Synopsis

Dr.Katsuichiro Goda is a Lecturer in Civil Engineering at the University of Bristol, United Kingdom. He received B.Sc. and M.Sc. degrees in Environmental Sciences from Kyoto University (Japan) in 2001 and 2003, respectively. In 2007, he earned a Ph.D. degree in Civil Engineering at the University of Western Ontario (Canada). His research is focused on catastrophic earthquake risk management from economic and societal viewpoints. His research interests are broad and multidisciplinary, and cover a wide range of academic fields, including engineering seismology, earthquake engineering, and decision-making under uncertainty.

Goda has received international recognition on his high-quality research through various awards and grants, including NSERC postdoctoral fellowship award (Canada), Kajima Corporation Research Grant (Japan), and 2011 Philip Leverhulme Prize. In 2012, his professional expertise was recognised by the Seismological Society of America through a prestigious 2012 Charles F. Richter Early Career Award and an Alexander vonHumboldt research fellowship award for experienced researchers (Germany).

Goda has authored 51 peer-reviewed journal papers, and 18 refereed conference papers. The H-index is 13. He consistently publishes papers in leading international journals with high impact factors, such as the Bulletin of the Seismological Society of America, Structural Safety, Earthquake Engineering & Structural Dynamics, and Risk Analysis. His papers are well-cited by other researchers because of the novelty and significance.

Abstract

Dependency Modelling in Earthquake Risk Assessment

Performance-based earthquake engineering (PBEE) is an essential framework for assessing socioeconomic impact of major earthquakes. It aims to quantify the extent of seismic damage and consequences probabilistically. Important requirements for a viable PBEE methodology are that key variables, such as earthquake scenario, ground motion, nonlinear structural response, damage severity, and economic loss, are modelled comprehensively and that their uncertainty and dependency are propagated consistently through probabilistic calculus.

This seminar is focused upon dependency modelling of random variables in earthquake risk assessment. Specifically, two topics will be discussed: (1) spatial correlation of peak ground motions and (2) nonlinear dependency modelling using copulas.

Spatial correlation models of peak ground motions and response spectra are key components for extending current probabilistic seismic hazard and risk analysis for a single location into those for multiple locations, and facilitate broad applications,

including seismic loss estimation of spatially-distributed buildings and ShakeMap interpolation. Use of adequate spatial correlation models is essential to model catastrophe nature of seismic risk realistically.

A copula approach can offer a general and flexible way of describing nonlinear dependence among multi-variate data in isolation from their marginal probability distributions, and serves as a powerful tool for modelling and simulating nonlinearly-interrelated data. It has a wide range of applications in natural hazard modelling and reliability analysis, involving nonlinearly interrelated random variables. In the seminar, joint probability distribution modelling of peak and residual displacement seismic demands based on the copula theory is demonstrated, and the developed statistical models are used to examine the effects of nonlinear dependence on seismic reliability assessment.