DEPARTMENT OF CIVIL, STRUCTURAL AND ENVIRONMENTAL ENGINEERING
University at Buffalo
The State University of New York
CSEE GRADUATE STUDENT ASSOCIATION

EERI
Student Chapter
University at Buffalo

MCEER
EARTHQUAKE ENGINEERING TO EXTREME EVENTS

Engineering Seminar

Constantin Christopoulos, Ph.D., P.Eng.

Associate Professor
University of Toronto, Canada

"Evolving Seismic Design from Ensuring Life Safety to Achieving High Seismic Performance"

ABSTRACT

Modern seismic design codes have promoted the concept of ductile structural systems over the past few decades to achieve cost-effective designs that ensure a significantly enhanced level of seismic safety, primarily by ensuring the life safety performance level under a design level earthquake.

The development of performance-based design methodologies has further enabled structural engineers to carry out seismic designs with the goal, in theory, of achieving multiple performance levels for increasing levels of seismic hazard. In practice however, most seismic design codes for traditional seismic resistant systems result in structures that experience severe inelastic action in primary structural elements and in a residual global deformed state that put into question the use of the structure following a design level seismic event.

The more recent development of self-centering seismic resistant systems is aimed at achieving structures that sustain little or no structural damage after a design level earthquake and can be repaired and made fully operational quickly following such an event.

In this presentation, the performance of the most ductile steel structures that are widely used in North America is first discussed with an emphasis on their expected final state. A characterization of the residual response of such ductile systems is then presented which indicates that most structures designed according to the latest seismic provisions would likely be unusable after a design level earthquake because of excessive residual drifts.

A few innovative systems for steel structures that are aimed at achieving the goal of having very limited damage, as well as rapid and effective repair following design level earthquakes are then presented. These include the design of steel structures with replaceable nonlinear links, new self-centering moment resisting frames, self-centering bracing systems for new structures and for the upgrade of existing deficient structures, as well as rocking structures with single or multiple rocking sections. The mechanics of the systems are first presented, the experimental and numerical development work is then discussed, the response of buildings incorporating these systems and finally designs strategies and the road to codification of these systems in North America will be presented.

DATE: Wednesday, April 27 2011

TIME: 2:30 P.M.

LOCATION: 140 KETTER HALL, NORTH CAMPUS, UNIVERSITY AT BUFFALO

ORGANIZED BY: ***CSEE-GSA, Student Chapter of EERI at UB, MCEER and Dept. of CSEE***

Refreshments will be served !!!

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Dr. Constantin Christopoulos is an Associate Professor of Civil Engineering and the Director of Structures Testing Facility at the University of Toronto. Dr. Christopoulos received his bachelor and Masters degrees from École Polytechnique de Montréal and his PhD from the University of California, San Diego. His current research focuses on the development of new high-performance damping devices and systems to enhance the response of buildings subjected to extreme dynamic loads. He has co-authored more than 70 journal and conference technical papers, one textbook on the Principles of Supplemental Damping and Seismic Isolation, and the co-inventor on several international patents. Dr. Christopoulos is an Associate Member of the Canadian CSA-S16 Steel Code Committee, is leading projects related to the seismic isolation of bridges and the design of existing buildings with supplemental damping devices in the Canadian Seismic Research Network and has been involved in a number of high-profile consulting projects involving the implementation of damping devices in structures.