POLITECNICO DI MILANO

PhD in INGEGNERIA STRUTTURALE, SISMICA, GEOTECNICA / STRUCTURAL SEISMIC AND GEOTECHNICAL ENGINEERING - 38th cycle

PNRR_351_DOTT_RICERCA Research Field: DIGITAL TWINS FOR HISTORICAL STRUCTURES AND INFRASTRUCTURES

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	The integrity of existing masonry structures and infrastructures, such as masonry bridges in road and rail networks, relies on conservation, survey and monitoring of structural response to service and environmental actions, and depends on ongoing maintenance interventions. The information gathered through different sensors and data platforms through IOT technology can be used digitally to setup and develop digital twins, providing the interpretation of observed phenomena and prediction of future evolution. This digitalization of single structures and infrastructures, allows innovative continuous up-to-date control, planning and prioritization of maintenance interventions and safety for the society,replicable and then extendable to larger areas. The research focuses on the development of innovative techniques to include measured conditions and damage into the digital models, and the use of the digital tools to plan interventions. The results contribute to guarantee the resilience of road and rail transport networks relying on historical structures and regeneration of cultural and touristic buildings, improving their safety and accessibility on the territory.
Methods and techniques that will be developed and used to carry out the research	LIDAR scanning for geometry survey (PoliMi). Use of sensors for structural response and environmental actions

	combined with IoT technology for data treatment (PoliMi, TecnoIndagini). Development of Finite Element models (PoliMi, Penn State USA) to interpret measurements and predict service conditions and failure. Computational Limit Analysis for failure prediction and safety (PoliMi, Sheffield UK, Penn State USA). Preventive maintenance operations (PoliMi, Sheffield UK). Repair management strategies (PoliMi). These multidisciplinary activities will be carried out with interactions amongst the institutions and research centres involved.
Educational objectives	Integration of advanced simulation digital tools with experimental in situ study through sensors an IOT technology develops knowledge and applications related to the Transition to industry 4.0. Knowledge of historical structures and infrastructures. Formulation of modeling assumptions and interpretation of results. Choice of proper interventions.
Job opportunities	Infrastructure Management Companies. Engineering firms, with a focus on monitoring and structural assessment. National and International committees for safeguard of historic constructions.
Composition of the research group	1 Full Professors 4 Associated Professors 1 Assistant Professors 1 PhD Students
Name of the research directors	Dario Coronelli

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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	597.76 €
By number of months	6

National Operational Program for Research and Innovation	
Company where the candidate will attend the stage (name and brief description)	
By number of months at the company	0
Institution or company where the candidate will spend the period abroad (name and brief description)	University of Sheffield, https://www.sheffield.ac.uk/civil - Integrated Civil and Infrastructure Research Centre, https://icair.ac.uk/
By number of months abroad	6

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

Universities, Companies, Agencies and/or National or International Institutions that are cooperating in the research:

- University of Sheffield, UK, Prof. Matthew Gilbert
- Penn State University, USA, Prof. Thomas Boothby
- TecnoIndagini srl, IT
- Ouster, USA

Educational activities (purchase of study books and material, funding for participation to courses, summer schools, workshops and conferences): 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 (availability of funding in recognition of support to teaching activities by the PhD student): Ph.D. students are encouraged to apply, upon prior authorization, to the calls to support teaching activities at the undegraduate and Master levels at Politecnico, being paid for that. The 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 and desk availability: Each Ph.D. student has his/her own computer for individual use.Each Ph.D. student has his/her own desk, cabinet and locker.