

## Engineering Seminar

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### “Adaptive Stiffness and Negative Stiffness for Seismic Protection”

#### ABSTRACT

Traditionally researchers have focused on supplemental damping systems for earthquake protection. The speaker and his coworkers have focused on the development of adaptive/variable stiffness systems for seismic protection. This talk presents various stages of development of the concept of adaptive/variable stiffness systems. Variable stiffness and adaptive pendulum tuned mass dampers developed during the course of the investigation are presented. The invention of adaptive tuned mass dampers is presented in detail resulting in real implementation.

Recently a team of researchers at Rice and University at Buffalo (along with RPI & UCLA researchers) funded through the NSF NEES program have developed practical negative stiffness systems. The talk presents the invention of the Negative Stiffness Device (NSD) and process that lead to the invention of the NSD—a creative process of invention and innovation by a team of researchers. The innovation of apparent weakening concept is presented. Detailed analytical and shake table test results are presented to show the effectiveness of the new and innovative concept of adaptive negative stiffness and apparent weakening for earthquake protection. Effectiveness of NSD in base isolated structures, inelastic single and multistory buildings, and based isolated bridges is demonstrated using experimental and analytical results obtained in the NEES-Adapt-Struct project.

(project website: [www.ruf.rice.edu/~dsg](http://www.ruf.rice.edu/~dsg)).

**DATE: Wednesday, October 10 2012**

**TIME: 11:00 A.M.**

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

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

**Refreshments will be served !!!**

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Dr. Satish Nagarajaiah holds a joint appointment between the Civil Engineering Department, and the Mechanical Engineering Department at Rice University. He is a tenured full professor since 2006. He obtained his Ph.D. (1987-1990) from State University of New York at Buffalo, where he was a post-doctoral researcher before he started his academic career in 1993. Dr. Satish Nagarajaiah's teaching and research interests are in the areas of structural dynamic systems and control; seismic protection; earthquake engineering; smart structures; system identification; and structural health monitoring. His research is funded by the NSF, NASA, DOE, Air Force, other State/Federal agencies, & Private Industries. NSF has awarded him the prestigious faculty early CAREER award for his research in Variable Stiffness Systems and Smart Structures. He has published extensively and presented keynote lectures. For full details visit his web site [satishnagarajaiah.rice.edu](http://satishnagarajaiah.rice.edu). His recent activities, media interactions, and news can be found at <http://twitter.com/SatishNagarajah>. Dr. Nagarajaiah currently serves as the managing editor of the journal of structural engineering [ASCE International journal], and editor of the structural control and health monitoring journal [Wiley International Journal]. He is an elected inaugural fellow of Structural Engineering Institute (SEI) of ASCE. He currently serves as the past chair and member (2006-to date) of ASCE SEI, Technical Activities Division Executive Committee. He also serves as a member of the board of directors of the international association of structural control and monitoring. He served as the chair of the U.S. panel on structural control and monitoring (2006-2008). He was the founding chair of ASCE structural health monitoring committee (2004-2006), ASCE-Engineering Mechanics Institute, and chair of the structural control committee (1998-2002), ASCE Structural Engineering Institute.