UNIVERSITA' DEGLI STUDI DI NAPOLI FEDERICO II

DIPARTIMENTO DI STRUTTURE PER L'INGEGNERIA E L'ARCHITETTURA
CORSO DI DOTTORATO DI RICERCA IN
INGEGNERIA STRUTTURALE GEOTECNICA E RISCHIO SISMICO

XXXIX CICLO

Il sottoscritto prof. Marco Di Ludovico

(PO □   PA X   RU □   RTD □) afferente al Dipartimento di Strutture per l'Ingegneria e l'Architettura

S.S.D. ICAR/09 Tecnica delle Costruzioni

CHIEDE

di essere inserito tra i possibili tutor di studenti di dottorato per il XXXIX ciclo.

1. **Curriculum sintetico del proponente (max 500 parole)**
Prof. Marco Di Ludovico is currently Associate Professor at Department of Structures for Engineering and Architecture, University of Napoli Federico II. He hold the PhD in Civil Engineering in the 2007 at the same department. His research activities focus on theoretical and experimental work in the field of: non-linear behavior of structures, behavior of RC members under biaxial actions, strengthening of PC girders, RC and masonry structures with composite materials (Fiber-Reinforced Polymers, FRP, Cementitious Composite, FRC, Fabric Reinforced Cementitious Matrix, FRCM, Composite Reinforced Mortar, CRM, and Fibre Reinforced Mortar, FRM) , pseudo static, pseudo dynamic and dynamic tests on full scale structural members, in – situ testing, health monitoring systems, fragility curves on existing structures, post-earthquake damage and performance loss, reparability of existing structures, expected seismic losses, innovative methodologies and technologies for knowledge, management restoration and protection of Cultural Heritage. He had the scientific responsibility of the following research projects: ReLUIS 2014-2016 RS13, DPC - ReLUIS 2016-2018- RS 4, DPC - ReLUIS 2019-2021 – Research Line - WP 2, WP 4; WP 7; WP 8 , INCASS. He participated to several research projects: MACE, MAMAS, SIMURAI, SIT-MEW, DABACOM N, PROVACI, INNOVANCE, STRIT, METROPOLIS, METRICS; H2020 LIQUEFACT. Scientific coordinator of the scientific consultancy for the Saint Gobain PPC Italia S.p.A. "Characterization and Qualification of FRCM systems for strengthening masonry structures. His scientific activity is documented more than 95 ISI papers on national and internationals journals and 150 conference papers, h-index 24/26 and 1344/2158 citations /4084 citations (Scopus/Google scholar). Supervisor of 6 concluded PhD and 75 MSc theses, Supervisor of 3 concluded Postdoc projects, Member of: fib bulletin TG 5.1, CNR DT 200, CNR-DT 215/2018, Technical committee for developing Commentary to Italian Building Code NTC 2018, EAEE (European Association for Earthquake Engineering), Working Group 1 (EC8) Future Directions for Eurocode 8. Co-founder of the spin-off SEISMART srl, Sustainable Engineering, Innovative Solutions & Materials for Antiseismic Reliable Techniques (www.seismart.it).

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2. Dottorandi dei quali il proponente è stato tutor nell'ultimo triennio	
n.1	*Alessandro Lubrano Lobianco (Phd program in Structural and Geotechnical Engineering and Seismic risk, XXXV cicle, ongoing) grant: Ateneo*
n.2	*Natale Andrea (Structural and Geotechnical Engineering and Seismic risk, XXXIV cicle, ongoing) grant: POR*
n.3	*Autiero Francesca (PhD program in Industrial Product and Process Engineering, XXXIIV cicle) grant: Ateneo*

3. Titolo della ricerca proposta
<u>Seismic resilient structures and infrastructure under climate change</u>

4. Area tematica
Ingegneria Geotecnica □ Ingegneria Strutturale ☒ Rischio Sismico □

5. Tipologia di borsa per la quale si propone il progetto
Ateneo ☒ DM 117 (Investimento 3.3) □ *(in questo caso indicare l'azienda co-finanziatrice)*

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DM 118 (Investimento 4.1 P.A.) □

DM 118 (Investimento 4.1 generici) ⬚
DM 118 (Investimento 4.1 Patrimonio culturale) □

6. Sintesi del progetto di ricerca (max 500 parole. Stato dell'arte, obiettivi e breve programma previsto per le attività e)

An increasing number of disaster events has been recorded worldwide in the last twenty years compared to the previous two decades (UNDRR, 2020: The human cost of disasters: an overview of the last 20 years - 2000-2019). A total number of 7,348 natural hazard-related disasters (excluding biological and technological), globally affected over 4 billion people and led to about US$3 trillion (adjusted to inflation for US$ 2019) in economic losses, approximately doubled with respect to the previous twenty years. What is more, this rate of disaster occurrence is likely to further increase due to climate and environmental change. On the other hand, the exposure of people and assets has increased in all countries faster than vulnerability has decreased (Sendai Framework for Disaster Risk Reduction 2015–2030), thus yielding a steady increase in impacts in the economic, social, health, cultural and environmental sectors. Italy is one of the nations most exposed to natural risks, particularly to those deriving from geological, seismic, volcanic, geomorphological, hydrological, hydraulic and meteorological events, which combined to other sources of structural degradation call for multi-risk multi-scale approaches. On average, about twenty destructive earthquakes per century occur, which have claimed over 100,000 lives in the past century. Volcanic eruptions are infrequent but potentially devastating. More than 600,000 landslides were experienced in the past century, an average of two per km2. Floods are common in both lowland and mountain environments. Several coastal communities are exposed to tsunami risk and one third of the coasts is affected by soil erosion. Climate changes will lead to widespread phenomena of heat waves, heavy rains, reduction in rainfall and, consequently, drought, desertification, soil loss and salinization of aquifers and rise of sea level.

Given the global distribution and the potentially increasing frequency of disaster events and severity of the impacts, as a result of climate change, and the increasing exposure and vulnerability of urban communities, it is urgent to develop strategies for a better understanding of future natural multi-hazard dynamics and improved predictive models to quantify single and multi-risk from the short- to the long-time scales. The PhD project will address aspect related to the vulnerability assessment of existing ageing structures and infrastructure for different and multiple hazards (earthquake, landslides, tsunami, etc.), along with the analysis of mitigation strategies. The research will conducted through numerical analysis and experimental tests, and from data collection from past disasters. Simplified models for the loss assessment and risk prediction under different hazards will be developed.

7. Eventuali pubblicazioni del tutor sul tema di ricerca (max 10)

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Di Ludovico, M., De Martino, G., Prota, A., Manfredi, G., & Dolce, M. (2022). Relationships between empirical damage and direct/indirect costs for the assessment of seismic loss scenarios. Bulletin of Earthquake Engineering, 20(1), 229-254.

Del Vecchio, C., Di Ludovico, M., & Prota, A. (2020). Repair costs of reinforced concrete building components: from actual data analysis to calibrated consequence functions. Earthquake spectra, 36(1), 353-377.

Di Ludovico, M., Chiaradonna, A., Bilotta, E., Flora, A., & Prota, A. (2020). Empirical damage and liquefaction fragility curves from 2012 Emilia earthquake data. Earthquake Spectra, 36(2), 507-536.

Del Zoppo, M., Di Ludovico, M., & Prota, A. (2022). A mechanics-based method towards risk assessment of RC buildings under tsunami and flow-type hazards. Engineering Structures, 264, 114452.

Belliazzi, S., Lignola, G. P., Di Ludovico, M., & Prota, A. (2021, June). Preliminary tsunami analytical fragility functions proposal for Italian coastal residential masonry buildings. In Structures (Vol. 31, pp. 68-79). Elsevier.

Del Zoppo, M., Di Ludovico, M., & Prota, A. (2021). Methodology for assessing the performance of RC structures with breakaway infill walls under tsunami inundation. Journal of Structural Engineering, 147(2), 04020330. P

olese, M., Di Ludovico, M., d'Aragona, M. G., Prota, A., & Manfredi, G. (2020). Regional vulnerability and risk assessment accounting for local building typologies. International journal of disaster risk reduction, 43, 101400.

Polese, M., Gaetani d'Aragona, M., Di Ludovico, M., & Prota, A. (2018). Sustainable selective mitigation interventions towards effective earthquake risk reduction at the community scale. Sustainability, 10(8), 2894.

8. Eventuali progetti di ricerca finanziati in cui l'attività si inserisce

DPC-ReLUIS 2022-2024, WP 4 "Risk maps and seismic damage scenario (MARS-2)"

H&RA Lacinia - Hazard & Risk Assessment in Lacinia H2020-MSCA-IF-2020,

iRESET - Improving community Resilience through Experimentally validated tools for assessing the performance of Structures under Earthquake and Tsunami hazards

9. Eventuali fondi disponibili a supporto dell'attività del dottorando (escluso finanziamento borse)

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10. Informazioni relative ad un periodo di ricerca all'estero (minimo tre mesi) previsto per il dottorando (*indicare Università/ente di ricerca e docente/ricercatore di riferimento* con indirizzo mail) (max 300 parole)

University College London, UCL, Prof. Tiziana Rossetto, t.rossetto@ucl.ac.uk

11. Eventuali collaborazioni con imprese/aziende sul tema di ricerca (max 300 parole)

Mapei

RINA

Gallager Re

Napoli, 30/06/2023

Il presente modulo va compilato in ogni sua parte ed inviato all'indirizzo di posta elettronica phd.dist@unina.it entro e non oltre **il 30/06/2023.**