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

I sottoscritti prof. Francesco Silvestri (PO ■ PA □ RU □ RTD □), afferente al Dipartimento di Ingegneria Civile, Edile ed Ambientale (S.S.D. ICAR/07 Geotecnica), e prof. Fulvio Parisi (PO □ PA ■ RU □ RTD □), afferente al Dipartimento di Strutture per l'Ingegneria e l'Architettura (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 dei proponenti (max 500 parole)

Prof. Francesco Silvestri

Career

1986: M.Sc. in Civil Engineering at the University of Napoli Federico II, where he took the degree of Ph.D. in Geotechnical Engineering in 1991.
1990: Research engineer - Scientist assistant at the University of Texas at Austin (USA).
1990 to 1998: Research Assistant at the 'Department of Geotechnical Engineering' of the University of Napoli Federico II.
1998 to 2003: Associate Professor at the 'Department of Soil Defense' of the University of Calabria. 2003 to 2007: Full Professor at the 'Department of Soil Defense' of the University of Calabria.
2007 to date: Full Professor at the University of Napoli Federico II, currently at the 'Department of Civil, Architectural and Environmental Engineering'.

Research

Experimental and analytical research on characterisation and analysis of mechanical behaviour of soils under time-variable loads, relevant to working and seismic conditions of buildings and infrastructures.
Specific research topics:
- advanced experimental techniques for measurement of soil mechanical properties;
- constitutive modelling of cyclic/dynamic soil behaviour in pre-failure conditions and at liquefaction;

- embankments, levees, earth dams, coastal and underground structures under working and seismic loading;
- geotechnical characterisation, seismic response analysis and microzonation of small to large urban centers;
- ground deformations, soil liquefaction, instability of slopes and cavities induced by earthquakes and other natural events;
- soil-foundation-structure interaction for buildings and bridges with shallow or deep foundations;
- propagation, effects and attenuation measures of man-made vibrations;
- ground improvement and early warning technologies for seismic risk reduction.

On the above mentioned research topics, he published more than 300 papers with a h-index = 26.
Appointed as general or panel session reporter, chairman and discussion leader at national and international conferences.

Organizing activities
Guest editor and reviewer of technical papers for National and International Journals and Conferences.
Member of national/international Technical Committees on geotechnical testing, design codes and earthquake geotechnical engineering.
Italian delegate to the International Technical Committee of ISSMGE on 'Earthquake Geotechnical Engineering' since 2006.
Co-chairman of WG6 (Geotechnical Earthquake Engineering) of EAEE (European Association of Earthquake Engineering) since 2015 to 2019.
Member of Organising Committees and Editor of the Proceedings of national/international conferences.
Chairman of the VII International Conference on Earthquake Geotechnical Engineering (Roma, 2019).
Principal Investigator of institutional Research Units in the national Research Projects on soil dynamics and earthquake engineering.
Coordinator of the support about geotechnical aspects to the Department of Civil Protection in the emergency after the Aterno valley earthquake in 2009, the Ischia earthquake in 2017, and the Casamicciola landslide in 2022.
Task coordinator in the national research project ReLUIS since 2010 to date.
Principal Investigator of international research projects.
Participation in investigation projects with private financing.

Teaching

Courses on 'Soil Dynamics and Earthquake Geotechnical Engineering' and 'Static and Seismic Foundation Design' - M.Sc. Degree in 'Structural and Geotechnical Engineering' - University of Napoli Federico II (Italy).

Short Course on 'Soil dynamics and non-linear site response analysis' - International Master Erasmus Mundus Courses on 'Geomechanics, Civil Engineering and Risks (MGCER)' and on 'Earthquake Engineering and Engineering Seismology (MEEES)' - Laboratoire 3SR - University of Grenoble Joseph Fourier (France).

Short Course on 'Soil Behaviour and Soil-Structure Interaction in Seismic Conditions' (lectures on Fundamentals of Soil Dynamics and Seismic response analysis) - PhD Program in Civil, Chemical and Environmental Engineering - University of Genova (Italy).

Coordinator of international agreements with the Aristotle University of Thessaloniki (Greece) and the University of Cuyo at Mendoza (Argentina) with Erasmus + .

Supervisor of 15 PhD theses in Geotechnical Engineering or Seismic Risk.

Prof. Fulvio Parisi

Dr. Parisi is Associate Professor in Structural Engineering at University of Naples Federico II, Italy, and Associate Researcher at the Institute for Complex Systems of the National Research Council of Italy (CNR). In 2023, he received the Italian national scientific qualification as Full Professor in Structural Engineering.

He teaches the courses entitled "Design and Retrofit of Masonry Structures" and "Diagnosis and Therapy of Structural Failures", giving several invited lectures in different universities and research centres across Europe and USA. He is also the Coordinator of the MSc Programme in Forensic Engineering, where he teaches "Failures and Collapses". In the PhD Programme in Structural & Geotechnical Engineering and Seismic Risk at University of Naples Federico II, he taught "*Performance-Based Earthquake Engineering of Masonry Buildings*" and is teacher of "*Robustness of Structures*". Since 2014, he has supervised 11 PhD students, 3 postdocs, and over 50 MSc and BSc students.

He is an Associate Editor of the ASCE Journal of Performance of Constructed Facilities and Advances in Civil Engineering, as well as Editorial Board Member of the following international journals: Buildings; Engineering Failure Analysis; Frontiers in Built Environment (Sections: Bridge Engineering and Earthquake Engineering); Frontiers in Earth Science (Section Geohazards and Georisks); International Journal of Forensic Engineering; International Journal of Masonry Research and Innovation. He serves as reviewer for more than 50 journals and was a scientific committee member or mini-symposium organizer in more than 15 international conferences. He is expert scientific

reviewer of the Italian Ministry for University and Research and Czech Science Foundation.

He was involved in 17 research projects and currently works in the framework of 9 research projects, carrying out both theoretical and experimental research in the following fields: nonlinear structural analysis and vulnerability assessment of buildings and bridges made of masonry, reinforced concrete or prestressed concrete; seismic design, assessment and retrofit of masonry structures and cultural heritage constructions; structural health monitoring and digital technologies for condition-based structural assessment; progressive collapse simulation and structural robustness; multi-hazard risk and resilience assessment of civil infrastructure.

He authored over 200 papers in peer-reviewed international journals and conference proceedings, 1 book, 12 book chapters, 34 scientific reports, a software for seismic analysis of masonry buildings, and 3 databases for experimental data selection on masonry properties. He edited 2 books and 5 special issues of peer-reviewed international journals.

His research outcomes were awarded or recognized by several institutions and journals. In 2020, he was included in the list of World's Top 2% Scientists according to the scientific impact of his research activity in 2019. In 2021 and 2022, this recognition was confirmed, including Dr. Parisi in the list of World's Top Scientists for both career-long and single-year impacts.

Some findings of his studies were implemented or cited in the following guidelines: ACI 549.4R-13 "*Guide to Design and Construction of Externally Bonded Fabric-Reinforced Cementitious Matrix (FRCM) Systems for Repair and Strengthening Concrete and Masonry Structures*" (2013) published by the American Concrete Institute (ACI); CNR-DT 2014/2018 "*Istruzioni per la valutazione della robustezza delle costruzioni*" and CNR-DT 2015/2018 "*Istruzioni per la Progettazione, l'Esecuzione ed il Controllo di Interventi di Consolidamento Statico mediante l'utilizzo di Compositi Fibrorinforzati a matrice inorganica*", both published by CNR.

He is an active member of several international working groups, technical committees of standard bodies, and international associations, including the Fédération Internationale du Béton (fib), the European Association for Earthquake Engineering (EAEE), Comité Européen de Normalisation (CEN), National Research Council of Italy (CNR), and UNI – Ente Italiano di Normazione (Italian National Standards Body). Currently, he is a member of fib Commission 7 "*Sustainability of Concrete Structures*", co-convenor of fib Task Group 7.6 "*Resilient Structures*", convenor of fib Task Group 7.7 "*Sustainable Concrete Masonry Components and Structures*", member of fib Action Group 10 "*Robustness*", and member of CEN/TC 250/WG6 "*Robustness*". At national level, he is a member of UNI/CT021 "*Structural Engineering*", vice-coordinator of UNI/CT021/GL06 "*Robustness*", and member of UNI/CT021/SC10 "*General Criteria for Structural Design*". Since 2018, he is Executive Board Member of the *Complex Systems*

Society - Italian Regional Chapter on Complex Systems (*CSS/Italy*) and Coordinator for Campania Region.
In 2019, Dr. Parisi founded FORENSICS srl (FORensic ENgineering ServICeS), which is a spin-off company of the University of Naples Federico II where he is Head of Civil and Risk Engineering services.

2. Dottorandi dei quali il proponente è stato tutor nell'ultimo triennio	
	Prof. Francesco Silvestri
n. 3	Giorgio Andrea Alleanza (34th cycle, ministerial grant), Francesco Gargiulo (35th cycle, ministerial grant), Juan Manuel Barbagelata (37th cycle, ministerial grant)
n. 5	**Prof. Fulvio Parisi**
	Giacomo Miluccio (35th cycle, grant by research project), Valentina Buonocunto (37th cycle, ministerial grant), Ludovico Alberico Grieco (38th cycle, grant by research project), Ciro Canditone (38th cycle, grant by company and Ministry of University and Research), Stefania Zimbalatti (38th cycle, grant by company and Ministry of University and Research)

3. Titolo della ricerca proposta
Seismic risk assessment of historical urban centres considering site-city interaction

4. Area tematica
Ingegneria Geotecnica □
Ingegneria Strutturale □
Rischio Sismico ■ (ma include anche le due precedenti)

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)

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)

Heavy damage to old masonry constructions after moderate-to-strong earthquakes continuously highlight the high seismic risk of historical urban centres, which are often subjected to significant local amplification of ground motion due to soil deformability. Even though site effects can be considered in current methodologies for seismic risk assessment, a few studies have investigated the effects of soil-structure interaction (SSI) on seismic performance and risk of historical masonry buildings, which frequently include underground storeys and are characterised by a variety of foundation systems. In this respect, recent studies have been carried out to investigate the nonlinear seismic response of case-study historical buildings through nonlinear dynamic analysis of soil-foundation-structure (SFS) capacity models. Those numerical simulations focused on building sub-structures prone to suffer out-of-plane collapse mechanisms, which are usually detected in historical masonry constructions. The importance of SSI effects in seismic performance of a real school building collapsed under the 2017 Central Italy earthquakes has been evaluated, allowing a comprehensive understanding of observed damage. Nonetheless, vulnerability models for historical masonry buildings including SSI effects are still missing.

The scope of this research programme is to develop seismic fragility models for historical masonry building aggregates, considering site-city interaction (SCI) effects. The latter type of interaction includes both SSI at the scale of single buildings and the interaction among densely distributed buildings and the site. Such a complex interaction is frequently neglected in regional seismic risk assessment studies, although SCI effects can play an important role in seismic damage and disaster risk reduction of historical urban centres. Indeed, SCI effects can generate a further variability in regional

simulations, in addition to that related to the earthquake shaking, soil amplification and building configuration.

The research programme involves the following primary tasks:

1. To perform nonlinear dynamic analysis of three-dimensional SFS capacity models representative of single masonry buildings (asset type A) or masonry building aggregates (asset type B), making use of advanced software packages.
2. To develop computationally efficient capacity models of selected assets, accounting for variability in site characteristics and foundation systems.
3. To run fragility analysis of selected assets, considering (i) record-to-record variability, (ii) uncertainty in soil, foundation and structural systems (intra-building variability), and (iii) uncertainty associated with building variability within the city system (inter-building variability).
4. To perform seismic damage simulation and risk assessment at urban scale for selected historical centres located in regions with moderate-to-high hazard.

For this latter task, a significant case study maybe represented by the city of Matera, a world heritage UNESCO centre in southern Italy, where masonry buildings are constructed by calcarenite stones dug in the subsoil, and therefore there exists a kind of peculiar continuity between the under- and above-ground living environment. Previous experimental and analytical studies by the proponents on arrays of small-size residential buildings with identical structural properties proved the primary importance of the variability of subsoil layering and the associated soil-structure interaction on their dynamic response. The research project wishes to explore this aspect with more detail by means of advanced numerical analyses and, possibly, physical modelling by dynamic centrifuge on single, aggregate and multiple building systems.

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

Piro A., de Silva F., Galasso C., Parisi F., Silvestri F. (2022). Effects of soil-foundation-structure interaction on nonlinear dynamic response and seismic fragility of masonry buildings. In: J. Li, P.D. Spanos, J.B. Chen, Y.B. Peng (editors). Proceedings of 13th International Conference on Structural Safety and Reliability (ICOSSAR 2021), Shanghai, China, 13-17 September 2022.

Piro A., Tragni N., de Silva F., Parisi F., Gallipoli M.R., Silvestri F. (2022). Validation of a simplified approach for evaluating soil-structure interaction effects on the seismic response of masonry buildings. In: Proceedings of 3rd European Conference on Earthquake Engineering & Seismology, Bucharest, Romania, 4-9 September 2022.

Silvestri F., de Silva F., Parisi F., Piro A. (2022). The influence of soil-foundation-structure interaction on the seismic performance of masonry buildings. Keynote Lecture. In: W. Lanmin, Z. Jian-Min, R. Wang (editors). Proceedings of 4th

International Conference on Performance Based Design in Earthquake Geotechnical Engineering, Beijing, China, 15-17 July 2022.

Brunelli A., de Silva F., Piro A., Parisi F., Sica S., Silvestri F., Cattari S. (2021). Numerical simulation of the seismic response and soil-structure interaction for a monitored masonry school building damaged by the 2016 central Italy earthquake. Bulletin of Earthquake Engineering, 19: 1181-1211.

Piro A., de Silva F., Parisi F., Scotto di Santolo A., Silvestri F. (2020). Effects of soil-foundation-structure interaction on fundamental frequency and radiation damping ratio of historical masonry building sub-structures. Bulletin of Earthquake Engineering, 18(4): 1187-1212.

de Silva F., Piro A., Brunelli A., Cattari S., Parisi F., Sica S., Silvestri F. (2019). On the soil-structure interaction in the seismic response of a monitored masonry school building struck by the 2016-2017 Central Italy earthquake. In: M. Papadrakakis, M. Fragiadakis (editors). Proceedings of COMPDYN 2019 – 7th ECCOMAS Thematic Conference on Computational Methods in Structural Dynamics and Earthquake Engineering, Crete, Greece, 24-26 June 2019.

Piro A., de Silva F., Martinelli G., Meccariello M., Parisi F., Silvestri F., Scotto di Santolo A. (2019). Effects of the underground urban development on the seismic response of a historical centre in Italy. In: Silvestri F., Moraci N. (editors). Earthquake Geotechnical Engineering for Protection and Development of Environment and Constructions – Proceedings of the 7th International Conference on Earthquake Geotechnical Engineering, Rome, 17-20 June 2019.

Cattari S., Sivori D., Brunelli A., Sica S., Piro A., de Silva F., Parisi F., Silvestri F. (2019). Soil-structure interaction effects on the dynamic behaviour of a masonry school damaged by the 2016-2017 Central Italy earthquake sequence. In: Silvestri F., Moraci N. (editors). Earthquake Geotechnical Engineering for Protection and Development of Environment and Constructions – Proceedings of the 7th International Conference on Earthquake Geotechnical Engineering, Rome, 17-20 June 2019.

Piro A., de Silva F., Scotto di Santolo A., Parisi F., Silvestri F. (2018). Sensitivity analysis of seismic soil-foundation-structure interaction in masonry buildings founded on cavities. Proceedings of the 16th European Conference on Earthquake Engineering, Thessaloniki, 18-21 June 2018.

Vuoto A., Piro A., de Silva F., Scotto di Santolo A., Parisi F., Silvestri F. (2018). Seismic soil-structure interaction: Two case studies in Sant'Agata de' Goti, Italy. Proceedings of the 16th European Conference on Earthquake Engineering, Thessaloniki, 18-21 June 2018.

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-ReLUIS 2022–2024 project (https://www.reluis.it) and the RETURN (Multi-Risk sciEnce for resilienT commUnities undeR a changiNg climate, https://www.fondazionereturn.it/) project.

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

The research activity will consist of numerical and experimental studies, which will be supported by the abovementioned research projects and additional funding for research mobility both inside and outside Europe.

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 6 months in a major university or research centre, such as:

- University College London (UK), in cooperation with either Prof. Carmine Galasso or Prof. Dina D'Ayala (d.dayala@ucl.ac.uk)
- Aristotle University of Thessaloniki (Greece), in cooperation with Prof. Dimitris Pitilakis (DPitilakis@civil.auth.gr)
- Dundee University (UK), in cooperation with Prof. Jonathan Knappett (J.A.Knappett@dundee.ac.uk)

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

The research activity might stimulate cooperation with several engineering and construction companies interested in seismic assessment and retrofit of historical constructions, such as EdilCam or ARUP.

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Napoli, 15/06/2023

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 **il 30/06/2023.**