

UNCERTAINTY QUANTIFICATION AND RELIABILITY-BASED DESIGN OPTIMIZATION OF CONCRETE STRUCTURES SUBJECTED TO DYNAMIC ACTIONS

Abstract

Randomness exists widely in engineering problems due to uncertainty of structural parameters and external excitations. The structures in extreme actions such as earthquakes, strong winds and huge waves, may exhibit strong nonlinear behavior. To breakthrough the coupling of randomness and nonlinearity is the essential issue in reliability evaluation of complex structures. In this presentation, some advances and existing problems are outlined, including: (1) A new non-local macro-meso-scale damage model for quasi-brittle damage and failure analysis of homogeneous and heterogenous engineering materials; (2) The principle of preservation of probability, and the generalized density evolution equation (GDDE) and dimension-reduced probability density evolution equation (DR-PDEM) for the uncertainty propagation in high-dimensional nonlinear stochastic systems; and (3) uncertainty-informed reliability-based design optimization of concrete structures subjected to seismic actions. Existing problems to be studied will also be discussed.

Short bio

Jianbing Chen is currently University Distinguished Professor of Tongji University in the College of Civil Engineering. He specializes in the area of nonlinear analysis of complex structures, uncertainty quantification, stochastic mechanics, reliability and design optimization of engineering structures and systems. Dr. Chen published 4 books and over 230 peer-reviewed journal papers, including the book titled “Stochastic Dynamics of Structures” published by John Wiley & Sons in 2009. He received the National Natural Science Award of China (2016), the 2017 IASSAR Early Achievement Award, the National Science Fund for Distinguished Young Scholars of China (2017), and the Humboldt Research Award in 2023. He now serves as the Chairman of the Executive Board of the International Association for Structural Safety and Reliability (IASSAR), member of Board of Directors of the International Civil Engineering Risk and Reliability Association (CERRA), the Board member of the International Joint Committee on Structural Safety (JCSS) and reporter of JCSS WP1, the Vice President of the Chinese Society for Vibration Engineering, and Co-Editor-in-Chief of Probabilistic Engineering Mechanics, associate editors of the international journals including ASCE-ASME Journal of Uncertainty and Risk in Engineering Systems (Part A & Part B), Structure and Infrastructure Engineering, and editorial board members of Structural Safety, Reliability Engineering and System Safety, etc.

