

# Advanced in Real-Time Hybrid Simulation Workshop

## October 10-11, 2011

Location: Lehigh University NEES Facility

**Objectives:** To disseminate information on recent multi-site real-time hybrid simulation testing conducted in the Network for Earthquake Engineering Simulation (NEES); disseminate other recent advances in real-time hybrid simulation for civil structures; and facilitate collaboration of researchers, ideas and facilities among participants.

### Agenda:

#### Day 1 – October 10, 2011 (Monday)

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| 8:00 - 8:45 | Breakfast & Registration   |
| 8:45 - 9:00 | Welcome & Introduction – R. Christenson (Associate Prof., Univ. of Connecticut)  |
| 9:00 - 9:30 | Overview of Lehigh NEES Site, Experiments Conducted, Data Archived – J. Ricles (Director, NEES at Lehigh)                              |
| 9:30 -10:00 | Multi-Site Real-Time Hybrid Simulation Test – NEES Control Room  |
| 10:00-10:30 | Break  |
| 10:30-11:00 | Multi-Site Real-Time Hybrid Simulation Presentation – R. Christenson (Associate Prof. University of Connecticut)                       |
| 11:00-12:00 | RTHS Participant Presentations   |
| 11:00-11:20 | “NEES Cyberinfrastructure and Cloud Simulation Features of the NEEShub” – G. Rodgers (Senior Software Engineer, NEEScom)               |
| 11:20-11:40 | “A Substructure Shake Table Test Method Using Controlled Masses” – N. Nakata (Assistant Prof., Johns Hopkins University)               |
| 11:40-12:00 | “Real Time Hybrid Simulation of Electrical Insulator Posts using a Smart Shake Table” – M. Gunay (PostDoc, NEES at Berkeley)           |
| 12:00- 1:00 | Lunch  |
| 1:00 - 3:00 | RTHS Participant Presentations   |
| 1:00-1:20   | “RTHS Developments with National Instrument PXI-FPGA System” – O. Mercan (Assistant Prof., University of Toronto)                      |
| 1:20-1:40   | “Benchmark Problem and Future Development in RTHS” – X. Shao (Assistant Prof., Western Michigan University)                            |
| 1:40-2:00   | “Real Time Hybrid Testing from System, Control to Experimental Error” – X. Gao (PhD Student, Purdue University)                        |
| 2:00-2:20   | “Substructuring Techniques for Hybrid Simulation of Complex Structural Systems” – G. Mosqueda (Associate Prof., University at Buffalo) |
| 2:20-2:40   | “Impedance Control Approach to Real Time Hybrid Simulation – J. Carl (Senior Research Scientist, FM Global)                            |
| 2:40-3:00   | “RTHS of Complex Systems using the Convolution Integral Method” – Z. Jiang (PhD Student, University of Connecticut)                    |

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Day 1 – October 10, 2011 (Monday) CONTINUED

- 3:00 - 3:30 Break
- 3:30 - 5:00 Concurrent Breakout Sessions
- (i) real-time computation advances needed in RTHS
  - (ii) servo-hydraulic actuator control for RTHS
  - (iii) benchmark problems and standardizations for assessing RTHS facilities and results from tests

Day 2 – October 11, 2011 (Tuesday)

- 8:00 - 9:00 Breakfast & NEES Facility Tour
- 8:30 - 9:00 RTHS Frame Test Demonstration
- 9:00 -10:20 RTHS Participant Presentations
- 9:00 - 9:20 “Overview of KOCED program and Korean RTHS Facilities” – C.-Y. Kim (Prof., Myongji University)
  - 9:20 - 9:40 “Experimental evaluation of the seismic performance of steel MRFs with compressed elastomer dampers using large-scale RTHS” – J. Ricles (Director, NEES at Lehigh)
  - 9:40 -10:00 “Model Based Feedforward-Feedback Control for RTHS” – B. Phillips (PhD Student, University of Illinois)
  - 10:00-10:20 “Improved Adaptive Compensation Method for RTHS” – C. Chen (Assistant Prof., San Francisco State University)
- 10:20-10:30 Break
- 10:30-11:30 RTHS Participant Presentations
- 10:30-10:50 “Multi-Time-Step Integration Algorithms for RTHS” – A. Prakash (Assistant Prof., Purdue University)
  - 10:30-11:10 “Real-time Hybrid Simulation Studies of Complex Large-Scale Systems Using Multi-Grid Processing” – Y. Chae (PostDoc, NEES at Lehigh)
  - 11:10-11:30 “Control-oriented System Identification of a Large Frame for RTHS” – A. Ozdagli (PhD Student, Purdue University)
- 11:30-12:00 Report on Breakout Sessions & Conclusion of Workshop