

## **Advanced Simulation of Structural Systems**

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Large-scale dynamic experiments are essential to understand the system level dynamic behaviour of complex structures equipped with load-rate dependent components. However, such tests are costly and their numbers can be minimized by performing an array of real-time hybrid simulations (RTHSs) that couple physical testing of critical components (i.e., experimental substructure) with the computer model of the remaining structure (i.e., analytical substructure). While it is economical and practical, RTHS is a challenging testing method since it combines computer simulation with physical testing in real-time. Successful application of RTHS requires robust and real-time executable algorithms, accurate control of the hydraulic actuators and synchronized data communication.

This presentation will highlight the needs and accompanying challenges in real-time hybrid simulation, and discuss the recent developments in the field. Three different RTHS platforms, new and computationally efficient real-time hybrid simulation algorithms and tracking indicators, and a novel adaptive controller developed at the University of Toronto will be introduced. Application examples of RTHS to investigate the dynamic performance of structures equipped with different supplemental damping systems will be presented.