Seismic analysis and risk mitigation of existing constructions

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Editorial

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Following a thorough and lengthy procedure, we would like to thank all contributors for their highest calibre papers, which comprise the Special Issue on "*Seismic analysis and risk mitigation of existing constructions*" of the *Open Construction and Building Technology Journal*.

The topic of the Special Issue encompasses a large number of issues spanning the design of special interventions for the reduction of the effects of earthquakes on civil structures and infrastructures, to the structural identification and assessment issues.

The field of seismic engineering is continuously looking for new strategies and methods, which empower the designers and make them able to obtain more accurate response predictions. Researchers are involved in this process and are called to successfully encounter new challenges emerging from the increasing need for the assessment of existing constructions, especially when assuming strategic roles.

As is also reflected by the papers presented in the Special Issue, the continuous advances of the research in this field moves across two basic directions. On the one hand, there is the direction of the robustness and the reliability of the recent nonlinear seismic assessment methods (static, dynamic, incremental dynamic). Several approaches can be followed to predict the response of structures to strong ground motions; however the results coming from each of them are in some cases conflicting and not always amenable to easy interpretation.

On the other hand, the reliability of structural models still remains a major task of structural engineering and of seismic engineering in particular. Mathematical models have to reproduce the physics of structures and its evolution during complex damaging processes. Global and local models tend to reflect this by minimizing the loss of information.

In the Special Issue, we are proud to present state-of-the-art research findings described in detail in 9 papers authored by 27 researchers of different universities in Italy, California (USA), Greece and United Kingdom. The papers deal with the seismic analysis and risk mitigation aiming to address different purposes by proposing numerical, analytical approaches and experimental tests.

Two papers [1, 2] are devoted to the structural identification of historical heritage buildings focusing on the formulation of refined Finite Element (FE) models. In particular the experimental dynamic tests, and their post processing to the identification of the dynamic properties of the dome of the Teatro Massimo in Palermo are described in [1]. In another paper [3] the structural health monitoring of bridges is discussed, presenting the application of a novel sensing technology to an existing Structural Health Monitoring (SHM) system. Here the authors propose a modified SHM algorithm to investigate the feasibility of replacing traditional wired accelerometers with wireless energy-harvesting sensors. The environmental accelerations recorded on the Vincent Thomas Bridge in San Pedro, California, were used as basic data for the calibration of the new procedure for a Wireless Sensor Network system.

Papers [4, 5] deal with the seismic risk in terms of vulnerability and fragility curves at the local scale of a structure and global scale of a small urban centre respectively. In particular, paper [4] describes the development of fragility curves at different damage states of a detailed FE Abaqus model of a moment resisting reinforced concrete frame. The fragility functions derived by the direct observation on the model are compared to those determined by HAZUS macroseismic methodology and Risk-UE methodology pointing out the attention on the predictive capacity of each method. In paper [5] the investigation is extended to the definition of vulnerability maps in terms of vulnerability indexes and critical peak ground accelerations for mid-small urban centres belonging to Mediterranean areas. The procedure is tested on the city centre of the Island of Lampedusa and it is based on a preliminary fast evaluation of the vulnerability index of buildings.

As mentioned before, seismic assessment may follow different approaches. Nonlinear static pushover analysis is often compared with incremental dynamic analysis (IDA). Results obtained by the two methods often need deep discussions to be interpreted. Paper [6] presents an numerical study based on static pushover and IDA techniques, presenting the results of more than 1000 nonlinear analyses made on numerical models of two buildings, representative of the 60s and the 80s typical form, in Greece. A comparison is also made considering the presence and the absence of the infills in structural models. Despite the large dispersion of results, mean IDA values are in agreement with static pushover findings.

Finally, papers [7 - 9] are devoted to design and analytical modelling issues. Paper [7] specifically treats seismic risk mitigation obtained by the use of the technology offered by FVDs (fluid viscous dampers) and criteria for optimizing their application on buildings. A simplified procedure for the design of these devices is proposed presenting the results of a case study. The main goal is the determination of the dissipative capacity to assign to the dampers in order to mitigate seismic response, based on different possible geometrical configurations of the dampers.

Going again to investigate the seismic performance of historical buildings, the response of multi-block columns subjected to ground motions is discussed in paper [8]. An introductory study about a novel analytical approach for the analysis of the rocking behaviour is presented. The rocking response of single block and multi-block columns are compared providing final considerations about the possible overturning conditions.

In the last paper [9], the reliability of literature analytical models for seismic retrofitting of RC columns by steel jacketing technique is investigated. A state of the art of the ordinary models for confined RC concrete sections and of confined concrete models for columns strengthened by steel angles and battens is provided presenting a comparison with the stress-strain results of an experimental campaign carried out by the authors. Such interventions are really common for RC buildings when the risk mitigation by active devices (isolators or dampers) cannot be performed for technical of economical reasons.

In closing, on behalf of the Journal, we would like to express our sincere thanks to all the authors of the papers as well as the reviewers for their systematic and innovative work.

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