



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. **Giovanni Forte** (PO ☐ PA ☐ RU ☐ RTD X)
affidente al Dipartimento di **Ingegneria Civile, Edile e Ambientale (DICEA)**

S.S.D. **GEO/05 – Geologia Applicata**

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Il sottoscritto ing. **Carlo Del Gaudio** (PO ☐ PA ☐ RU ☐ RTD X)
affidente al Dipartimento di **Strutture per l'Ingegneria e l'Architettura (DIST)**

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

CHIEDONO

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

1. Curriculum sintetico del proponente (max 500 parole)

Giovanni Forte is Assistant Professor (RTD-B) of Engineering Geology at DICEA, University of Naples Federico II. He has a Bachelor in Earth Sciences (2008), a Master's degree in Geology and Engineering Geology cum laude in 2010. He is PhD in Seismic Risk (XXVI cycle) at University of Naples Federico II defending a thesis on "Integrated approach to the analysis of earthquake triggered landslides and their impact on roadway infrastructures" in 2014. He got the National Scientific Qualification (ASN) for the position of Full Professor on 1st February 2023.

Teaching activity

Since 2011 he supports the teaching activities of the engineering geology group. Since January 2018 he is Professor of the courses of **Engineering Geology** (Geologia Applicata) 6 CFU, **Geological Risks for the design of Civil Engineering works** (Rischi geologici nella Progettazione di Opere di Ingegneria Civile) 3/9 CFU for the bachelors and master degrees in civil, building and environmental engineering. Since 2021 he also teaches **Digital maps and geological 3D modelling** 9 CFU for the master in Transportation Engineering and Mobility.



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He supervised more than 35 students for their graduation thesis for both bachelor's and master's degrees.

Research activity

The main scientific research topics deal with **natural hazards, slope stability, earthquake engineering** and **hydrogeology**. The results of the researches are presented in several national and international congresses and summarized in several indexed-journals. He participated in several Research Projects as: **AMABT** (FRA), **MASLIDE** (FRA), **ISTOS** (Horizon2020), **MITIGO** (PON), **RELUIS** (Department of Civil Protection), **VIRA** (Department of Civil Protection), **CLARITY** (Horizon2020), **GRISIS** (POR), **METROPOLIS** (PON).

Carlo Del Gaudio is Assistant Professor (RTD-A) of Structural Engineering at DIST, University of Naples Federico II. He has a Bachelor in Civil Engineering (2008), a Master's degree in Structural and Geotechnical Engineering cum laude in 2011. He is PhD in Seismic Risk (XXVII cycle) at University of Naples Federico II defending a thesis on "Seismic fragility assessment of rc buildings at large scale" in 2015. He got the National Scientific Qualification (ASN) for the position of Associate Professor on 13th February 2023.

Teaching activity

Since 2012 he supported the activities of Prof Verderame of Structural engineering (Corso di laurea triennale in Ingegneria per l'Ambiente e il Territorio, equivalent to Bachelor of Science), and Rehabilitation of existing structures (Corso di laurea magistrale in Ingegneria Strutturale e Geotecnica, equivalent to Master of Science). Since 2022 he is co-lecturer of Structural engineering (Corso di laurea triennale in Ingegneria per l'Ambiente e il Territorio, equivalent to Bachelor of Science).

He is lecturer of the course "Insights in seismic fragility assessment: state of the art and future challenges" (duration 8 hours) in Ph.D. Schools in Industrial And Civil Engineering And Territory Innovation And Sustainability of Università degli Studi Niccolò Cusano.

He is lecturer of the course "Insight into the derivation of empirical fragility approaches: a contribution towards the updated Italian seismic risk assessment" (duration 8 hours) in Ph.D. School of Structural Engineering, Geotechnics and Seismic Risk of University of Napoli Federico II.

Research activity

The research activities deal with experimental and numerical analysis of reinforced concrete (RC) elements, the modeling and non-linear analysis of RC structures, the



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influence of infill elements on the response of RC buildings, the evaluation of seismic vulnerability of RC buildings via simplified mechanical analysis, seismic vulnerability and risk assessment for large stock of buildings via empirical approaches, structural intervention and retrofit techniques of RC buildings.

2. Dottorandi dei quali il proponente è stato tutor nell'ultimo triennio

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3. Titolo della ricerca proposta

A novel toolbox for vulnerability assessments of Buildings Assets under integrated and multi-layered risks.

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) X

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), among which geophysical (earthquakes) and hydrogeological (floods) risks continue to be those having the most powerful impact in terms of victims and affected people, respectively. In Italy, on average, about twenty destructive earthquakes per century occur, which have claimed over 100,000 lives in the past century and more than 600,000 landslides were experienced in the past century, an average of two per km².

The current practises on multi-risk approaches primarily focuses on multi-hazard assessment, and a widespread use of fragility curves for vulnerability assessment. In the context of vulnerability assessment, there exists an extensive collection of research on deriving seismic fragility curves using mechanical or empirical methods. However, there seems to be a scarcity of approaches addressing the potential effects of hyper-concentrated flows or landslides resulting from rapid flow, except for a few specific case studies that provide a detailed mechanical characterization of buildings.

The objective of this project is to reproduce the nonlinear response of buildings when subjected to both seismic events, flash floods, and flow-like landslides, and to assess the resulting damage. The mechanical aspect of the approach enables a comprehensive characterization of the geometric and mechanical model of buildings within the specific context of Italy, using a simulated design procedure that aligns with the construction practices and technical codes in place. The scalability and generalization to different geographical contexts can be also pursued with for minor modifications in simulated design procedures.

The project has two main drivers:



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- The exploitation of empirical observation, relying on multiple survey sources, including advanced technologies, as strongly recommended by National Research Program (PNR). This approach aims to overcome the fragmentation of information and promote a holistic management approach within a multidisciplinary culture.
- The integration of observational damage data from past events that the project proponents were involved in, specifically in the Campania region (Irpinia province, Sarno, Castellammare di Stabia, Ischia). These data can be used to validate the projected multi-layered risk scenarios in the case studies and assess the feasibility of the proposed approach. Additionally, a reverse hazard analysis can be conducted to simulate flooding and the invasion of hydrogeological phenomena, which can be useful when on-site surveys are not available, ensuring the scalability of the methodology.

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

1. **Forte G.**, Verrucci L., Di Giulio A., De Falco M., Tommasi P., Lanzo G., Franke K.W., Santo A. (2021). Analysis of major rock-slides that occurred during the 2016–2017 Central Italy seismic sequence. *Engineering Geology*, 290, 106194.
2. Miano A., Jalayer F., **Forte G.**, Santo A. (2020). Empirical fragility assessment using conditional GMPE-based ground shaking fields: application to damage data for 2016 Amatrice Earthquake. *Bulletin of Earthquake Engineering*, 18(15), 6629–6659.
3. **Forte G.**, De Falco M., Santangelo N., Santo A. (2019). Slope stability in a multi-hazard eruption scenario (Santorini, Greece). *Geosciences (Switzerland)*, 9(10), 412.
4. **Forte G.**, Chioccarelli E., De Falco M., Cito P., Santo, A., Iervolino, I. (2019). Seismic soil classification of Italy based on surface geology and shear-wave velocity measurements. *Soil Dynamics and Earthquake Engineering*, 122, 79–93.
5. **Forte G.**, Fabbrocino, S., Silvestri, F., Santucci de Magistris, F. (2019). Assessment of seismic slope stability at different scales in Molise region (Southern Italy). *Earthquake Geotechnical Engineering for Protection and Development of Environment and Constructions- Proceedings of the 7th International Conference on Earthquake Geotechnical Engineering*, pp. 2452–2459.
6. Silvestri F., **Forte G.**, Calvello M. (2016). Multi-level approach for zonation of seismic slope stability: Experiences and perspectives in Italy. *Landslides and Engineered Slopes. Experience, Theory and Practice*, 1, pp. 101–118.
7. **Del Gaudio, C.**, Di Ludovico, M., Polese, M., Manfredi, G., Prota, A., Ricci, P., & Verderame, G. M. (2020). Seismic fragility for Italian RC buildings based on



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damage data of the last 50 years. Bulletin of earthquake engineering, 18, 2023-2059.

8. **Del Gaudio, C.**, Ricci, P., Verderame, G. M., & Manfredi, G. (2015).
Development and urban-scale application of a simplified method for seismic fragility assessment of RC buildings. Engineering Structures, 91, 40-57.

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

The research activity is associated with seismic risk assessment studies performed in the framework of the DPC-ReLUIIS 2022–2024 project (<https://www.reluis.it>), the RETURN (Multi-Risk sciEnce for resilienT commUnities undeR a changiNg climate, <https://www.fondazionereturn.it/>).

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

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)

The PhD student is expected to spend at least 6 months in a major university or research centre,
such as:

Professor **PAULO B. LOURENÇO** and Ing. **Nicola Chieffo** at the Department of Civil Engineering, University of Minho, Portugal. (pbl@civil.uminho.pt; nicola.chieffo@civil.uminho.pt;))

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

UNIVERSITA' DEGLI STUDI DI NAPOLI FEDERICO II



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Napoli, 30/06/2023

FIRMA

Gr. Forte
Antonio Forte

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.

