

Forum: Emerging Topics and Grand Challenges in Natural Hazards Research

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Objectives

- To identify emerging topics in the field of natural hazards and their effect on the civil engineering infrastructure
- To identify challenges and needs associated with conducting research on these topics
- To identify how the NHERI Lehigh EF and program can be utilized by the community to perform research on these emerging topics

Emerging Topics

- New response modification devices (e.g., semi-active stiffness damper, new nonlinear viscous dampers, etc.)
- 3-D seismic input, 3-D response, vertical input
- Coupled multi-hazards in the lab
 - Example, fire following earthquake
- Hybrid wind testing
- Climate change, sea level rise, storm surge, flood loading
 - Retrofit of existing infrastructure, better design for these issues
 - Natural hazards in context of climate change
- Homeland security driven research issues, progressive collapse, man-made hazards (outside the domain of NSF funding)
- Hurricane resistant design; wind
- Sustainability; material innovation; architecture; improve energy efficiency
- Structural health monitoring; condition assessment; smart structures, alternate load path

Emerging Topics

- Energy efficient material, structurally viable
- Residential building; concrete residential building; single or multi-family buildings
- New retrofitting methods; reinforced masonry not easy ways to retrofit
- Large number of bridges have corrosion damage
 - NSF will not fund bridges
- Irregularity in structures
- Computational model accuracies; sensitivity; computation simulation is 'going to replace experiment'
 - Faster computation in RTHS; high performance computing
 - Large-scale computation in RTHS; state of the art limited to 500-600 DOFs; need to go higher; can parallelize; communication becomes problem
 - Community to get confidence in hybrid simulation; need to have a big demonstration project; actuator control;
 - Can we take project and do HS; HS for collapse; damaging equipment is a concern due to large velocity; need for simulation of collapse; collapse criteria; defining collapse in a numerical simulation
- Debris loading from tsunami and flood;
- Composite action in structure (steel and concrete composite)

Challenges and Needs

NHERI EFs and other facilities

Utilization

- Figuring out how to do other hazards; hybrid wind
- Integrate geotech with structures; SSI; laminar soil box
- Multi institutes to coordinate on projects
- Wind driven wild fire
- Tsunami effects of nuclear power plants
- Outreach to attract bright students to structural (civil) engineering
 - Public relations; RAPID will do these
- Test bed structures are important to have; tie with sim center
 - We have red frame and damper test beds; need to have more; will reduce expt cost; details need to be carefully considered in developing test beds
- Interdependencies among (CRISP program) infrastructure system; important for community resilience
- Test bed for non structural systems/components
- Next generation model; require something that we are not collecting; what kind of information is needed for the kind of research for example Dr. Bocchini does; fragility presented in terms of damage
 - Damage to SCBF; what repair actions are required; probability of repair actions
 - Sim center, designsafe
 - Aging effect in fragility analysis particularly in structural and reinforcing steel

NHERI EFs and other facilities Utilization

- Snow loading on power systems
- Community centers where more tornados; tornado resistant design

