies in private or public bodies owning or managing structures and infrastructures (e.g., buildings, bridges, pipelines for oil and gas, water, waste-water).
Composition of the research group	0 Full Professors 1 Associated Professors 1 Assistant Professors 6 PhD Students
Name of the research directors	MariaGiuseppina Limongelli, PierFrancesco Giordano

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	700.0 €
By number of months	6

National Operational Program for Research and Innovation

Company where the candidate will attend the stage (name and brief description)	S.I.N.A. S.p.A.
By number of months at the company	6
Institution or company where the candidate will spend the period abroad (name and brief description)	to be defined
By number of months abroad	6

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

Additional support:



Budget for the research activity (only for positions supported by scholarship):

total amount Euro 5707.20 per student

In detail:

- 1st year Euro 1902.40
- 2nd year Euro 1902.40
- 3rd year Euro 1902.40

Additional information about the organization and regulations of ABC-PhD programme can be found in the Regulations for the 40th Cycle of ABC-PhD:

download is available at link:

<https://www.dottorato.polimi.it/corsi-di-dottorato/architettura/architettura-ingegneria-delle-costruzioni-e-ambiente-costruito>

Additional information about ABC department and ABC-PhD programme:

available at link:

<https://www.dabc.polimi.it/>

Desk availability:

The ABC department provides non-permanent desks to be temporarily booked in common PhD rooms.