G-COE Special Seminar at Tokyo Institute of Technology
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Damage-based design earthquake load inputs for inelastic structures

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Strong ground motion involves high uncertainties (e.g. time, location, magnitude, duration, frequency content, amplitude, etc.). Structural engineers are often concerned with the critical input or worst-case scenario that produces the highest structural response. This talk deals with the mathematical modeling of critical earthquake inputs for inelastic structures. The critical acceleration that produces the maximum damage is estimated by solving inverse dynamic problems using optimization techniques, nonlinear time-history analysis and damage indices. Damage indices imply that the structure is damaged by repeated stress reversals and high stress excursions. The input acceleration is constrained to prescribed bounds on energy, peak values of ground acceleration, velocity and displacement and upper and lower limits on the Fourier amplitude spectra. Issues related to various energy terms dissipated by the inelastic structure are explored. Numerical illustrations on modeling critical earthquake loads for bilinear inelastic frame structures are provided.

References:

Moustafa, A and Manohar CS. (2007). Reliability-based vector nonstationary random critical earthquake excitations for parametrically excited systems. *Structural Safety*, 29: 32-48.

Moustafa, A (2009). Damage-based design earthquake loads for SDOF inelastic structures. *Journal of Structural Engineering* (ASCE), MS. No. STENG-232R2, in press.

Moustafa, A (2009). Discussion of a new approach of selecting real input ground motions for seismic design: The most unfavourable real seismic design ground motions. *Earthquake Engineering & Structural Dynamics*, 38:1143-1149.

15:00 – 16:00, November 09, 2009 (Monday)
CUEE conference room at Midorigaoka Building 3, Room 304

Dr. Moustafa received his B.Sc. (1992) and M.Sc. (1996) in Civil Engineering from Minia University, Egypt. He obtained his Ph.D. from the Indian Institute of Science, Bangalore in 2002. Dr. Moustafa has worked at Minia University, Egypt as a Demonstrator (1992-1996), Lecturer (1996-1997) and Assistant Professor (2002-date) in the Department of Civil Engineering. He has been also a visiting Faculty at Nagasaki University (Jul. 2004-Dec. 2005, Apr. 2008-Dec. 2008), Vanderbilt University (Jan. 2006-Feb. 2008) and Kyoto University (Jan. 2009-date). His research interests include earthquake engineering, nonlinear dynamics, random vibration, structural reliability and structural health monitoring. He has worked on developing a new health assessment framework for sensors and structural components using bond graphs (funded by US Air Force).

Please contact Assoc. Prof. Anil C. Wijeyewickrema (Ext. 2595) for more information.