Advancements in vulnerability assessment and strengthening of historical constructions

MAHDI KIOUMARSI\*, Maria Zucconi†, Francesca Nerilli†
and Amirhosein Shabani\*

\*Department of Civil Engineering and Energy Technology, OsloMet—Oslo Metropolitan University

Pilestredet 35, Oslo 0166, Norway

mahdik@oslomet.no, amirhose@oslomet.no

<https://www.oslomet.no/en/about/employee/mahdik/>

<https://www.oslomet.no/om/ansatt/amirhose/>

†Faculty of Civil Engineering, Niccolò Cusano University

Via Don Carlo Gnocchi, 3 Roma, 00166 Roma (RM), Italy

maria.zucconi@unicusano.it, francesca.nerilli@unicusano.it

<https://ricerca.unicusano.it/author/maria-zucconi/>

<https://ricerca.unicusano.it/author/francesca-nerilli/>

**Key words:** Numerical Modeling, Soft Comuting Techniques, Heritage Buildings, Seismic Vulnerability Assessment, Masonry structures.

ABSTRACT

Recent studies underline the potential impact of exceptional hazards such as earthquakes and floods on cultural heritage sites, yield tremendous adverse effects on societies, economies, and politics. Historical masonry structures with complex architecture susceptible to earthquakes represent a large part of the building portfolio in high seismicity zones [1, 2]. Moreover, historical masonry arch bridges are also required to be preserved due to their importance as cultural heritage assets that carry lessons from the past generations and their functioning value as infrastructures. Historical masonry bridges were not originally built for the heavier current use, while there are serious concerns about their safety for societies [2]. Several aspects such as building materials, structural responses, strengthening strategies, resilience, and adaptation methodologies must be considered in the conservation of heritage structures [1]. The structural vulnerability assessment of heritage structures is particularly complex to evaluate because it is influenced by many factors, such as material properties, geometry, and their non-linear behavior [1].

Starting from the above premises, the main aim of this mini-symposium is to outline the recent advances in soft comuting and numerical modeling methods for the structural analysis of heritage construction, including historical buildings and bridges. In this perspective, the main relevant topics to be covered, but not limited to, are: advanced numerical models, soft comuting techniques, seismic assessment of historical constructions, non-linear static and dynamic analysis, design of strengthening interventions, including innovative and traditional technics, large-scale vulnerability analysis, and critical reviews.

**REFERENCES**

1. Shabani A, Kioumarsi M, Plevris V, Stamatopoulos H. Structural Vulnerability Assessment of Heritage Timber Buildings: A Methodological Proposal. *Forests*, (2020),11(8):881.
2. Shabani A, Kioumarsi M, Zucconi M. State of the art of simplified analytical methods for seismic vulnerability assessment of unreinforced masonry buildings. *Engineering Structures*, (2021),239:112280.