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Editorial: Recent Advances in Seismic Risk Assessment and Its Applications

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Editorial on the Research Topic

Recent Advances in Seismic Risk Assessment and Its Applications

In recent years there have been significant improvements in developing accurate and reliable methods for seismic risk assessment of existing buildings of historical value. To date, several procedures have been proposed that use numerical models with different levels of refinement. For instance, seismic risk assessment may be conducted at a territorial level, or else with specific numerical simulations applied to each construction where also non-structural elements are taken into account.

This special issue discusses recent advances in seismic risk assessment with particular attention to the development and validation of new procedures that are capable of assessing failure modes and the fragility curves of existing buildings. The studies presented have also a probabilistic background, and show the importance of typological characteristics in the seismic response of a building. Furthermore, non-linear numerical analyses have confirmed the importance of implementing specific models in order to design appropriate interventions aimed at reducing the seismic risk of a specific construction.

The paper "Use of the Knowledge-Based System LOG-IDEAH to Assess Failure Modes of Masonry Buildings, Damaged by L'Aquila Earthquake in 2009" by Novelli and D'Ayala first presents a decision-making process, including a rule-based model for the post-earthquake damage assessment of failure modes in masonry buildings. This approach involved developing a web-based tool using structural engineering expertise on the seismic behavior of masonry structures, which interprets the damage and patterns of cracks in combination with *in-situ* visual inspections. A set of L'Aquila city buildings struck by an earthquake in 2009 was analyzed to validate the proposed tool. The results clearly show that this approach is particularly suitable for analyzing a large number of buildings and for providing a database useful for evaluations at a territorial scale.

A seismic risk evaluation of wood structures is presented in the manuscript "Nationwide Earthquake Risk Model for Wood-Frame Houses in Canada" proposed by Goda. In particular, the paper shows the results of a study of a performance-based earthquake engineering methodology that was implemented to assess the seismic risk of Canadian wood-frame houses. This scope considered probabilistic seismic hazard analysis, and fragility functions derived from incremental dynamic analyses. Seismic risk maps are proposed for the annual expected damage ratio and for the 50-year probability of experiencing a certain damage ratio. The proposed maps could be very useful for implementing risk-based management strategies in Canada.

In their "Assessment of Combined In-Plane and Out-of-Plane Fragility Functions for Adobe Masonry Buildings in the Peruvian Andes" Sumerente et al. propose fragility curves that are derived

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by combining the in-plane and out-of-plane loading conditions of typical adobe buildings located in the city of Cusco (Perù). The seismic behavior of one and two-story buildings was investigated and artificially generated through Monte Carlo simulations. The structure of each building is defined with simplified capacity curves for in-plane and out-of-plane mechanisms, while a set of ground motions are used to evaluate the seismic demand.

D'Amato et al. present a seismic isolation strategy in their discussion of the "Seismic Retrofit of an Existing RC Building With Isolation Devices Applied at Base." The results of these non-linear dynamic analyses demonstrate the importance of adding a bracing system along with the significance of building height, which is necessary for stiffening the superstructure and, therefore, minimizing higher vibration mode effects.

In a "Comparison Between Phenomenological and Fiber-Section Non-linear Models," Terrenzi et al. investigate the non-linear behavior of R.C. columns by considering sections using either fiber models in distributed plasticity elements or phenomenological laws in lumped plasticity elements. This paper observes significant differences between the two models in terms of the high values of the axial load. In particular, the results provided by these phenomenological models are not in agreement with the experimentally obtained column responses. Therefore, the authors conclude that phenomenological laws in conjunction with the predicted equations should be used only when elements are subjected to a low axial load.

An integrated approach for the rehabilitation of buildings from a thermal and seismic point of view is discussed in the manuscript "Non-invasive Methods for Energy and Seismic Retrofit in Historical Building in Italy" proposed by Negro et al.. This paper uses a historic building with artistic and cultural value in the historic center of Matera (Italy, UNESCO site since 1993) as a case study. Firstly, an energy audit protocol was studied and applied to the building. Then, alternative and classical interventions are considered as ways of simultaneously upgrading both thermal and structural performance. Innovative and sustainable materials have been also considered for realizing non-invasive interventions that are capable of preserving the building identity, as required in cultural heritage.

AUTHOR CONTRIBUTIONS

All authors listed have made a substantial, direct and intellectual contribution to the work, and approved it for publication.

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