Earthquake researchers get online primer for simulation method

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Researchers from around the world now have access to expert instruction for an emerging simulation method to study seismic effects on structures and to design buildings that better withstand strong earthquakes.

The National Science Foundation's George E. Brown Jr. Network for Earthquake Engineering Simulation (NEES) is providing a primer on its NEEShub.

The primer explains how to use hybrid simulations, methods that are helping researchers study the effects of earthquakes on buildings and other structures. The effort was led by Narutoshi Nakata, an assistant professor of civil engineering at Johns Hopkins University, and Shirley Dyke, a Purdue University professor of mechanical engineering and civil engineering. Several members of the NEES community contributed to the development of the documents.

"This hybrid approach is taking off lately. People are getting very excited about it," Dyke said. "But its potential has not really been harnessed. We are making available this primer, which includes a general introduction to hybrid simulation, its components, capabilities, and the procedures by which a simulation is typically performed."

She will present information about the primer during Quake Summit 2014, which is part of the 10th U.S. National Conference on Earthquake Engineering, July 21-25 in Anchorage, Alaska. Quake Summit is the

annual meeting for NEES, a shared network of laboratories based at Purdue.

The simulations are referred to as hybrid because they combine computational models with physical test specimens. While the most accepted method to study seismic effects on structures is to use a full-scale shake table, they are not generally available in structural labs.

"Furthermore, issues of scale, equipment capacity and availability of research funding continue to limit the full-scale shake table testing of complete structures," Dyke said. "Analytical models, on the other hand, are limited to solving specific types of problems. Combining both experimental and analytical tools in a single simulation takes advantage of what each tool has to offer."

The primer includes information about a form of hybrid simulation called real-time hybrid simulation. Researchers have been able to perform structural tests at slow speed, but testing in real-time – or the actual speed of an earthquake – sheds new light on a problem. The real-time ability has only recently become feasible due to technological advances in computing.

More information: Naru Nakata; Shirley Dyke; Jian Zhang; Gilberto Mosqueda; Xiaoyun Shao; Hussam Mahmoud; Monique Hite Head; Michael Bletzinger; Gemez A. Marshall; Gaby Ou; Cheng Song (2014), "Hybrid Simulation Primer and Dictionary," nees.org/resources/7702

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