

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. GENNARO MAGLIULO

(PO D PAX RU D RTD D) afferente al Dipartimento di

S.S.D. (indicare codice e nome per esteso) ICAR/09 - Tecnica delle costruzioni

CHIEDE

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

1. Curriculum sintetico del proponente (max 500 parole)

Gennaro Magliulo is Associate Professor of Structural Design at the Department of Structures for Engineering and Architecture (DIST) of University of Naples Federico II since 2018. He is qualified for Italian Full Professorship of "Structural Design" since 2019 and is affiliate researcher at the Construction Technologies Institute of the National Research Council since 2016. Prof. Magliulo was awarded PhD in Structural Engineering at University of Naples Federico II, discussing a thesis titled "Seismic behavior of RC frame buildings with plan irregularities" in 2001.

At DIST, prof. Magliulo teaches two master's degree courses: Precast Structures and Healthcare Facilities. He is currently tutor of a PhD student in the frame of the doctorate in Structural and Geotechnical Engineering and Seismic Risk at the University of Naples Federico II. Prof. Magliulo was tutor of ten PhD students, seven in the frame of the doctorate in Seismic risk at University of Naples Federico II, one in the frame of the doctorate in Engineering of Materials and Structures at the same university, and two in the frame of the doctorate in Environmental Phenomena and Risks at the University of Napes Parthenope. He also taught the course of Seismic Analysis of Buildings within the doctorate in Seismic Risk. He is currently member of the board of doctorate in Biology and Applied Sciences at University of Molise. Prof. Magliulo was tutor of more than 100 master's students in the frame of their thesis projects and supervised more than 50 final year internships.



DIPARTIMENTO DI STRUTTURE PER L'INGEGNERIA E L'ARCHITETTURA CORSO DI DOTTORATO DI RICERCA IN INGEGNERIA STRUTTURALE GEOTECNICA E RISCHIO SISMICO

Prof. Magliulo is author of 7 patents and more than 200 articles, and more than 50 of them were published in international peer reviewed journals. Prof. Magliulo is reviewer for several international peer reviewed journals, is member of the editorial board of Bulletin of New Zealand Society for Earthquake Engineering and currently editor of a special issue to be published by the Journal of Earthquake Engineering on Seismic Performance of Nonstructural Elements and Systems. His research concerns earthquake engineering and dynamics of structures, nonstructural components, RC structures and precast structures, in the fields of theoretical modelling, numerical analysis, experimental research and code activity.

Prof. Magliulo has been principal investigator of more than 20 international and national research projects, funded by either public or private entities. He is member of the board of ACI Italy Chapter and of "Seismic Performance Of Non-structural Element" association, and member of the fib committee TG 6.17 "Retrofitting and repairing of precast structures in seismic areas". He is also member of ACI and of the European Association of Earthquake Engineering.

2. Dottorandi dei quali il proponente è stato tutor nell'ultimo triennio	
n2	PhD Course in Structural and Geotechnical Engineering and Seismic Risk, University of Naples Federico II
	• TUOZZO FEDERICO - XXXVIII cycle ZITO MARTINO - XXXV cycle
n2	 PhD Course in Environmental Phenomena and Risks, University of Napes Parthenope DI SALVATORE CHIARA – XXXIV cycle PICCOLO VALERIA - XXXIV cycle



DIPARTIMENTO DI STRUTTURE PER L'INGEGNERIA E L'ARCHITETTURA CORSO DI DOTTORATO DI RICERCA IN INGEGNERIA STRUTTURALE GEOTECNICA E RISCHIO SISMICO

3. Titolo della ricerca proposta

Systemic resilience of hospital and healthcare facilities considering seismic response and functional adaptability

4. Area tematica

Ingegneria Geotecnica 🛛

Ingegneria Strutturale X

Rischio Sismico X

5. Tipologia di borsa per la quale si propone il progetto

Ateneo X

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) 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)



DIPARTIMENTO DI STRUTTURE PER L'INGEGNERIA E L'ARCHITETTURA CORSO DI DOTTORATO DI RICERCA IN INGEGNERIA STRUTTURALE GEOTECNICA E RISCHIO SISMICO

To achieve adequate resilience of healthcare and hospital (HHF) facilities is among the most critical challenges for modern communities [1,2]. The resilience of a critical facility can be expressed considering three aspects or capacities: (a) reduced failure probability, (b) reduced consequences from failure, and (c) reduced time to recovery [3].

The physical performance of HHFs affects capacities (a) and (b) and pertains to the structural parts and, in some cases, the nonstructural elements. Functional adaptability can be defined as the capacity to adapt to rapid/economic rearrangement due to sudden changes and demand redistribution without compromising the operativity; functional adaptivity affects capacity (c).

The project aims to develop new methodologies, engineering solutions, and applicative/technical recommendations for the resilience enhancement of HHFs in Italy/Europe, with focus on nonstructural elements. The project addresses capacities (a), (b), and (c). The aim will be achieved by implementing the combination of observational, experimental, theoretical, and numerical methods, following a comprehensive/multi-disciplinary approach.

Two sets of key measures will be investigated: structural/seismic performance and functional adaptivity of nonstructural elements and equipment of HHFs. Functional adaptivity represents the capacity of nonstructural elements to be adapted to alternative arrangements/conditions, due to relatively rapid necessity changes (e.g., reorganization of wards due to an earthquake). Both sets of measures will be quantitatively evaluated considering a local-to-global perspective, integrating them to the functioning conditions of HHFs. The nonstructural elements of interest will consist in architectural, mechanical/electrical/electronic, hydraulic components, including medical and hospital equipment and accounting for functioning condition; both single element and complex systems/networks will be accounted for.

The research activities of the PhD student will consist in the following tasks.

a) Critical assessment of existing literature and codes/guidelines (months 1 to 6).

b) Field inspection and observational analysis in selected HHFs (months 1 to 12).

During the first year, the PhD will carry out a research period at the Hospital of Caserta (AORN Sant'Anna e San Sebastiano), in order to perform the abovementioned activities.

c) Development of novel efficient methods and reliable/robust models to estimate integrated resilience of HHFs (months 6 to 18).

During the second year, the PhD may carry out research period at the Construction Technologies Institute (ITC) of the National Research Council (CNR), to possibly ease and strengthen the abovementioned research activities, possibly collaborating with industrial companies and administrative offices.

d) Assessment and evaluation of the resilience of existing case study facilities (months 12 to 24), considering both seismic performance and function adaptivity.



DIPARTIMENTO DI STRUTTURE PER L'INGEGNERIA E L'ARCHITETTURA CORSO DI DOTTORATO DI RICERCA IN INGEGNERIA STRUTTURALE GEOTECNICA E RISCHIO SISMICO

e) Development of resilience enhancement methodologies, engineering solutions/technologies, and technical recommendations (months 24 to 36).

During the second year, the PhD will undertake a six-month research fellowship at an abroad university, supervised by an internationally recognized expert in the field; this period will allow to finalize and validate the research activities.

References

- Masi, A., Santarsiero, G., Gallipoli, M.R., Mucciarelli, M., Manfredi, V., Dusi, A., Stabile, T.A., 2014. Performance of the health facilities during the 2012 Emilia (Italy) earthquake and analysis of the Mirandola hospital case study. Bulletin of Earthquake Engineering 12, 2419–2443. https://doi.org/10.1007/s10518-013-9518-4
- Ministero delle Infrastrutture e dei Trasporti, 2018. D.M. del 17/01/2018 "Aggiornamento delle Norme tecniche per le Costruzioni 2018" NTC 2018 (in Italian).
- 3. Rose, A., Liao, S.-Y., 2005. Modeling Regional Economic Resilience to Disasters: A Computable General Equilibrium Analysis of Water Service Disruptions*. J Regional Sci 45, 75–112. https://doi.org/10.1111/j.0022-4146.2005.00365.x

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

- Cosenza, E., Di Sarno, L., Maddaloni, G., Magliulo, G., Petrone, C., Prota, A., 2015. Shake table tests for the seismic fragility evaluation of hospital rooms. Earthquake Engineering & Structural Dynamics 44, 23–40. https://doi.org/10.1002/eqe.2456
- D'Angela, D., Magliulo, G., Cosenza, E., 2021a. Seismic damage assessment of unanchored nonstructural components taking into account the building response. Structural Safety 93, 102126. https://doi.org/10.1016/j.strusafe.2021.102126
- D'Angela, D., Magliulo, G., Cosenza, E., 2021b. Towards a reliable seismic assessment of rocking components. Engineering Structures 230, 111673. https://doi.org/10.1016/j.engstruct.2020.111673
- Di Sarno, L., Magliulo, G., D'Angela, D., Cosenza, E., 2019. Experimental assessment of the seismic performance of hospital cabinets using shake table testing. Earthquake Engineering & Structural Dynamics 48, 103–123. https://doi.org/10.1002/eqe.3127
- Di Sarno, L., Petrone, C., Magliulo, G., Manfredi, G., 2015. Dynamic properties of typical consultation room medical components. Engineering Structures 100, 442– 454. https://doi.org/10.1016/j.engstruct.2015.06.036



DIPARTIMENTO DI STRUTTURE PER L'INGEGNERIA E L'ARCHITETTURA CORSO DI DOTTORATO DI RICERCA IN INGEGNERIA STRUTTURALE GEOTECNICA E RISCHIO SISMICO

- Magliulo, G, Pentangelo, V., Maddaloni, G., Capozzi, V., Petrone, C., Lopez, P., Talamonti, R., Manfredi, G., 2012. Shake table tests for seismic assessment of suspended continuous ceilings. Bulletin of Earthquake Engineering 10, 1819–1832. https://doi.org/10.1007/s10518-012-9383-6
- Magliulo, G., Petrone, C., Capozzi, V., Maddaloni, G., Lopez, P., Talamonti, R., Manfredi, G., 2012. Shake table tests on infill plasterboard partitions. The Open Construction & Building Technology Journal 155–63.
- Petrone, C., Di Sarno, L., Magliulo, G., Cosenza, E., 2017. Numerical modelling and fragility assessment of typical freestanding building contents. Bulletin of Earthquake Engineering 15, 1609–1633. https://doi.org/10.1007/s10518-016-0034-1
- Petrone, Crescenzo, Magliulo, G., Manfredi, G., 2017. Shake table tests on standard and innovative temporary partition walls. Earthquake Engineering & Structural Dynamics 46, 1599–1624. https://doi.org/10.1002/eqe.2872
- Zito, M., D'Angela, D., Maddaloni, G., Magliulo, G., 2022. A shake table protocol for seismic assessment and qualification of acceleration-sensitive nonstructural elements. Computer aided Civil Eng mice.12951. https://doi.org/10.1111/mice.12951

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

- Research project PRIN "ENRICH: ENhancing the Resilience of Italian healthCare and Hospital facilities" (2022-2025), funded by MUR. National coordinator: Prof. Gennaro Magliulo.
- Research project "ReLUIS 2022-2024 WP17: Contributi normativi relativi a Componenti non strutturali" (2022-2024), funded by DPC and ReLUIS. Research unit coordinator (UNINA-Magliulo): Prof. Gennaro Magliulo.

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

• Research project PRIN "ENRICH: ENhancing the Resilience of Italian healthCare and Hospital facilities" (2022-2025), funded by MUR. National coordinator: Prof. Gennaro Magliulo.



DIPARTIMENTO DI STRUTTURE PER L'INGEGNERIA E L'ARCHITETTURA CORSO DI DOTTORATO DI RICERCA IN INGEGNERIA STRUTTURALE GEOTECNICA E RISCHIO SISMICO

• Research project "ReLUIS 2022-2024 WP17: Contributi normativi relativi a Componenti non strutturali" (2022-2024), funded by DPC and ReLUIS. Research unit coordinator (UNINA-Magliulo): Prof. Gennaro Magliulo.

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 course will include a period of six months of visiting research among an internationally recognized university, under the supervision of expert academics. The research period will be carried out during the last year of PhD. In particular, Prof Magliulo collaborates with several international universities and research groups in the field of seismic assessment of structures and nonstructural elements, which would be potential hosts/co-supervisor in the framework of research period abroad for the PhD student. The following options would be suitable for arranging the abroad period of the PhD student.

- Prof. Gilberto Mosqueda, University of California San Diego (USA); <u>gmosqueda@ucsd.edu</u>. Prof. Mosqueda is among the most recognized experts in earthquake engineering, structural dynamics, and seismic assessment of structural and nonstructural elements.
- Prof. Rajesh Dhakal, University of Canterbury (New Zealand); <u>rajesh.dhakal@canterbury.ac.nz</u>. Prof. Dhakal is among the most recognized experts in the field of performance-based earthquake engineering, seismic assessment of nonstructural elements, and seismic losses.
- Dr. Marianna Ercolino, University of Greenwich (UK); <u>m.ercolino@gre.ac.uk</u>. Dr. Ercolino is a young researcher, expert in seismic assessment of structures and numerical modeling.

The research abroad will be carried out during the third year of the PhD course, and it will be aimed at deepening, extending, and validating the research activities implemented in the course of the first part of the PhD. Possibly, experimental activities will be carried out at the hosting universities, according to the compatibility with the evolution of the studies.

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

The PhD course will include a period of six months of visiting research at the Azienda Ospedaliera di Rilievo Nazionale (AORN) Sant'Anna e San Sebastiano, Caserta. The activity



DIPARTIMENTO DI STRUTTURE PER L'INGEGNERIA E L'ARCHITETTURA CORSO DI DOTTORATO DI RICERCA IN INGEGNERIA STRUTTURALE GEOTECNICA E RISCHIO SISMICO

will be carried out during the first year of PhD study. In particular, the PhD will inspect and collect the relevant information to be processed and elaborated to assess the resilience of the hospital facility. The direct data collection and the collaboration with the hospital will contribute to define robust and relevant scenarios to assess, also accounting for the perspectives of the hospital stakeholders. The PhD will interact with technical staff (technical and safety offices), medical/paramedical personnel, and patients in order to develop a comprehensive perspective and to accommodate the actual requirements and needs.

Prof. Magliulo already collaborates with the abovementioned hospital in the framework of the PRIN ENRICH project (please, see Sections 8 and 9), coordinated by him. Prof. Magliulo already organized and supervised several internships at the Caserta hospital for master's students in the framework of extra-moenia internships.

As an additional research internship, the PhD may include a period of 3 months at the Construction Technologies Institute (ITC) of the National Research Council (CNR), at the headquarter in San Giuliano Milanese (Milan). This research period would allow the PhD student to address the research topic in synergy with the ITC-CNR, which has a major national (and European) role on the structural and seismic qualification of structures and nonstructural components. ITC-CNR has strong connections with industrial partners and administrative processes, and this will strengthen the practical and operative nature of the research period.

Prof. Magliulo is an affiliate researcher at the ITC-CNR and has several connections and collaborations with ITC-CNR researchers and industrial companies.

The research period at the ITC-CNR may be carried out during the second year of the PhD course, and it will be aimed at defining technical and administrative processes to assess and improve the seismic resilience of hospital and healthcare facilities and components, also with regard to qualification and certification procedures.

Napoli, 27/06/2023

FIRMA

Il presente modulo va compilato in ogni sua parte ed inviato all'indirizzo di posta elettronica <u>phd.dist@unina.it</u> entro e non oltre **il 30/06/2023.**