# SEMM Seminar

## Mitigating computational and experimental constraints to study wave-structure interaction with a hybrid simulation approach

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502 Davis Hall

**Abstract:** Data from realistic full-scale simulations providing insight into the wave-induced response of structures is very limited. In particular, structural behavior under wave-induced loads is not well understood due to: [i] difficulties and uncertainties in handling combined computational fluid and structural models, requiring validation with experimental data, and [ii] limitations in traditional experimental techniques that necessitate idealized, scaled structural specimens that may not represent full-scale structural response. Real-time hybrid simulation (RTHS) is a cost-effective cyber-physical simulation method that can be used to examine the behavior of systems too large or complex to test fully in a laboratory setting, alleviating the aforementioned constraints. In RTHS, a system is split into two portions: an experimental, physical sub-assembly and a computational, numerical sub-assembly. The physical and numerical sub-assemblies interact, in real-time, through sensors and actuators. The response of the coupled, hybrid sub-assemblies then represents the response of a complete assembly; thus, mitigating many of the similitude constraints imposed in traditional wave experiments. Hydrodynamic-RTHS, or hydro-RTHS, couples physical waves and a partial structural specimen with a computational structural model in the NHERI-EF Large Wave Flume at OSU; this choice of sub-assemblies is practical as it physically simulates the wave-structure response and leverages the complexity and similitude advantages gained through the structural numerical model.

**Bios:** Barbara Simpson is currently an Assistant Professor at Oregon State University. She received her Ph.D. from UC Berkeley and her Bachelor of Science from the University of Kansas. Dr. Simpson uses advanced computational and experimental methods to characterize structural response. Her aim is to develop innovative structural systems that improve building performance and reduce the effects of natural hazards on the built environment. One of her current pursuits is the development of real-time hybrid simulation frameworks for fluid-structure interaction problems. Other research areas include the robust design and retrofit of building structures with emphasis on strongback-spine and braced frame systems, performance-based earthquake engineering, and computational modeling, optimization, and simulation.