# Advances in Seismic Safety and NextGen NanoSensors

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(PhysOrg.com) -- In between spring and fall quarters, engineering professors at UC San Diego are working to keep society safe, healthy and on the leading edge of smart technologies through a variety of research projects - from keeping buildings earthquake safe to enhancing heart surgery for children and developing the next generation of nano sensors.

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## Earthquake-Safe Buildings

As earthquake preparedness continues to be at the forefront of research and conversations around the globe, engineers at UC San Diego have received a boost in funding to help protect buildings and people from potential seismic disasters.

Benson Shing, a structural engineering professor at the UC San Diego Jacobs School of Engineering, will use a nearly $1.5 million grant from the U.S. Commerce Department's National Institute of Standards and Technology (NIST) to study and test performance-based seismic design methods and tools for reinforced masonry shear-wall structures. Under the three-year project, Shing and his colleagues will develop innovative methodologies and improved design requirements for the seismic resistance design of shear walls in reinforced masonry buildings, and reliable analytical tools for assessing their seismic performance in an effort to enhance the cost-effectiveness and performance of these structures. These types of masonry structures are mainly used for low rise commercial buildings, as well as for mid-to-low rise office buildings and hotels. As part of the grant, Shing plans to conduct a series of simulated earthquake tests on two-and-three-story shear wall systems at the end of 2011 and in early 2012 at the UC San Diego Englekirk Structural Engineering Center, home of the world's largest outdoor shake table.

“We hope to break new ground in design and modeling,” Shing said about the project.

Earlier this year, the NSIT awarded a total of $34.12 million in grants for measurement science and engineering research. The NIST Measurement Science and Engineering Research Grants Program, made possible through the American Recovery and Reinvestment Act, will fund 27 projects at higher-education, commercial, and nonprofit organizations in 18 states.

## Enhancing Heart Surgery For Children

UC San Diego mechanical and aerospace engineering professor Alison Marsden is working through an international collaboration to develop multiscale models for all three stages of the surgery used to treat children with single ventricle heart defects. The end goal of the $6 million project, funded by Fondation Leducq in France, is to produce software that can be used for clinical decision support. These surgeries are typically done with three stages starting from birth: the Norwood (or variant), Glenn procedure, and Fontan surgery. According to Marsden, these young patients are among the most challenging for pediatric cardiologists to treat, and they can develop a number of very serious morbidities.

“While our group at UCSD has done research previously on the Fontan surgery (stage three), we were not able to take advantage of closed loop models of the circulatory system,” she said. “This collaboration will allow us to model the surgical connection in detail as well as the response of the entire circulation. In addition, this is the first time in our research group that we are taking a close look at the engineering aspects of the first two stages of the surgery, and that will hopefully shed light on possibilities for earlier interventions that can help prevent poor outcomes. The network gives us access to a large pool of clinical data

through several leading clinical centers that are participating in the grant."

Marsden is an American core member of the international research team on this project, which also includes Great Ormond Street Hospital for Children in London, Politecnico di Milano in Milan, The French National Institute for Research in Computer Science and Control (INRIA) in Paris, Medical University of South Carolina, University of Michigan, and Clemson University.

## NextGen Nano Sensors

UC San Diego nanoengineering professor Jen Cha is using a $300,000 grant from the U.S Defense Department's Advanced Research Projects Agency (DARPA) to develop nanoscale materials for biological and chemical sensing for health and environmental monitoring. Cha and her research team are hoping to find routes to fabricate arrays of nanoscale materials for medical diagnostics or for security sensing that does not require high engineering costs. For these types of applications to make a "real world" impact, the production of the devices needs to be kept at an absolute minimum, Cha explained.

"If we can get around the problem of repeatedly needing an expensive tool, such as those used for semiconductor chip manufacturing (i.e. lithography), and still be able to achieve sub-50 nanometer resolution, that would be pretty revolutionary for applications such as low-cost diagnostics and chemical sensors," she said.

Provided by University of California - San Diego

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