

# Insights in seismic fragility assessment: state of the art and future challenges

**26 Ottobre e 2 Novembre 2022**

Aula D ore 11:00-13.00, 14:00-16:00.

Via Don Carlo Gnocchi 3, Roma, 00166

Il seminario è disponibile anche per via telematica previa richiesta credenziali via email a [maria.zucconi@unicusano.it](mailto:maria.zucconi@unicusano.it)

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### Abstract

The total number of natural hazard-related disasters recorded worldwide, and the ensuing economic losses is approximately doubled in the last twenty years compared to the previous two decades (UNDRR, 2020: The human cost of disasters: an overview of the last 20 years - 2000-2019). The main consequence can be ascribed to the increasing exposure of people and assets in all countries faster than vulnerability has decreased (Sendai Framework for Disaster Risk Reduction 2015–2030), thus yielding a steady increase in impacts in on the economic, social, health, cultural and environmental sectors.

Against this background, reliable and integrated approaches allowing a better understanding of the dynamics behind natural disasters and improving the predictive models in quantifying risk are also calling to face multi-disciplinary approaches. Assessing and understanding disaster risk are the basis for the whole disaster risk management cycle facing the prevention, forecasting, emergency response and overcoming, and also encouraging the compliance with the existing safety-enhancing provisions of sectoral laws and regulations, and safety standards, and updating them, where needed.

A steady interest among researchers in the topic of seismic fragility assessment of residential and non-residential (i.e. school, hospitals) buildings in the last 40 years has produced an abundant and productive published literature. Advanced computational techniques and available resources have led to the development of different methodologies for fragility assessment. This seminar presents a review of the different methodologies developed for seismic fragility assessment of buildings along with their features, limitations and applications. The seminar presents a review of available methodologies and identifies opportunities for future development.

Moreover, the possible decision support tools to identify the potential seismic risk and consequences during and after an earthquake are handled in the seminar, aiming at the assessment of additional impact indicators commonly used for civil protection purposes, to set up and enforce response and mitigation strategies for reducing earthquake losses, but also to enhance preparedness measures and emergency planning

A specific focus is made in the seminar to the last National Risk Assessment NRA for Italy, developed at the end of 2018 by the Department of Civil Protection (DPC) in response to the specific requirement of the Sendai Framework for Disaster Risk Reduction 2015–2030, where six research units belonging to two

Centers of Competence of the DPC, (ReLUIS - Network of university laboratories for seismic engineering - and EUCENTRE - European Centre for Training and Research in Earthquake Engineering), collaborated under the guidance and coordination of DPC to produce the recent updating of national seismic risk maps for the residential building stock.

Lastly, mentions to the web-gis platforms IRMA (*Italian Risk Maps*) and Da.D.O. (*Observed Damage Database*) are also made, allowing data sharing (from large post-earthquakes damage campaigns occurred in the past 50 years), methods and models for risk assessment. These platforms published by DPC, with the technical support of Eucentre, is addressed to Civil Protection Department users, members of the scientific community and Regions aimed to evaluate the seismic risk of Italian residential buildings.

## Short C.V.

### Professional Career

- 2011 Graduation in Civil Engineering, University of Napoli Federico II.
- 2015 PhD in Seismic Risk (Supervisor: prof. Gerardo M. Verderame), University of Napoli Federico II.
- 2015 – 2021 Postdoctoral Fellowship on “Seismic vulnerability assessment of Reinforced Concrete Buildings via simplified mechanical methods”, Department of Structures for Engineering and Architecture, University of Naples Federico II, Italy
- since 2021 Assistant Professor (Type A, Law 240/2010)  
Department of Structures for Engineering and Architecture, University of Naples Federico II, Italy

### Main Research Areas

Fragility assessment and consequent losses at urban scale using empirical and mechanical methods. Advanced nonlinear modelling and performance assessment of masonry infills in RC buildings under seismic loads

Seismic performance of retrofitted RC buildings

### Awards and Recognitions

Designation as expert in the scientific-disciplinary sector ICAR/09 Structural engineering, University of Naples Federico II, Italy.

Several designations of “Outstanding Publication” and “Most downloaded paper” in International indexed Journal in the fields of structural engineering.

### Scientific Guidance

2019 – 2021: Co-tutoring of PhD student – Department of Structures for Engineering and Architecture, University of Naples Federico II, Italy

### Publication Productivity

Total number of publications (since 2015): 32

Current h-index: 15

Total citations 540 by 320 documents.

### TEACHING ACTIVITIES

2011 – current: Teaching assistant – Structural engineering (prof. G.M. Verderame), University of Naples Federico II, Italy

2011 – current: Teaching assistant – Rehabilitation of existing structures (prof. G.M. Verderame), University of Naples Federico II, Italy

### ORGANISATION OF SCIENTIFIC MEETINGS AND RESEARCH TOPICS

2019: Organizer – Minisymposium on “Seismic risk assessment of building portfolios” – 7th ECCOMAS Thematic Conference on Computational Methods in Structural Dynamics and Earthquake Engineering (COMPDYN 2019) (Crete, Greece, June 24-26)

2021: Organizer – Minisymposium on “Recent findings and open issues in seismic performance assessment of as-built and retrofitted existing RC buildings” – 8th ECCOMAS Thematic Conference on Computational Methods in Structural Dynamics and Earthquake Engineering (COMPDYN 2021) (Athens, Greece, June 27-30)

2022: Organizer – Research Topic titled “Facing a holistic and forward-looking approach for a problem-solving and integrated disaster risk governance: insights into seismic fragility methods” in the International Journal *Frontiers in Built Environment* (Earthquake Engineering).

2023: Organizer – Minisymposium on “The role of the structural monitoring to predict the prior damage or the factual degradation pattern in order to update the seismic vulnerability of existing buildings” – 9th ECCOMAS Thematic Conference on Computational Methods in Structural Dynamics and Earthquake Engineering (COMPDYN 2023) (12-14 June 2023, Athens, Greece)

2023: Organizer – Minisymposium on “Insight in seismic performance of retrofitted buildings: feasibility and effectiveness of intervention in RC buildings” – 9th ECCOMAS Thematic Conference on Computational Methods in Structural Dynamics and Earthquake Engineering (COMPDYN 2023) (12-14 June 2023, Athens, Greece)

### **MAJOR COLLABORATIONS**

Proff. Mauro Dolce-Andrea Prota, support in drafting the “National Risk Assessment 2018”, coherently with EU decision 1313/2013 and responding to the specific requirement of the “Sendai Framework for Disaster Risk Reduction 2015–2030” to periodically adjourn the assessment of disaster risk, Department of Civil Protection, Italy

Proff. Angelo Masi-Sergio Lagomarsino, Fragility models for the residential building stock in Italy, Consortium of the Network of University Laboratories of Seismic and Structural Engineering, Italy

Proff. Angelo Masi-Serena Cattari, Fragility models for schools and other strategic or relevant buildings, Consortium of the Network of University Laboratories of Seismic and Structural Engineering, Italy

Prof G.M. Verderame, participation in the working group for technical-scientific advice on behalf of the Department of Structures for Engineering and Architecture for the drafting technical specifications for the safety checks of Rete Ferroviarie Italiane (R.F.I.) – within the research agreement 6/2011 between ReLUIS and R.F.I. (October - November 2013).

Prof G.M. Verderame, participation in the working group for technical-scientific advice on behalf of the Department of Structures for Engineering and Architecture for the derivation of a territorial information system for infrastructures of Azienda Sviluppo Industriale (ASI) of the province of Avellino, with consequent in-situ survey aimed at the identification of the main geometrical-typological characteristics and of their criticalities, for the prioritization of the interventions and the drafting of technical specifications for the safety checks of the artifacts.

Inarcassa Foundation, Support in drafting technical specifications for the development of a software to for the compilation of the inspection form within the project “1st National Day for Seismic Risk Reduction”.

Prof G.M. Verderame, support in the vulnerability classification of all the buildings occupied by the Italian State Police (Dipartimento di Pubblica Sicurezza) and in planning the seismic safety checks campaign and consequent retrofit interventions.

Prof G.M. Verderame, blind analysis on 3-D Full-Scale 10 Storeys RC buildings, nicknamed “E-Defense” in the city of Miki, to the north of Kobe, through the National Research Institute for Earth Science and Disaster Resilience (Japan) (NIED).