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Editorial

Introduction to the Special Issue Numerical Modeling and Simulation for Structural Safety and Disaster Mitigation

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Natural disasters including earthquake, hurricane, tsunami, flood and wildfire, cause enormous loss of lives and properties for human society every year. The structures and infra-structures are built to protect the mankind from natural disasters, but their damage and failure sometimes become part of the disasters. Therefore, the structural safety and disaster mitigation have become timely research topics for safeguarding our society. On the other hand, with the rapid developments of computer facilities and computational methods, modern researchers and engineers are well equipped. With the help of numerical modelling and simulation tools, the structures could be analyzed with the consideration of more realistic situations and designed in more reliable approaches. Furthermore, more and more innovative numerical methods are developed to meet the demands of better investigation and understanding for the nonlinear behaviors of structures subjected to the attacks of disasters.

In this context, the community realizes that the numerical methods and the engineering applications should get closer than ever before. The application of the newly developed numerical methods to the engineering practice is also of particular innovations. On the other hand, the most used numerical methods are usually inspired by the problems in the engineering applications. Thus, the two guest editors conceived the idea of organizing a special issue which is dedicated to the innovative development and application of numerical methods in the view of engineering problems. Totally 15 papers were selected for publication in this special issue among 40 submissions based on a very robust peer-review process. The published papers in this special issue are authored by the researchers from nearly 20 institutes and universities. Both the deterministic methods and the stochastic methods are included in this special issue for the analysis and simulation of engineering problems in the material level, structural level, system level and the disaster level.

In the material level, the two articles following, "An equivalent strain based multi-scale damage model of concrete" by Liang et al. [1] and "Multi-scale damage model for quasi-brittle composite materials" by Feng [2], developed the damage models for concrete and composite materials based on multi-scale approaches. The following article "Comparative investigation of two random medium models for concrete mesostructure" by Liang et al. [3] proposed the random field simulation model for the description of the stochastic mesostructure of materials. The following two articles, "Experimental and numerical investigation on the tensile fracture of compacted clay" by Hu et al. [4] and "Identification of the discrete element model parameters for rock-like brittle materials" by Chen et al. [5], developed the numerical models for geomaterials, e.g., clay and rock, based on the modern developed numerical methods.

In the structural level, the two following articles, "Collapse simulation and response assessment of a large cooling tower subjected to strong earthquake ground motions" by Huang et al. [6] and "Safety performance of a precast concrete barrier: numerical study" by Li et al. [7], investigated the failure and collapse of engineering structures based on advanced numerical methods. The following article, "Improving the seismic performance of staircases in building structures with a novel isolator" by Zhang et al. [8], numerically investigated the seismic performance of the structure with newly designed isolators. The behaviors of the new energy structures are numerically investigated by the following two articles, "Analysis of the quasi-static buffeting responses of transmission lines to moving downburst" by Sun et al. [9] and "Scour effect on dynamic characteristics and responses of offshore wind turbines" by Tang et al. [10]. The stochastic simulation and reliability analysis are performed for the engineering structures in the following two articles, "Analysis of naval ship evacuation using stochastic simulation models and experimental data sets" by Bellas et al. [11] and "A comprehensive model for structural non-probabilistic reliability and the key algorithms" by Sun et al. [12].

In the system level and the disaster level, Liu and his coworkers contributed two articles for the simulations of pipe structures and systems, e.g., "Seismic analysis of the connections of buried segmented pipes" by Liu et al. [13] and "Comparison between the seismic performance of buried pipes and pipes in a utility tunnel" by Liu et al. [14]. And the following article, "A statistical model for phase difference spectrum of ground-motion and its application in generating non-stationary seismic waves" by Du et al. [15], investigated the performance of earthquake disasters based on stochastic approaches.

In summary, we hope that the communities of computational mechanics and computer methods pay more attention to the engineering problems, which are full of inspirations and values. And the engineers working on the engineering practice pay more attention to the new computational methods, which are helpful and incredible. In this context, the presented topics of this special issue will attract more audience from the academics and engineering.

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