**Special Session**

**Multi-hazard assessment of buildings and bridges through data-driven and physics-based methods considering pre-existing damage and material degradation**

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## Abstract

Civil engineering facilities such as buildings and bridges may be subjected to a variety of natural and/or anthropic hazards over their lifetime. While not necessarily leading to structural failure, the occurrence of those hazards may produce the onset or accumulation of local damage, reducing structural capacity against future loading conditions. Furthermore, material degradation due to ageing and/or lack of maintenance may induce local or distributed loss of structural capacity, because of progressive reduction of mechanical properties and resistance over time. By contrast, common methods for the assessment of structural safety, vulnerability and risk do not usually account for pre-existing damage or degradation phenomena. Nonetheless, the ever-increasing availability and accuracy of data produced by digital technologies for condition-based assessment of structures, structural health monitoring (SHM) systems and various surrogate modelling strategies can significantly expand the boundaries of physics-based methods, which mostly rely upon nonlinear response analysis of structural models.

This special session aims at presenting the latest developments on structural vulnerability and risk assessment of building and bridge structures where the presence and/or effects of pre-existing damage are considered through advanced structural modelling and response analysis, inspection technologies, SHM, and surrogate modelling. Papers that focus on, but are not limited to, the following topics are welcome:

- Incorporation of SHM and observed damage data in both simplified and advanced numerical models of existing buildings and bridges.
- Development and implementation of surrogate models for computationally efficient assessment and digital twinning of existing structures.
- Modelling and propagation of aleatory and/or epistemic uncertainties associated with, for instance, material properties, loads, geometric properties, capacity models, structural detailing, and technologies.
- Influence of pre-existing (seismic/non-seismic) damage and/or material degradation (e.g., corrosion, delamination, carbonation, alveolation) on structural response, performance, vulnerability, and risk of existing buildings and bridges.
- Progressive collapse simulation and structural robustness quantification under single or multiple damage scenarios.
- Characterisation and modelling of consequences of natural events (e.g., earthquakes, tsunamis, landslides, floods, soil subsidence) and anthropic events (e.g., impacts, fires, explosions, human errors).