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Editorial

Special Issue on Advanced Methods for Seismic Performance Evaluation of Building Structures II

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1. Introduction

Earthquakes could be a hazard to human lives and the economy, leading to catastrophic disaster unless proper preparation is not made for buildings and infrastructures. To prevent catastrophes from earthquakes, new engineering technologies and seismic evaluation methods have been being developed [1]. Due to innovative seismic systems such as seismic dampers and base isolation systems, the potential of economic loss associated with structural and nonstructural damage and collapse has been much reduced. To improve safety for humans, buildings and infrastructures should be evaluated using comprehensive seismic loss and resilience estimation, and they should be retrofitted using reliable seismic devices based on the evaluation results.

To develop engineering technologies and seismic evaluation methods, multidisciplinary science and engineering-based knowledge is required, which includes geology, geotechnical engineering, structural engineering, seismology, economics, and social science, etc. It is difficult to cover all the issues of earthquake engineering in one Special Issue. Thus, this Special Issue narrowed the scope, which includes only advanced methods for seismic performance evaluation of building structures. Although the scope of the issue was narrowed, this issue still covered many specialized topics such as numerical models, seismic performance evaluation, seismic hazards, seismic force-resisting systems, energy dissipaters, and seismic design for building structures.

To provide more opportunities to publish more papers with significance, the Special Issue was divided into parts I and II in chronological order. The current issue is the Special Issue on "Advanced Methods for Seismic Performance Evaluation of Building Structures II". Both experimental and analytical studies were included in the issue. This Special Issue included seven papers that were accepted through stringent reviewing process. Papers published in the current issue was summarized in the following section. Since the Special Issue of the Applied Sciences, "Advanced Methods for Seismic Performance Evaluation of Building Structures II", covered recent advances in the development of major components of seismic performance evaluation and design, the information provided in this issue would be valuable to seismic engineering.

2. Advanced Methods for Seismic Performance Evaluation II

The demand on reducing seismic risk has been growing every year and has led to the development of innovative seismic performance evaluation methodologies and retrofit devices. Comprehensive cutting-edge seismic performance evaluation methods such as methods evaluating seismic loss and resilience have been emerged. To evaluate the seismic performance of individual buildings and building communities using those methods, multidisciplinary knowledges are required such as seismic hazard, nonlinear numerical model, and damage states of structural and nonstructural elements [2].

The aim of this Special Issue was to collect the latest and novel research on seismic performance evaluation of building structures and share them with seismic engineering communities. This Special Issue also included three important topics on seismic performance evaluation of building structures: (1) novel seismic performance evaluation methods,

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(2) advanced numerical model and analysis methods to conduct seismic performance evaluation, (3) seismic hazard estimation methods, and (4) seismic loss estimation. A total of nine papers were submitted, and seven of them were published in this Special Issue.

The first paper, authored by Kapasakalis, K. A., Antoniadis, I. A. and Sapountzakis E. J., presents a soil-dependent approach for the design of novel negative stiffness seismic protection devices [3]. In this paper, a vibration control system (VCS) was proposed to increase the effective damping, which can reduce the required base displacements. In this paper, a novel passive negative stiffness (NS)-based vibration absorber was also implemented in parallel to a base isolation.

The next paper, authored by Zhang, Z., and Wang, F [4], covered experimental investigation on the seismic performance of prefabricated reinforced masonry shear walls with vertical joint. To evaluate the seismic performance of prefabricated reinforced masonry shear walls, four single-story reinforced masonry shear walls (RMSWs) were tested under reversed cyclic loading. In this paper, the shear behavior of RMSWs with flanges at the wall ends and the effect of construction methods were evaluated.

The topic of the third paper was an experimental study on the flexural behavior of precast concrete modular beam systems using inserted steel plates. This paper was written by Ro, K., Kim, M.-S., Cho, C.-G., and Lee, Y.-H. [5]. This paper proposed a PC modular beam system to improve structural performance, and also to provide simple construction. The structural performance of the proposed PC modular beam system was evaluated by experimental tests with one reinforced concrete (RC) beam specimen consisting of a monolithic beam, and two PC specimens with the proposed modular system. It was shown that the proposed PC modular beam system exhibited satisfactory structural performance.

The fourth paper, by Schanze, E., Leiva, G., Gómez, M., and Lopez, A. [6], reported numerical results of the seismic response for an instrumented building with underground stories. This work evaluated models to investigate the effects of different underground stories modeling approaches. Earthquake vibration data recorded for the 16-story Alcazar building office in downtown Viña del Mar (Chile) were used.

The fifth paper evaluated the performance of rigid braced indirect suspended ceiling with steel panels [7]. The authors of this paper were Lee, J.-S., Jung, D. I., Lee, D.-Y., and Cho, B.-H. In this study, a brace-applied ceiling system for a suspended ceiling with a steel panel was considered in the indirect suspended ceiling. The seismic performance was verified through a shaking table test.

The topic of the next paper was the dynamic behavior of vertical tunnel shaft embedded in liquefiable ground during earthquakes [8]. The authors of this paper were Kwon, S. Y., and Yoo, M. In this paper, a 3D numerical modeling with fast Lagrangian analysis of continua in three dimensions (FLAC3D) was constructed to predict the dynamic behavior of a vertical tunnel shaft during liquefaction. It was shown that the thickness of the liquefiable soil layer and applied seismicity level were the major parameters affecting the dynamic behavior of tunnel shafts.

The last paper presented the intensity measure based on a smooth inelastic peak period for a more effective incremental dynamic analyses [9]. Statistical analyses showed that there were significant improvements in the results when the inelastic smooth peak period is adopted.

3. Future Work for Innovative Seismic Performance Evaluation

Innovative seismic performance evaluation methods have been recently developed. To conduct a comprehensive seismic performance evaluation, multidisciplinary knowledges are required. As described earlier, the aim of this Special Issue was to collect the latest and novel research on seismic performance evaluation of building structures and share them with seismic engineering communities. This Special Issue included seven papers that provided noble seismic engineering ideas.

Although only seven papers were included in this Special Issue, they certainly contribute to engineering communities and improve the current engineering practice. Since multidisciplinary knowledges on geology, seismic hazard, structural modeling, and numerical analyses are required to conduct the seismic performance evaluation, more refined studies should be conducted. Such efforts could help to mitigate the potential of seismic risks associated with future earthquakes. Innovative seismic performance methodologies should be developed to accurately evaluate the status of structures. Seismic loss estimation and seismic resilience-based approaches could be more developed in future studies. Since advanced seismic performance evaluation methods involve various parts such as seismic hazard, damage estimation, structural response prediction, and loss estimation, etc., individual parts should thus be studied further and practical solutions be made, which could also be the areas of future studies.

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