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. Andrea Prota

(PO x 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 inserito nell'elenco dei tutor per il XXXIX ciclo.

1. Curriculum del proponente (max 500 parole)

Andrea Prota is Full Professor of Structural Engineering, Head of the department of Structures for Engineering and Architecture, received his PhD in Civil Engineering in the 1998 at the University of Napoli Federico II. His research activities consists in the theoretical and experimental research in the following fields: nonlinear behavior of reinforced concrete and masonry structures, seismic retrofit of concrete and masonry structures with composites, behavior of concrete structures reinforced with composite bars, reinforcement bars behavior under monotonic and cyclic compression actions, polymeric and composite structures, protection of structures subjected to fast dynamic loads, strategies and techniques to reduce seismic risk of built environment. He is currently member of: ACI 440, head of the subcommitee 400M; fib TG 5.1; RILEM TC on Composite Materials, ISO/TC 71 /SC 6, CNR DT 200, DT 203, fib bulletin 14,40, 90, ACI 440. ASTM D7331. Coordinator of the WP 2 Reinforced Concrete Structures within the DPC-ReLUIS project 2014-2016, 2016-2018.
He was involved in many research projects founded by national or international agencies or private companies. In particular: coordinator of the DPC-ReLUIS PI 2019-2021 and 2022-2024 WP5, scientific coordinator of the research projecta: METRICS, STRIT, PROVACI, MACE, MAMAS, SAS, ENCORE, PON MITRAS, PON TEMPES. Scientific coordinator of the project for Research and Development of Mapei products: "Applicability and validation of the FEM modeling for different thermal insulation of exterior enclosure"; Scientific coordinator for the National Railway Network "Seismic assessment of the RC buildings and arch vault bridges, development and management of the database"; Scientific coordinator Schnell S.p.A. for "Scientific Consultancy for seismic experimental testing of a building made of mock-up Concrewall EVO panels". Reviewer of Technical Papers for: ASCE Journal of Composites for Construction, ASCE Journal of Structural Engineering, ACI

Structural Journal, ACI Material Journal, Bulletin of Earthquake Engineering, Composites Part B, Engineering Structures, Composite Structures, Construction and Building Materials. He is author of more than 600 publications, with more than 200 ISI papers.

Marco Gaetani d'Aragona is currently Research Fellow - RTD-A - of Structural Engineering at the Department of Structures for Engineering and Architecture of the University of Naples Federico II. He graduated in Structural and Geotechnical Engineering in 2011 and received his Ph.D. in Materials Engineering and Structures in 2015 at the same university, working on post-earthquake assessment of non-ductile buildings.
He is involved in several multidisciplinary research activities mainly focused on the seismic assessment of reinforced concrete buildings, including: finite element modeling, simplified mechanical modeling, vulnerability assessment and definition of large scale frameworks for the assessment of seismic performances of existing and retrofitted building typologies, seismic loss assessment and optimal retrofit strategies. He was visiting research scholar at the University of British Columbia (Canada).
He is active member of research projects dealing with computational mechanics and dynamics, inventory of existing building typologies, seismic risk assessment of as-built and retrofitted infilled RC buildings, vulnerability assessment of reinforced concrete buildings.
He is author of more than 30 scientific papers published in international peer-reviewed journals or presented at international conferences, and 2 book chapters.

2. Dottorandi dei quali il proponente è stato tutor nell'ultimo triennio

*n. __1_*	Molitierno Carmine (PhD program in Structural and Geotechnical Engineering and Seismic risk, XXXVI cicle, ongoing); grant: Ateneo
*n. __2_*	Mele Annalisa (PhD program in Structural and Geotechnical Engineering and Seismic risk, XXXV cicle, ongoing); grant: Ateneo

3. Titolo della ricerca proposta

Seismic fragility assessment of existing Italian reinforced concrete bridges

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) □
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)

State of the Art

Recent disasters involving existing reinforced and prestressed concrete bridges have spotlighted the necessity of a systematic disaster risk reduction program.
Given the strategic role that bridges play in emergency management, the vulnerability reduction of the Italian infrastructural system has become a topic of strong interest for the scientific community. Specifically, there is a need for the definition of fragility curves for bridge typologies in as-built and retrofitted configurations to be adopted in large-scale vulnerability studies.
Several studies addressed the seismic assessment of individual bridges through nonlinear static or dynamic analysis, proposing fragility curves for individual structures. However, the development of fragility curves for each individual structure becomes unfeasible

when dealing with large bridge stocks due to the required computational effort. Therefore, a parametric statistical approach may be particularly advantageous to characterize the parameters affecting the bridge response. The derivation of fragility curves from a number of relevant geometrical or structural parameters taken from real case studies is of utmost importance for the accuracy of vulnerability assessment investigations as part of the decision-making process. Given such a characterization, one can simulate reliable data to represent additional structural configurations to fully characterize a wide range of bridges thus proposing reliable fragility functions properly accounting for the intra-class variability and the uncertainties affecting the bridge response in as-built and retrofitted configurations.

Objectives

The main goal of this PhD project is to develop fragility functions for existing reinforced concrete and prestressed concrete bridges classes, in as-built and retrofitted configuration, accounting for typical uncertainties in geometrical, mechanical properties, modeling, definition of damage states, and record-to-record variability.

Program

The PhD research activities will be focused on the seismic assessment of existing and retrofitted Italian bridges typologies. In particular, the following program is proposed:

- **1st year**: Study of the state-of-the-art of modeling techniques for the seismic assessment of existing bridges; understanding of the behavior of critical bridge components (e.g., abutments, column bent), of their mutual interaction (e.g., elastomeric pads, backwall-deck pounding), and with soil (e.g., abutment backfill); based on the acquisition of the Italian bridge asset, definition of suitable vulnerability classes based; definition of bridges archetypes, representative of the proposed bridge typologies, automated structural model generation via a simulated design procedure.
- **2nd year**: Modeling of uncertainties related to material, geometry, record selection, and to the analytical model; development of computationally-efficient analytical models for structural analysis of bridges; understanding of basic concepts for fragility assessment (e.g., cloud analysis, probabistic seismic demand model); sensitivity analysis to select most influencial parameters in vulnerability assessment of existing bridges; definition of main structural deficiencies for existing bridges, and selection of a set of suitable retrofit strategies to be employed on analytical models.
- **3nd year**: Selection of proper intensity measures and definition of damage limit

states at the component and/or system level; computation of seismic fragility curves for each bridge typology in as-built and retrofitted configuration under investigation accounting for uncertainties in modeling, structural and geometrical properties, definition of damage states, and record-to-record variability.

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

1. Crisci, G., Ceroni, F., Lignola, G. P., & **Prota, A**. (2022, April). Seismic response of RC deck-stiffened arch existing bridges. In AIP Conference Proceedings (Vol. 2425, No. 1, p. 360010). AIP Publishing LLC.
2. Crisci, G., Ceroni, F., Lignola, G. P., & **Prota, A**. (2021). Performance of existing reinforced concrete arch bridges under current non seismic loads. In the 8th ECCOMAS Thematic Conference on Computational Methods in Structural Dynamics and Earthquake Engineering, Athens, Greece, 28-30 June 2021.
3. Di Sarno, L., Da Porto, F., Guerrini, G., Calvi, P. M., Camata, G., & **Prota, A**. (2019). Seismic performance of bridges during the 2016 Central Italy earthquakes. Bulletin of Earthquake Engineering, 17(10), 5729-5761.
4. Di Sarno, L., Del Vecchio, C., Maddaloni, G., & **Prota, A**. (2017). Experimental response of an existing RC bridge with smooth bars and preliminary numerical simulations. Engineering Structures, 136, 355-368.
5. Miano, A., Jalayer, F., De Risi, R., **Prota, A**., & Manfredi, G. (2016). Model updating and seismic loss assessment for a portfolio of bridges. Bulletin of Earthquake Engineering, 14(3), 699-719.
6. Miano, A., Jalayer, F., De Risi, R., **Prota, A**., & Manfredi, G. (2015, July). A case-study on scenario-based probabilistic seismic loss assessment for a portfolio of bridges. In Proceedings of the 12th International Conference on Applications of Statistics and Probability in Civil Engineering, ICASP12 (pp. 12-15).
7. Cosenza, E., Manfredi, G., **Prota, A**., Fiorillo, A., Campanella, G., Del Vecchio, C., ... & Ruggiero, N. (2015). Seismic assessment of typical existing Italian RC bridges. In proceedings of the XVI Conference ANIDIS, L'Aquila, 13-17 September 2015.
8. Del Vecchio, C., Caruso M, C., Di Sarno, L., Kwon O, S., **Prota, A**., & Del Vecchio, C. (2015). Numerical Seismic Assessment of an Existing Bridge with Different Support Conditions. In the 5th International Conference on Computational Methods in Structural Dynamics and Earthquake Engineering (COMPDYN), (pp. 1024-1039).
9. Lignola, G. P., da Porto, F., **Prota, A**., & Manfredi, G. (2014). Evaluation of RC-arch Bridges and Main Parameters in Performance Assessment. Special Publication, 298, 1-22.
10. Tecchio, G., Zampieri, P., Da Porto, F., Modena, C., **Prota, A**., & Manfredi, G. (2012, September). Simplified assessment of railway masonry bridges seismic capacity. In Proceedings of 15th world conference on earthquake engineering, September (pp. 24-28).
11. Cuzzilla, R., Di Ludovico, M., **Prota, A**., & Manfredi, G. (2011). Seismic rehabilitation of RC bridges by using FRP and SRP: case study of a bridge in the south of Italy. Special Publication, 277, 1-20.
12. Lignola, G. P., **Prota, A**., Manfredi, G., & Cosenza, E. (2007, April). Strengthening of hollow

RC piers with composites: experimental tests and modelling. In 1ST US-Italy Seismic Bridge Workshop.

13. Fico, R., Galati, N., **Prota, A**., & Nanni, A. (2005). Design and construction of a bridge deck using mild and post-tensioned FRP bars. Special Publication, 230, 1121-1138.
14. Di Ludovico, M., Nanni, A., **Prota, A**., & Cosenza, E. (2005). Repair of bridge girders with composites: Experimental and analytical validation. ACI Structural Journal, 102(5), 639.
15. Stone, D., **Prota, A**., & Nanni, A. (2002, January). Performance evaluation of an FRP-reinforced concrete bridge. In Proc., 81st Annual Meeting.

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

- DPC-ReLUIS joint programme 2022-2024: Task 5.4 – Interventi di miglioramento ed adeguamento di ponti esistenti
- International Academic networks

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

- DPC-ReLUIS joint programme 2022-2024: Task 5.4 – Interventi di miglioramento ed adeguamento di ponti esistenti
- International Academic networks

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)

To be confirmed:

University of Patras: Dr. Thanasis C. Triantafillou (ttriant@upatras.gr) is Professor of Civil Engineering at the University of Patras, Greece. He is Deputy Head of the

Department of Civil Engineering and Director of Mechanics and Materials Technology Lab. Dr Triantafilou is the leader of UPATRAS research team which maintains research interests in the area of experimental mechanics of structural materials and structural components, strengthening techniques of RC and other structures based on innovative materials (e.g. FRPs, composites), innovative experimental techniques for the analysis of the mechanical behavior of structural components under monotonic and cyclic loading, development and production of new materials. The PhD student will spend his period at University of Patras (6 months in the second year) to understand concepts of mechanics of structural materials and structural components, and main strengthening techniques of RC structures based on the use of innovative materials. The goal is to acquire deep knowledge in innovative retrofit solutions to be applied to increase the ductility and capacity of existing RC bridges.

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

Napoli, 30/06/2023

FIRMA

Andrea Prota

Marco Gaetani d'Aragona

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.**