Special session on

Nonstructural Elements in Civil Engineering: Seismic Vulnerability, Risk, and Mitigation Strategies

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Nonstructural elements represent a significant share of both the economic value and functional importance of buildings and industrial facilities. Nevertheless, their seismic performance has often been underestimated in both design practice and regulations, especially when compared to structural components.

In residential and public buildings (such as hospitals, schools, offices), components like partition walls, ceilings, shelving systems, rigid bodies, HVAC systems, and equipment are particularly vulnerable to seismic action. Similarly, in industrial facilities, nonstructural systems such as storage tanks, piping networks, control cabinets, and machinery play a critical role in maintaining safety and operational continuity.

A key challenge in the seismic analysis of nonstructural elements lies in the dynamic interaction between primary and secondary systems. The response of nonstructural components is often coupled with the dynamic behavior of the supporting structure, introducing complexities that are still only partially addressed in existing design codes. Moreover, seismic limit states and damage thresholds for many types of nonstructural elements are either poorly defined or entirely missing in most regulatory frameworks. This gap underlines the crucial role of scientific research in advancing our understanding and improving risk assessment and mitigation strategies for these elements.

This session aims to bring together contributions from both academia and industry focused on the seismic vulnerability assessment, damage modeling, design criteria, and protection of nonstructural

elements in both buildings and industrial systems. Emphasis will be placed on methodologies that consider the coupled behavior of structures and nonstructural components, as well as on experimental, numerical, and empirical approaches.

Topics of interest include, but are not limited to:

1. Seismic vulnerability assessment of nonstructural components (e.g. partitions, ceilings, shelving systems, rigid bodies, technical equipment)
2. Seismic damage to mechanical, electrical, and plumbing (MEP) systems in hospitals, schools, and critical infrastructure observed in recent earthquakes (e.g., Türkiye-Syria 2023, Central Italy 2016, etc)
3. Seismic demand and seismic behavior of industrial non-structural systems (e.g., tanks, piping, control panels)
4. Dynamic interaction between main structures and secondary/non-structural systems
5. Experimental and numerical calibration of fragility functions
6. Development of design criteria, damage thresholds, and performance-based approaches
7. Regulatory frameworks and limitations in seismic provisions for non-structural elements
8. Risk mitigation strategies and operational continuity planning and lessons learned from recent earthquake impacts on industrial facilities
9. Seismic qualification and certification of components and systems
10. Experimental test campaign dissemination