

Implementation of Real-time Hybrid Simulation for Wave-Structure Interaction

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This presentation will present the ongoing development and implementation of real-time hybrid simulation (RTHS) for wave-structure interaction applications, termed hydro-RTHS, at the NHERI-EF Large Wave Flume and Multi-directional Wave Basin at Oregon State University. This hydro-RTHS framework couples physical waves and partial structural specimen with a computational structural model. This approach is practical as it: [i] maintains the complex physical phenomena associated with the fluid flow, [ii] provides the means to investigate structural models that are too large or complex to be tested in a laboratory setting, and [iii] reduces uncertainties by replacing parts of the complex wave-structure interaction problem with physical sub-assemblies. Although hybrid simulation is well-developed for earthquake engineering applications, existing RTHS methodologies may not be directly applicable for wave-structure interaction problems. Example challenges especially problematic include: [i] the variable and high frequency pressure response that arises from the wave loading conditions, [ii] the execution of potentially large and computationally expensive numerical sub-assemblies in real or faster than real time due to (a) the in-time fluid flow and (b) the reduced scale of the structural specimen, and [iii] overcoming the difficulties in conducting RTHS in a submersed or wet testing environment. This presentation will present the hydro-RTHS framework currently under development at OSU to address these challenges.