



College of Engineering
Department of
Mechanical & Industrial Engineering

The Sidney E. Fuchs Seminar Series

3:30-4:20pm, Friday, October 24th, 2014
Frank H. Walk Design Presentation Room



Simulation of the Seismic Performance of Nonstructural Systems

by **E. "Manos" Maragakis***

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Nonstructural systems represent 75% of the loss exposure of US buildings to earthquakes, and account for over 78% of the total estimated national annualized earthquake loss. A very widely used nonstructural system, which always represents a significant investment in a structure, is the ceiling-piping-partition system. Past earthquakes and numerical modeling considering potential earthquake scenarios show that the damage to this system causes the preponderance of US earthquake losses. Nevertheless, due to the lack of system-level research studies, its seismic response is poorly understood. Consequently, its seismic performance contributes to increased failure probabilities and damage consequences, loss of function, and potential for injuries. All these factors contribute to decreased seismic resilience of both individual buildings and entire communities.

This presentation summarizes damage of nonstructural systems in recent earthquakes and its impact on all categories of seismic risk and discusses the importance of these elements on the functionality of buildings. It also presents major experimental and analytical research studies on the seismic response of these elements performed under an NSF NEESR Grand Challenge research project on this topic. This project integrated multidisciplinary system-level studies that developed, for the first time, a simulation capability and implementation process for enhancing the seismic performance of the ceiling-piping-partition nonstructural system. It includes a comprehensive experimental program that used the Univ. of Nevada, Reno and Univ. at Buffalo NEES Equipment Sites as well as the E-Defense facility in Japan to conduct subsystem and system-level full-scale experiments. Integrated with this experimental effort is a numerical simulation program developing experimentally verified analytical models and system and subsystem fragility functions. The project includes public policy investigations to support implementation of the research results and a series of outreach and educational activities.

* Dr. Maragakis received his B.S. degree in Civil Engineering (CE) in 1980 from National Technical University of Athens, Greece and his MS and PhD degrees in CE from California Institute of Technology (Caltech) in 1981 and 1984 respectively. He joined the CE Department at the University of Nevada, Reno (UNR) in 1984, was promoted to associate professor in 1989 and full professor in 1994. He chaired the Civil and Environmental Engineering Department from 1994 until 2008. In 2008 he was appointed Interim Dean of the College of Engineering. He was appointed as Dean of the College in 2009 following a national search. In 2005 he was awarded the title of UNR Foundation Professor. Dr. Maragakis' research emphasis is in earthquake engineering. He has received several sizeable competitive grants from the National Science Foundation (NSF) and other funding organizations exceeding \$15M. In June 2007 he was awarded a \$3.6M NSF Grand Challenge project to study the seismic response of nonstructural systems. As the project leader he is coordinating efforts of researchers and practitioners from 23 institutions around the country and the world. He has authored or co-authored over 200 publications in journals, proceedings and technical reports. He was the founding chair of the Transportation Research Board (TRB) National Committee on the Seismic Design of Bridges (2000-2006).