

The Department of Mechanical Engineering/College of Engineering and Applied Sciences  
Stony Brook University

## Mechanical Engineering Seminar



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Department of Civil, Structural and Environmental Engineering

### Lecture Title: Low Damage Seismic Force-Resisting Systems

Monday, April 16 2012, 11AM, Room 173 Light Engineering

#### Abstract

The cost associated with the loss of business operation, damage to structural and nonstructural components following a moderately strong earthquake is significant to modern society. Such cost is often comparable to, if not greater than, the cost of the structure itself. Current seismic design philosophies emphasize the importance of designing ductile structural systems to undergo inelastic cycles during design earthquake events while sustaining their integrity, recognizing the economic disadvantages of designing buildings and bridges to withstand earthquakes in the elastic range of materials. The performance of a structure is typically assessed based on the maximum deformation and/or cumulative inelastic energy absorbed during the earthquake. Most structures designed according to current building codes will sustain residual deformations in the event of a design earthquake, even if they perform exactly as expected. Residual deformations can result in the partial or total loss of a building if static incipient collapse is reached, if the structure appears unsafe to occupants or if the response of the system to a subsequent earthquake or aftershock is impaired by the new at rest position of the structure. Furthermore, residual deformations can also result in increased cost of repair or replacement of nonstructural elements as the new at rest position of the building is altered. These aspects are not explicitly reflected in current seismic provisions. In this seminar, low damage seismic force-resisting systems that minimize residual deformations (i.e. that are "self-centering") and that are economically viable are presented and discussed. After a review of the current seismic design philosophy and the importance of residual deformations in performance-based seismic design, results describing the dynamic response of self-centering hysteretic systems are examined. A description of practical structural systems exhibiting self-centering properties developed by the author and his graduate students are then presented.

#### Biography

André Filiatrault received a Ph.D. in Civil Engineering from the University of British Columbia in 1988. After a two-year stay as an Assistant Professor at the University of British Columbia, he joined the Department of Civil Engineering at Ecole Polytechnique of the University of Montreal, where he became a Full Professor in 1997. Professor Filiatrault joined the faculty at the University of California, San Diego in 1998 where he was a Professor of Structural Engineering until 2003. Currently, Filiatrault is a Professor in the Department of Civil, Structural and Environmental Engineering at the University at Buffalo (UB), State University of New York. Professor Filiatrault served as the Deputy Director of the Multidisciplinary Center for Earthquake Engineering Research (MCEER) from 2003 to 2007 and as Director from 2008 to 2011. His research over the last twenty four years has been centered on the seismic testing, analysis and design of Civil Engineering structures.

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