Seismic Structural Health Monitoring for Buildings and Civil Infrastructure

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Abstract

In recent decades Structural Health Monitoring (SHM) has been proved to be a valuable tool for assessing the condition of buildings and infrastructures, both in normal conditions and after seismic events. Moreover, SHM can also support decision making process on the organization of inspections, intervention, and assessment strategies, both in normal management activities and in case of emergency after extreme events.

Regarding buildings, seismic events occurred in recent years highlighted the need to install measurement systems to capture the static and dynamic response of structures enabling the detection of potential changes in their behaviour after seismic events. This comes to be relevant specifically for strategic structures, that need to guarantee their functioning also in case of emergency, or heritage structures to prevent their loss or to evaluate their resilience. In the same way, civil infrastructures – as bridges – may need for the same kind of information tools, being often characterized by strategic importance, due to the great economic, social or environmental consequences in case of failure.

In this context, the scientific community is providing its contribution to the advancement of Structural Health Monitoring through the development of new devices, strategies for designing monitoring systems, and the integration of advanced analysis techniques to support data processing. This includes methods such as data-driven and model-based approaches, damage detection and localization, as well as the application of cutting-edge techniques to extend knowledge to similar structures such as the ones provided by machine learning and AI tools.

In this special session, we will share the latest developments in the field of seismic monitoring of existing constructions, including both buildings and civil infrastructures, with insights into:

- Seismic SHM strategies for the management of constructions, considering both normal daily and post- earthquake emergency management.

- Strategies and devices to monitor structural response of constructions undergoing seismic action.

- Use and enhancement of *data-driven* and *model-based* approaches to monitor constructions, also in case of seismic event occurrence, and the development of techniques for detection and quantification of damage.

- Development of different kind of *digital twins* for the interpretation of monitoring data and consequent assessment of constructions undergoing seismic action by means of calibrated numerical models.

- Development of monitoring strategies at territorial level.

- Use of machine learning and AI algorithms applied to seismic monitoring.

- Development of systems capable of integrating all sources of information, also obtained from different levels of monitoring.

- Seismic demand estimation of structures from national accelerometer network measurements.

- Use of SHM techniques for the analysis of seismically isolated constructions.
- Use of monitoring techniques to assess structural resilience.

All the Authors are kindly encouraged to propose their scientific and/or technical research around the proposed themes and all their kindred (not explicitly included in this list).