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. 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),

CHIEDE

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

1. Curriculum sintetico dei proponenti (max 500 parole)

Dr. Fulvio 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	
n. 5	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
Multi-risk resilience assessment of school buildings supported by digital technologies and data-driven techniques

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)*
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)

The research project aims at developing efficient algorithms to evaluate the resilience of school buildings with respect to multiple critical events, natural or man-made, individual or cascading.

The use of various enabling technologies of the Industry 4.0 plan is envisaged, such as:

- numerical simulations;
- cloud platforms for data collection, transmission and processing;
- big data analytics, including data-driven algorithms that learn from real or simulated data, returning future predictions.

The data processing will be performed using the high-performance computing SCOPE platform at University of Naples Federico II, also considering monitoring data relating to some school buildings (for example, those monitored by the Seismic Observatory of Structures).

The research project moves along the lines of the National Recovery and Resilience Plan (PNRR), specifically the national priority technological development trajectory "*Systems for the safety of the urban environment, environmental monitoring and the prevention of critical or risk events*". That trajectory originates from the intersection of the national thematic area "*Digital Agenda, Smart Communities, intelligent mobility*" with the "*Smart, Secure and Inclusive Communities*" area of the National Smart Specialization Strategy.

Multi-risk analysis responds to the need to evaluate and mitigate the consequences of potentially harmful future events, considering the limited economic resources for a rational planning of investments relating to the construction of new buildings and also to the management of existing works. The analysis of structural safety to multiple hazards is motivated by the increasing frequency of disasters, due to the rising levels of seismic and hydrogeological hazards of the territory, degradation of buildings, and urbanization.

The methodology is based on:

- models of actions due to extreme hazards (earthquakes, landslides, floods, etc.);
- advanced structural models for building analysis considering structural strength resources;
- high-performance computing platforms;
- machine learning algorithms;

- validation of the algorithms on real case studies.

The expected degree of innovation is considered very high, since the proposed methodology and the achievable results move in the direction of PNRR, with the aim of significantly improving the management of the structural safety of school buildings through advanced simulations, artificial intelligence and digital technologies. In this context, it should be noted that school buildings can not only be "critical structures" in relation to socio-economic consequences of their collapse, but are even "strategic structures" due to their key role in disaster emergency management, with high impact on resilience of urban centres. The innovation of the research project is thus also connected to the possibility of evaluating disaster consequences in aggregate terms, not only on individual school buildings but on the community they serve. This objective will be pursued via the combined use of physics-based and data-driven simulations using advanced software and cloud computing platforms.

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

Bozza A., Asprone D., Parisi F., Manfredi G. (2017). Alternative resilience indices for city ecosystems subjected to natural hazards. Computer-Aided Civil and Infrastructure Engineering, 32(7): 527-545.

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.

Brunesi E., Nascimbene R., Parisi F., Augenti N. (2015). Progressive collapse fragility of reinforced concrete framed structures through incremental dynamic analysis. Engineering Structures, 104: 65-79.

Brunesi E., Parisi F. (2017). Progressive collapse fragility models of European reinforced concrete framed buildings based on pushdown analysis. Engineering Structures, 152: 579-596.

Feng D.-C., Zhang M.-X., Brunesi E., Parisi F., Yu J., Zhou Z. (2022). Investigation of 3D effects on dynamic progressive collapse resistance of RC structures considering slabs and infill walls. Journal of Building Engineering, 54: 104421.

Galasso C., Pregnolato M., Parisi F. (2021). A model taxonomy for flood fragility and vulnerability assessment of buildings. International Journal of Disaster Risk Reduction, 53: 101985.

Parisi F., Sabella G. (2017). Flow-type landslide fragility of reinforced concrete framed buildings. Engineering Structures, 131: 28-43.

Parisi F., Scalvenzi M. (2020). Progressive collapse assessment of gravity-load designed European RC buildings under multi-column loss scenarios. Engineering Structures, 209: 110001.

Parisi F., Scalvenzi M., Brunesi E. (2019). Performance limit states for progressive collapse analysis of reinforced concrete framed buildings. Structural Concrete, 20(1): 68-84.

Scalvenzi M., Ravasini S., Brunesi E., Parisi F. (2023). Progressive collapse fragility of substandard and earthquake-resistant precast RC buildings. Engineering Structures, 275: 115242.

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

The research activity is associated with multi-hazard/multi-risk assessment studies performed in the framework of several research projects, such as DPC-ReLUIS 2022–2024, PNRR CN MOST, PNRR PE3 RETURN, and PRIN 20222 FAIL-SAFE.

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

The research activity will mainly consist of numerical research, which is 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 proposed research involves a period of 6 months at University College London, with registered office in London (UK), Gower Street, WC1E 6BT.
The tutor will be Prof. Carmine Galasso at the Department of Civil, Environmental and Geomatic Engineering (https://www.ucl.ac. uk/civil-environmental-geomatic-engineering/), assumed as the main operational headquarters located in London (UK), Kings Cross, WC1E 6DE.

The department deals with civil engineering issues with a multi-disciplinary approach, configuring it as an international center of excellence on risk and resilience of the built environment and people to disasters.
The activity involves the review and selection of optimal machine learning algorithms, for subsequent use in multi-risk probabilistic analysis of structures.
The high level of expertise available in the research group is documented by publications, scientific consulting services to important public and private clients, as well as participation in research projects on the topic of this research project. Specifically, the group recently worked on development of surrogate models based on machine learning techniques for vulnerability and risk assessment. The activity envisaged at this university is, therefore, the identification and calibration of mathematical models that can be applied not only to the seismic engineering sector, but to the wider multi-risk civil engineering sector.

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

The PhD student will spend 6 months at ARUP Italia s.r.l., with registered and operational headquarters in Milan at Corso Italia n.1, CAP 20122 (tel. 0285979301; email milan@arup.com; website https:/ /www.arup.com/offices/italy). The tutor will be Dr. Barbara Polidoro who is Associate at ARUP with expertise in risk assessment.
ARUP is an international engineering company that deals with design, planning and project management, capable of offering a wide range of professional services worldwide. The innovative and integrated approach of the company is based on proven skills and abilities, thanks to which the group is able to propose effective solutions for any type of problem. ARUP has been exerting a strong influence on the built environment for many years and is the creative force behind many of the most innovative and sustainable facilities built in recent decades all around the world.
The activity at ARUP would be divided into the following phases:

1) identification of real school buildings;
2) collection of data on geometry, materials and use of the selected buildings;
3) numerical simulations for structural performance assessment under extreme actions;
4) validation of simulation results against real data on behavior and/or damage to the structures.

Phase 1 will be crucial for the effective achievement of the purpose of the proposed research. The large database available at ARUP will allow for selection of case studies

with multi-risk issues. Nonetheless, the research group at University of Naples Federico II will collect and share additional data on school buildings located in Italy.

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.**