Editorial

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Biographical notes: Yuxi Zhao is a Professor of Structural Engineering at Zhejiang University, China. She received her BEng and MSc in Structural Engineering from Southeast University in China. In 2001, she received her PhD in Structural Engineering at Zhejiang University. Since then, she has been employed at Zhejiang University, where she was a Lecturer, Associate Professor before becoming a Professor in 2008. She worked in Imperial College London as an Academic Visitor from 2006 till 2008. Her research interest is concrete structures, particularly in the field of durability. She has awarded two research grants from National Natural Science Foundation of China, one grant from Natural Science Foundation of Zhejiang Province and one from National Key Technology Research & Development Program. She has published more than 30 publications in refereed journals and conference proceedings. She has co-authored one monograph, named 'Durability of concrete structures' and co-edited two conference proceeding.

Jianbing Chen received his PhD in Civil Engineering from Tongji University, China in 2002, became a faculty member there since then and is now an Associate Professor. He specialises in the area of earthquake engineering and stochastic dynamics of structures. Specifically, he is working on the development of probability density evolution method for non-linear structures involving randomness both in the system parameters and excitations. He was twice granted by the NSFC as PI and once granted by the MOST of China as PI of an 863 project. He has authored a Chinese book and co-authored an English monograph and over 90 papers on peer-reviewed journals and international conference proceedings. He currently serves as a Treasurer of the Random Vibration Committee of Chinese Society of Vibration Engineering and the Vice Treasurer of the Committee of Structural Computational Theory and Engineering Applications of Architectural Society of China.

Structural vibration and control have long been among the central topics of structural engineering. It is not only important to the safety but also of vital importance to the serviceability of structures to take into account dynamic effects of the loads from both ambient perturbation and disaster excitations including the earthquake, strong wind and impact or shock loading with the time scale spread in a large range. After over half a century's endeavours from researchers and engineers from around the world, great

progress has been made. However, huge challenges still exists in say, dynamic analysis of large-scale non-linear structures, test technique, field monitoring and damage assessment, performance evaluation and control especially when randomness are involved in non-linear systems, and so on. This special issue presents the recent development in these aspects.

Presented in 'Development of post-tensioned self-centring structures for earthquake resistance' by Chung-Che Chou and Jun-Hen Chen are experimental studies on two interior connections and a full-scale one-story two-bay frame subassembly using a newly developed post-tensioned self-centring mechanism which allows gap opening at interface instead of the traditional connections. Inelastic time history analyses are also conducted to examine the seismic responses of the three-story frame subjected to different level earthquakes.

To develop rational while simple methods for non-linear analysis of structures is still an important task. Oversimplified models may lead to appreciable errors by ignoring factors that have significant effects on structural behaviours. In the paper 'First-order elastic-plastic analysis of multi-story building frames by numerical modelling', Wanjala Ramadhan Salim takes back the effect of axial force combined with bending moments to improve the first-order non-linear analysis of structures. It is shown that without considering the axial force the capacity of the structure may be seriously over-estimated.

To take into account the uncertainties in structural properties and demands is very important in performance evaluation of structures under earthquake. In 'Seismic vulnerability assessment through explicit consideration of uncertainties in structural capacities and structural demands' by Quanwang Li, Jiankang Sun and Jiansheng Fan, the fragility curves, combined with incremental dynamic analysis, results of seismic risk analysis and regression statistics, are employed to consider uncertainties explicitly in a simplified way. The vulnerability assessment of a steel building frame is exemplified.

To identify or re-construct the internal properties of the material body in the structure is of course critical significant not only in the precise performance analysis, but also in the health monitoring and damage assessment of structures. Introducing the tomography which was originally developed for investigation of underground to concrete structures, in the paper 'Three-dimensional seismic tomography with tetrahedra element on isoparametric mapping', Yoshikazu Kobayashi develops the hexahedral element and additional tetrahedral element for the three-dimensional seismic tomography, based on the idea of isoparametric mapping of hexahedral element on finite element analysis, to overcome the difficulty in application to concrete structures due to irregular shape of the structures. The example in the paper qualitatively validates the proposed method.

'Some special phenomena and preliminary interpretations about measured strain signals from high-speed impact tests' by Chunwei Zhang, Hong Hao, Boris Tarasov and Xinqun Zhu is devoted to the error of measure system. The effects of experimental setup on the results, particularly the filtering of the data-acquisition system were investigated. The error contaminating the data, which could be reduced but cannot be eliminated completely, may mislead understanding of the impact or shock effects. Some phenomena were preliminarily interpreted qualitatively by wave propagation.

Serviceability is also a very important aspect of structures under normal environmental and service dynamic loading. Conducting field measurement using monitoring system and theoretical analysis using finite element methods, Jun Chen, Qinsheng Liu and Xiongxion She study the vibration serviceability of the longest floor in

China in ‘Field measurements and assessment of vibration serviceability of as-built long-span concrete floor’. Different types of human-induced excitations are considered and tested. The results show that the vibration response of the wood floor is much higher than the structural floor at the same location and thus it is suggested that the vibration amplitude control is much more important than frequency control for vibration service ability design of long-span concrete floor.

To add some control devices in the structural system is one of the feasible measures to mitigate structural response under strong disaster dynamic excitations. Seongkyu Chang and Dookie Kim study an algorithm for efficient computation of the control force for active control of structures in the paper titled ‘Active control of building structure using lattice probabilistic neural network based on learning algorithm’. In their investigation, the probabilistic neural network is improved by introducing lattice deployment through which the identification of the related pattern will be very quick and only adjacent patterns are employed in the prediction. The results are illustrated by a three-story structure subjected to two scaled acceleration records.

‘Control of seismically excited benchmark highway bridge with variable frequency pendulum isolator’ by Suhasini N. Madhekar and R.S. Jangid compare the control effect of the variable frequency pendulum isolator and friction pendulum system for a benchmarck highway bridge subjected to six accelerogram in different earthquakes as input. Detailed parametric studies are carried out based on different indices of response.

Randomness of the excitations should be rationally taken into account in stochastic dynamics and control. In their work titled ‘Order-independent optimal polynomial control of stochastic dynamical systems’, Yong-Bo Peng, Jie Li and Jian-Bing Chen study stochastic optimal control of non-linear structures in the frame work of physical stochastic optimal control. Remarkably, in contrast to traditional well-accepted impression, in stochastic optimal control when appropriate control criterion, say the exceeding probability, is employed, the first-order control is sufficient whereas the higher-order polynomial control will not improve and even may degenerate the control effects.