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Editorial

Special Issue: Resilience and Sustainability of Civil Infrastructures under Extreme Loads

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Abstract: The special issue entitled "Resilience and Sustainability of Civil Infrastructures under Extreme Loads" updates the state of the art and perspectives focused on cutting-edge approaches to enhance structures' resilience and sustainability under extreme loading events, including theoretical investigation, numerical simulation, and experimental study, keeping an eye on the seismic performance of civil structures. Notably, some innovative energy dissipative devices and resilient structural forms, which are encompassed in this special issue, would provide valuable references for the engineering application of resilient and sustainable civil infrastructures in the near future.

Keywords: resilience; sustainability; civil infrastructures; extreme loads; natural hazards; earthquakes; seismic performance; energy dissipative devices

1. Rationale

Natural hazards, such as earthquakes, that are detrimental to the safety of civil structures, have appeared more frequently in many regions and nations in recent years. Seismic excitations generate many unexpected damages to civil infrastructures. For example, seismic excitations usually contain multiple frequency components, and therefore the plastic deformation of the structure continuously accumulates in a certain direction, resulting in a large nonlinear displacement [1,2]. Moreover, liquefaction may occur after earthquakes, as it is worth mentioning that liquefaction can cause seismic settlement and tilting of structures [3,4]. Even worse, the progressive collapse of buildings is more likely to happen if structural redundancy suddenly decreases because of unexpected abnormal loads [5,6]. In light of that, there is an urgent need to exploring innovative methods to improve the resilience and sustainability of civil infrastructures under extreme loading events.

The Special Issue on Resilience and Sustainability of Civil Infrastructures under Extreme Loads contains papers that focus on the cutting-edge approaches to enhance structures' resilience and sustainability under extreme loading events, including theoretical investigation, numerical simulation, and experimental study. The contents of this special issue cover a wide variety of topics, which can be mainly divided into three categories, namely, (i) academic fundamental phase—the theoretical study of structural resilience and sustainability under specific loading events (contributions 6, 7, 9, 15); (ii) current cutting-edge research—new simulation tools for evaluating structural damage under extreme loading events (contributions 3, 5, 8, 11, 14, 18), and new experimental methods for seismic analysis of civil infrastructures (contributions 1, 4, 10, 13, 16, 17); and (iii) industrial application phase—new energy dissipative devices and resilient structural forms (contributions 2, 19). It is worth mentioning that to broaden the scope of structural resilience and sustainability, the concept of resilient

communities is also encompassed in this book. To be specific, through corporations, communities in devastated areas can be resilient in order to autonomously and efficiently recover from natural disasters (contribution 20). Additionally, this special issue also introduces the research related to the post-earthquake restoration simulation modal for water supply networks, which is conducive to determining prompt system recovery plans and restoration priorities in the case of an actual seismic hazard that may occur in water supply networks (contribution 12).

2. List of Contributions

The Special Issue contains 20 very high-quality papers. The author groups represent currently active researchers in the field of resilient and sustainable structures. The topics are not only current (cutting-edge research) but also of great academic (fundamental phase) and industrial (applied phase) interest. The readers will observe that the current technology utilized to enhance structural resilience and sustainability are mainly concentrated in the theoretical investigation, numerical simulation, and experimental study. Hence, further effort should be made on the applied phase of resilient and sustainable structures. It is worthy of mention that the development of efficient energy dissipative devices plays an important part in the actual implementation of resilient and sustainable structures. In fact, apart from innovative viscous damper filled with oil and silt, as introduced in the Special Issue, nonlinear energy dissipative devices (e.g., particle impact dampers) could also contribute a lot to improving structural resilience and sustainability [7]. The contributions of this Special Issue are as listed below:

1. Hybrid Simulation of Soil Station System Response to Two-Dimensional Earthquake Excitation, by Yang et al.
2. Study on Column-Top Seismic Isolation of Single-Layer Latticed Domes, by Zhai et al.
3. Long-Term Ground Settlements over Mined-Out Region Induced by Railway Construction and Operation, by Jiang and Wang.
4. Experimental Study and Numerical Simulation on Hybrid Coupled Shear Wall with Replaceable Coupling Beams, by Chen et al.
5. Flow Analysis and Damage Assessment for Concrete Box Girder Based on Flow Characteristics, by Ye et al.
6. Time-Frequency Energy Distribution of Ground Motion and Its Effect on the Dynamic Response of Nonlinear Structures, by Tao et al.
7. Shear Performance of Optimized-Section Precast Slab with Tapered Cross Section, by Ju et al.
8. A New Equation to Evaluate Liquefaction Triggering Using the Response Surface Method and Parametric Sensitivity Analysis, by Pirhadi et al.
9. A Multi-Objective Ground Motion Selection Approach Matching the Acceleration and Displacement Response Spectra, by Chen et al.
10. Experimental Study on Mitigations of Seismic Settlement and Tilting of Structures by Adopting Improved Soil Slab and Soil Mixing Walls, by Zhang and Chen.
11. Evaluation of Progressive Collapse Resistance of Steel Moment Frames Designed with Different Connection Details Using Energy-Based Approximate Analysis, by Lee et al.
12. Post-Earthquake Restoration Simulation Model for Water Supply Networks, by Choi et al.
13. Simplified Analytical Model and Shaking Table Test Validation for Seismic Analysis of Mid-Rise Cold-Formed Steel Composite Shear Wall Building, by Ye and Jiang.
14. Probabilistic Generalization of a Comprehensive Model for the Deterioration Prediction of RC Structure under Extreme Corrosion Environments, by Zhu et al.
15. Brazier Effect of Thin Angle-Section Beams under Bending, by Zhou et al.
16. Nonlinear Error Propagation Analysis of a New Family of Model-Based Integration Algorithm for Pseudodynamic Tests, by Fu et al.

17. Substructure Hybrid Simulation Boundary Technique Based on Beam/Column Inflection Points, by Chen et al.
18. Numerical Simulation and In-Situ Measurement of Ground-Borne Vibration Due to Subway System, by Yang et al.
19. Studies on Energy Dissipation Mechanism of an Innovative Viscous Damper Filled with Oil and Silt, by Lu et al.
20. Characteristics of Corporate Contributions to the Recovery of Regional Society from the Great East Japan Earthquake Disaster, by Fukumoto et al.

Author Contributions: All authors have conceived the special volume and the Preface, and have worked on that.

Conflicts of Interest: The authors declare no conflict of interest.

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