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

XXXVIII CICLO

Il sottoscritto prof. **Giovanni Forte** (PO □ PA □ RU □ RTD X)

afferente al Dipartimento di **Ingegneria Civile, Edile e Ambientale (DICEA)**

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

CHIEDE

di essere inserito nell'elenco dei tutor per il XXXVIII ciclo.

1. Curriculum del proponente (max 500 parole)

Giovanni Forte is Assistant Professor (RTD-B) of Engineering Geology at Department of Civil, Architectural and Environmental Engineering (DICEA), University of Naples Federico II. He has a Bachelor degree cum laude in Earth Sciences (2008), a Master 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 Associate Professor on 4th September 2018.

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.
He supervised more than 35 students for their graduation thesis for both bachelor and master 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).

Congress and Session Chair

- Organizing Secretariat of 3rd International Multidisciplinary Conference on Mineral and Thermal Waters – **MinWat 2020**, Caserta, Italy, 26th June – 30th June 2022.
- Chairman of the MinWat2020 session T2 "Protection and Management of Mineral and Thermal Waters".
- Lead Convenor of the **EGU 2022** NH 4.4 session: Earthquake-induced hazards: ground motion amplification and ground failures. Vienna, 23rd – 27th May 2022.
- Organizing Committe of **Flowpath** – National Meeting of Hydrogeology, Napoli, 1 – 3 December 2021.
- Lead Convenor of the **vEGU 2021** NH 4.1 session: Earthquake-induced hazards: ground motion amplification and ground failures, Online, 19th – 30th April 2021.
- Lead Convenor of the **EGU 2020** NH 4.3 session: Seismic microzonation and ground failure, Online, 4th – 8th May 2020.

Editorial activity

He is Reviewer for many Scopus-indexed journal.

- Guest Editor for Special Issue in **NHESS** Natural Hazard and Earth System Science (Copernicus Publications) on Earthquake induced Hazards: ground motion amplification and ground failures, since 2021.

-Associate Editor for **Innovative Infrastructure Solutions** (Springer) since 2020;
-Guest-Editor for the Special Issue in **Environmental Geochemistry and Health** (Springer) on MINWAT2020 Congress since 2020;
-Editorial Board member of **Geosciences** (MDPI) since 2020;
-Editorial Board member of **International Journal of Geotechnical Engineering** (Taylor & Francis) since 2017;
-Editorial Board member of **International Journal of Geo-Engineering** (Springer) since 2017.

Scientific affiliations

member of SGI - Società Geologica Italiana;
member of AIGAA – Associazione Italiana di Geologia Applicata e Ambientale;
member of the Italian Committee of IAH – International Association of Hydrogeologists;
member of EGU – European Geoscience Union.

2. Dottorandi dei quali il proponente è stato tutor nell'ultimo triennio	
n. _____	*specificare tipologia di borsa: ateneo, pon, por, ecc.* _____

3. Titolo della ricerca proposta
Innovative approach for seismic-induced landslide hazard mapping using 3D physical-based earthquakes simulations

4. Area Tematica
Ingegneria Geotecnica □ Ingegneria Strutturale □ Rischio Sismico X

5. Sintesi del progetto di ricerca (max 500 parole. Stato dell'arte, breve programma previsto per le attività e obiettivi)
Earthquake-induced landslides (EQIL) are devastating phenomena that cause significant social and economic losses. Since earthquake prediction is still an intractable scientific problem, when EQIL occur, near-real-time earthquake hazard maps are crucial for humanitarian agencies and decision-makers to facilitate mitigation actions in the affected areas. One of the fundamental layers in assessing EQIL hazard is the earthquake intensity map that shows the distribution of the earthquake waveform intensity. However, till now, the commonly used near-real-time information system provided by the USGS only uses a simplistic approach based on the ShakeMap service that depends basically on estimating

the earthquake shaking by interpolating the intensity information from the waveforms recorded by seismic stations, local site characteristics, and the empirically-driven ground motion equation. While the ShakeMap system provides useful information, in particular, on a regional scale or when dense seismic stations coverage is available; however, seismic stations are sparsely distributed with tens of kilometers of interstation spacing on average for well-covered regions, e.g., the USA and Europe and for a few hundred kilometers in many regions globally. Therefore, in best-case scenario, the intensity-driven information from the ShakeMap system simplifies the complex variation in the earthquake waveform due to the source mechanism, topography, and/or subsurface structure which can lead to significant amplification or focusing and de-focusing of the earthquake intensity, and as a consequence, leading to a significant variation in the landslide distribution and their susceptibility mapping. On the other hand, for areas poorly covered with seismological stations, the ShakeMap product could hardly provide any accurate information about the complex earthquake waveform intensity.

In this research, we aim to design a near-real-time (i.e., within a few hours of identifying the earthquake) EQIL hazard mapping system that implements physics-based earthquake simulation techniques. The research will be based on the analysis of the available earthquake-triggered landslides databases worldwide and in Italy. They will be adopted to extract in different geological settings the most critical parameters for performing forecast of seismic-induced landslides triggering. The system will mainly have three building blocks: 1) automatic and rapid earthquake source mechanism solution using the freely available real-time earthquake signals, 2) physics-based earthquake simulation using the previously estimated earthquake source, and the freely available earth models that honor high-resolution topography and subsurface structure, and 3) use the earthquake intensity results from the physical-based simulations to generate a landslide hazard maps that honors the complexity of the earthquake wavefield. After developing the methodology, the system will be tested in two sites affected by intense co-seismic landslide events; the first one will be in a seismologically well-covered study area, and the other site will be in a poorly covered region. We will then generate statistically-based landslide hazard maps using both our product and its ShakeMap counterpart to evaluate the performance of the newly designed system. Upon successful implementation and evaluation of the proposed methodology, the system can be generalized as a web service that can serve as the new

generation of earthquake-induced landslide hazard maps that can be an instrumental tool for decision-makers and humanitarian agencies for first response mitigation actions.

6. Pubblicazioni sul tema di ricerca

1. Pignalosa A., **Forte G.**, Budetta P., Santo A. (2022). Topographic amplification and debris remobilization as a cause for increasing rockfall hazard in seismic areas: A case study in Central Italy. Geomorphology, 403, 108160. DOI 10.1016/j.geomorph.2022.108160.
2. **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.
3. 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.
4. Licata V., **Forte G.**, d'Onofrio A., Santo A., Silvestri F. (2019). A multi-level study for the seismic microzonation of the Western area of Naples (Italy). Bulletin of Earthquake Engineering, 17(9), 4711-4741. DOI: 10.1007/s10518-019-00665-6.
5. **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.
6. **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.
7. Ebrahimian H., Jalayer F., **Forte G.**, Convertito V., Licata V., d'Onofrio A., Santo A. Silvestri F., Manfredi G. Site-specific probabilistic seismic hazard analysis for the western area of Naples, Italy. Bulletin of Earthquake Engineering, 17(9), 4743–4796.
8. **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.
9. **Forte G.**, Fabbrocino S., Fabbrocino G., Lanzano G., Santucci de Magistris F., Silvestri, F. (2017). A geolithological approach to seismic site classification: an

application to the Molise Region (Italy). Bulletin of Earthquake Engineering, 15(1), pp. 175–198.

10. 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. Progetti di ricerca finanziati in cui l'attività si inserisce

The research activity is associated with the seismic slope stability studies (task 2 - WP16) performed in the framework of the Italian Department of Civil Protection ReLUIS-DPC 2022–2024 research project.

8. Fondi disponibili per eventuali assegni, borse di ricerca, ecc., per acquisto eventuale di attrezzature, missioni

The research activity is supported by the abovementioned research project and additional funding for research mobility of the University of Twente

9. 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*) (max 300 parole)

The PhD candidate is going to spend from six months to one year in the Netherlands at the Faculty of Geo-Information Science and Earth Observation (ITC), University of Twente, Enschede to get access to their computing facility and to use Salvus software for earthquake simulations. During this period, assistant professors dr. Hakan Tanyas and dr. Islam Fadel from the Department of Applied Earth Sciences will provide co-supervision for the candidate.

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

Napoli, 06/07/2022 FIRMA

Il presente modulo va compilato in ogni sua parte ed inviato all'indirizzo di posta elettronica phd.dist@unina.it entro e non oltre **mercolerdì 20/07/2022**