**UNIVERSITY OF NAPLES FEDERICO II**

**DEPARTMENT OF STRUCTURES FOR ENGINEERING AND ARCHITECTURE**
**PHD PROGRAM IN**
**STRUCTURAL, GEOTECHNICAL ENGINEERING AND SEISMIC RISK**

# CYCLE XXXVIII

The undersigned prof. Fulvio Parisi (PO □ PA ■ Researcher □) at the Department of Structures for Engineering and Architecture (S.S.D. ICAR/09 Structural Engineering)

ASKS

To be included in the list of PhD tutors for cycle XXXVIII.

## 1. Curriculum vitae (max 500 words)

Fulvio Parisi is Associate Professor of Structural Engineering at University of Naples Federico II, Italy, and Associate Researcher of the National Research Council of Italy (CNR).
He teaches the courses entitled "Design and Retrofit of Masonry Structures" and "Diagnosis and Therapy of Structural Failures", giving many invited lectures in different universities and research centres across Europe and USA. He is a Scientific Board Member and teacher of "Structural Failures and Collapses" in the post-graduate MSc Programme in Forensic Engineering.
He is Associate Editor of 3 international journals and Editorial Board member of 4 international journals. In almost 20 research projects, his research mainly focused on the following topics: multi-hazard vulnerability of reinforced concrete and masonry structures; innovative structural retrofitting with composite materials; soil-structure interaction; structural robustness; structural health monitoring of existing structures; and risk and resilience of civil infrastructure to natural and man-made hazards. Since 2018, he is expert reviewer of the Italian Ministry for University and Research.
He authored over 150 papers in peer-reviewed journals and conference proceedings, 1 book, 12 book chapters, 33 reports, and 3 computer tools for seismic analysis of masonry buildings and experimental data selection of masonry properties. He edited 2 books and is guest editor of 4 journal special issues (2 ongoing).
His research outcomes received the following awards and recognitions: Young researcher award by Macedonian Association for Earthquake Engineering in the framework of the 14th European Conference on Earthquake Engineering (2010); 2 articles among the most cited papers in Engineering Structures (2019, 2020); 1 article among the most cited papers in ASCE Journal of Performance of Constructed Facilities (2018); 1 article among the most cited papers in Engineering Failure Analysis (2017); article "Learning from construction failures due to the 2009 L'Aquila, Italy, earthquake"

among the best 2010 papers of Journal of Performance of Constructed Facilities (2011). Some studies authored by Fulvio Parisi were implemented or cited in guidelines published by the American Concrete Institute (ACI) and CNR.
He was a scientific or organizing committee member of more than 15 international conferences, and coordinator or member of working groups in several associations and standard bodies, such as Fédération Internationale du Béton (fib), CNR, Comité Européen de Normalisation (CEN), and Ente Nazionale di Normazione (UNI).
In 2019, he founded the spin-off company FORENSICS srl (FORensic ENgineering ServICeS), where he is Head of Civil and Risk Engineering services.
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, this recognition was confirmed, including Dr. Parisi in the list of World's Top Scientists for both career-long and single-year impacts.

| **2. PhD students of whom the undersigned has been a tutor in the last three years** | |
|---|---|
| n. 3 | Martina Scalvenzi (34th cycle, ministerial grant, graduated in 2022)<br>Giacomo Miluccio (35th cycle, grant funded by research project)<br>Valentina Buonocunto (37th cycle, ministerial grant) |

| **3. Topic of the proposed research** |
|---|
| Advanced computational strategies for collapse analysis of masonry structures |

| **4. Field of study** |
|---|
| Geotechnical Engineering □<br>Structural Engineering ■<br>Seismic Risk □ |

## 5. Summary of the research project (max 500 words. State of the art, short program planned for the activities, etc.)

Natural, accidental and man-made events often produce disproportionate collapse of building structures, resulting from propagation of local damage to single or few structural components. It is frequently observed that this type of structural collapse is caused by extreme events, such as earthquakes, landslides, explosions, vehicle impacts, fires and human errors (even during construction). Together with non-structural measures based on hazard and exposure reduction, the risk of disproportionate collapse can be mitigated through appropriate levels of structural robustness, which allows the structural system to redistribute loads in the event of heavy damage to load-bearing elements. Despite the huge number of theoretical and experimental studies on reinforced concrete, steel and composite steel-concrete structures, the structural robustness of masonry buildings urgently needs to be investigated. Masonry buildings – some of them being used even as critical infrastructures such as schools, hospitals, institutional buildings, and military buildings – often suffer progressive collapse due to, for example, soil settlements, blast, fire, and impact. Some cases of partial or total collapse have also been observed after improper maintenance or structural retrofitting.

This research project will deal with progressive collapse simulation and robustness assessment of different types of masonry buildings, encompassing a variety of masonry technologies and building archetypes that are a large percentage of the built heritage. The research will make use of different computational strategies, including limit equilibrium analysis, nonlinear macro-element methods, and numerical methods. Special emphasis will be given on the implementation of discontinuum-based computational models, such as the discrete element method and applied element method. Several factors such as the building geometry, structural detailing, material degradation and type of floor and roof systems will be taken in due consideration.

## 6. Research publications

Varum H., Parisi F., Tarque N., Silveira D. (editors, 2021). Structural characterization and seismic retrofitting of adobe constructions: Experimental and numerical developments. Springer Nature, Switzerland, ISBN: 978-3-030-74736-7.

Losanno D., Ravichandran N., Parisi F. (2021). Comparative assessment of finite element macro-modelling approaches for seismic analysis of non-engineered masonry constructions. Bulletin of Earthquake Engineering, 19(13): 5565-5607.

Augenti N., Parisi F. (2019). Teoria e Tecnica delle Strutture in Muratura. Hoepli, Milano.

Parisi F., Balestrieri C., Varum H. (2019). Nonlinear finite element model for traditional adobe masonry. Construction and Building Materials, 223: 450-462.

Adam J., Parisi F., Sagaseta J., Lu X. (2018). Research and practice on progressive collapse and robustness of building structures in the 21st century. Engineering Structures, 173: 122-149.

Parisi F., Sabella G., Augenti N. (2016). Constitutive model selection for URM cross sections based on best-fit analytical moment–curvature diagrams. Engineering Structures, 111: 451-466.

Parisi F., Balestrieri C., Asprone D. (2016). Nonlinear micromechanical model for tuff stone masonry: Experimental validation and performance limit states. Construction and Building Materials, 105: 165-175.

Parisi F., Balestrieri C., Asprone D. (2016). Blast resistance of tuff stone masonry walls. Engineering Structures, 113: 233-244.

Parisi F., Lignola G.P., Augenti N., Prota A., Manfredi G. (2013). Rocking response assessment of in-plane laterally-loaded masonry walls with openings. Engineering Structures, 56: 1234-1248.

Augenti N., Parisi F. (2010). Constitutive models for tuff masonry under uniaxial compression. ASCE Journal of Materials in Civil Engineering, 22(11): 1102-1111.

## 7. Funded research projects in which the proposed research fits

The research activity is connected to a number of numerical investigations and experimental tests, which are underway within the following research projects:

- ReLUIS-DPC 2022–2024 (WP4 "Risk Maps and Seismic Damage Scenarios" and WP10 "Contributions to building codes for masonry structures");
- PRIN DETECT-AGING "Degradation Effects on sTructural safEty of Cultural heriTAGe constructions through simulation and health monitorING".

## 8. Funds available for research grants, equipment, missions, etc.

The research activity will mainly consist of numerical research, which is supported by the above-mentioned research projects. Such projects also provide funding for equipment and participation in meetings, workshops, and conferences.

## 9. Information related to the research period abroad (min. 3 months) provided for the PhD student (max 300 words)

The PhD student is expected to spend at least 4 months in a foreign research institution, such as:

- Carleton University (Canada) in cooperation with Dr. Bora Pulatsu (bora.pulatsu@carleton.ca), who is Assistant Professor of Structural Mechanics with expertise in both continuum- and discontinuum-based numerical methods for nonlinear response analysis of masonry structures.
- Imperial College London (UK) under supervision of Prof. Bassam Izzuddin (b.izzuddin@imperial.ac.uk), who is Professor of Computational Structural Mechanics with expertise in advanced nonlinear finite element analysis and multi-scale modelling of masonry structures.
- University of Minho (Portugal) under supervision of Prof. Paulo B. Lourenço (pbl@civil.uminho.pt), who is Professor of Structural Mechanics and Co-Head of the Institute of Sustainability and Innovation in Structural Engineering, with expertise in nonlinear response analysis, experimental testing, and retrofitting of masonry structures.

**10. Collaborations with companies on the research topic (if available) (max 300 words)**

The research activity will be carried out in cooperation with Applied Science International Europe s.r.l. (URL: https://www.appliedscienceint.com/), which provides various types of structural engineering services such as consulting, testing and software development for design, construction, forensic analysis and controlled demolition of structures and infrastructures (buildings, stadiums, large roofs, towers, industrial structures, bridges, etc.). Such a company developed the Extreme Loading for Structures® software, which is based on the applied element method for nonlinear dynamic analysis of structures under natural or human actions.
According to an agreement between the University of Naples Federico II and Applied Science International Europe s.r.l., which co-funded a PhD grant together with the Italian Ministry of University and Research (as per D.M. n. 352/2022), the PhD student will spend 12 months to work with the above-mentioned company.

Napoli, 07/20/2022

SIGNATURE



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This form must be filled and sent to the e-mail address phd.dist@unina.it by 07/20/2022.