University at Buffalo
Department of Civil, Structural and Environmental Engineering
School of Engineering and Applied Sciences

ENGINEERING SEMINAR

Passive Control of Structures using Apparent Weakening and Damping for Seismic Protection

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Abstract

Control of structures can be done by adding suitable control devices such as actively controlled actuators, strengthening and stiffening elements, and/or adding passive damping devices. Recently the speaker and his colleagues developed design and implementation concepts which weaken the structural system reducing the induced forces at the expense of increased deformations, while correcting and controlling such increases with supplemental damping. While weakening promoted by modern seismic design standards leads in most occasions to post-earthquake permanent damage, the weakening and damping approach minimizes such losses. Moreover, the speaker and his colleagues developed a concept of controlled stiffness change which simulates apparent yielding with nonlinear elastic behavior eliminating post-earthquake damage entirely. Devices that produce controlled negative stiffness were developed and investigated methodically in experimental and analytical studies leading to commercial patents. Moreover, design concepts based on active control theory were developed for the selection of passive systems. The presentation will scan most research studies supporting the above concept.

Short Bio

Andrei M. Reinhorn is a retired chaired professor (emeritus) at UB who was involved for over 34 years in education, research and consulting in structural dynamics with applications to earthquake engineering, wind effects and extreme loads engineering. He is a graduate of the Technion-Israel Institute of Technology (BS 1968, PhD 1978). Prof Reinhorn conducted research in evaluation and design of building structures experiencing inelastic deformations near collapse. He also developed modeling and solution techniques for structural control and base-isolated structures. He pioneered experimental structural control and brought the experimentation from small-scale laboratory implementations to the full-scale real-life realization of controlled structures using active tendon systems. He was one of the pioneers in defining the disaster resilience of communities and its quantification, using basic principles of process control. Most recently he developed new approaches to analysis of structures using State Space Approach (SSA) and Mixed Lagrangian Formulation (MLF). He developed integrated computing and experimentation methods, which are in the forefront of hybrid simulation techniques.
He published 4 books and in more than 650 publications in archival journals, edited books, conference proceedings and technical reports, well cited by professional peers (h-index of 57).

Professor Reinhorn was awarded the prestigious 2011 ASCE-Nathan M. Newmark Medal. He has received numerous other awards including 2015 ASCE-Moisseiff Award, 2007 SUNY Chancellor’s Award for Excellence in Scholarship and Creative Activity, 2006 UB “Exceptional Scholar” Sustained Achievement Award, 2005 ASCE/CERF Charles Pankow Award for Innovation, and 1998 AGC-Build San Diego Award. He served as department chairman, as member of university presidential review board for promotions and tenures, and as director of the SEESL laboratory (he was one of its designers and founders), one of the largest laboratories in the US for structural engineering and earthquake simulations.
More information can be found at http://civivl.eng.buffalo. edu/~reinhorn/

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