CPS Medium: Collaborative Research: CyberMech, a Novel Run-Time Substrate for Cyber-Mechanical Systems

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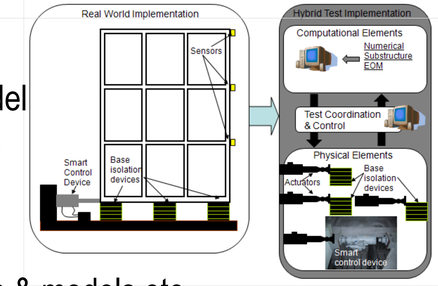
Project Dates: September 2011 – August 2016

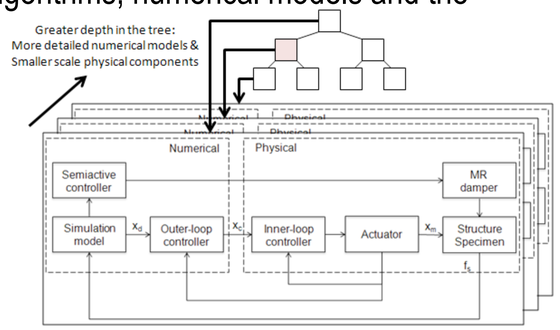
Introduction

- Hybrid Testing: Physical components & numerical model
- **R**eal-**T**ime **H**ybrid **S**imulation of structural components



Challenges

- Complex interaction b/w sensors, actuators, controllers & models etc.
- Configurable, adaptive concurrency platform for parallel execution
- Real-times constraints: Multiple time-scale dynamics
- Asynchronous, on-the-fly adjustments to data flow and control flow
- Co-design of physical components, control algorithms, numerical models and the computational platform they run on

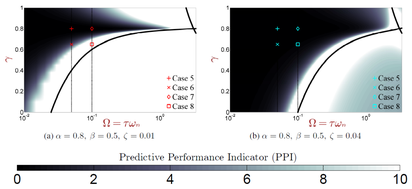


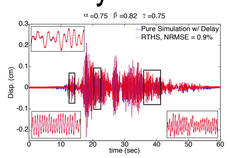
Target Application Domains

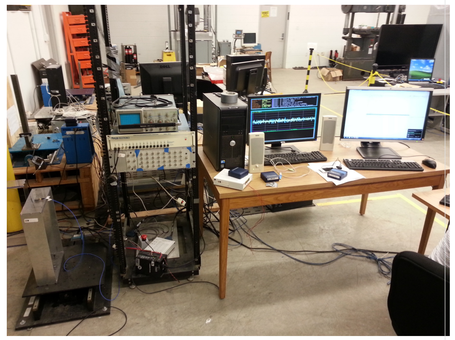
- RTHS with multi-scale models
- Tele-operation and interactive control of cyber-mechanical systems

Cyber-Physical Control Algorithms & Numerical models

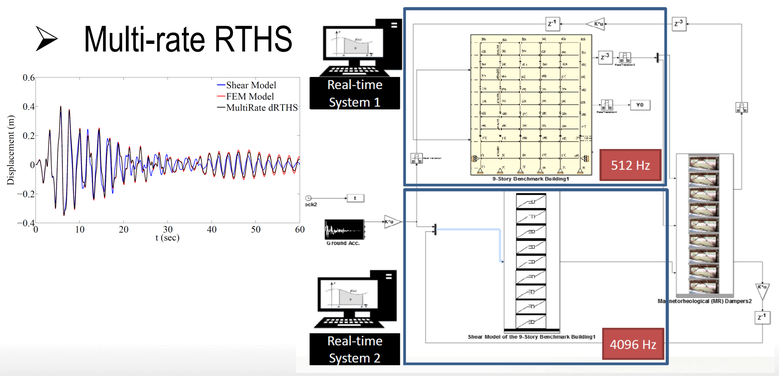
- RTHS Control & Compensation, Errors Analysis
- Stability & Performance Indicators



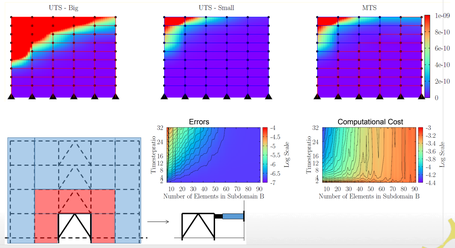




- Multi-rate RTHS

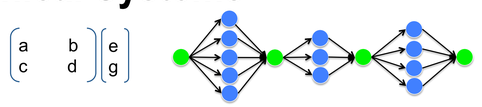


- Adaptive Multi-scale Models

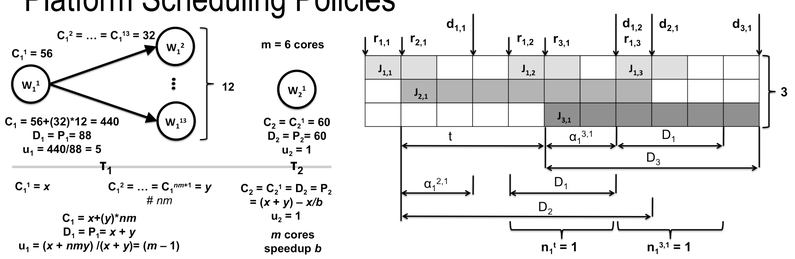


A Concurrency Platform for Cyber-Mechanical Systems

- Cyber-Physical Real-Time Parallel Task Model

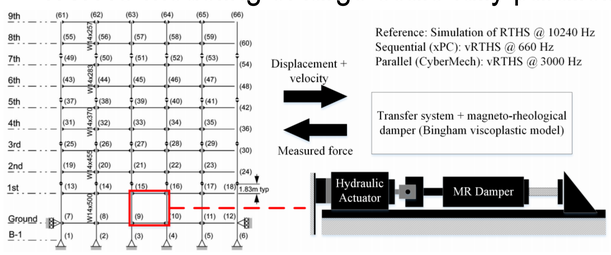


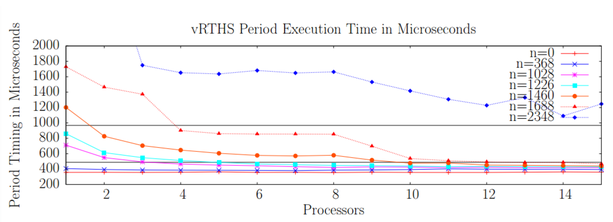
- Platform Scheduling Policies



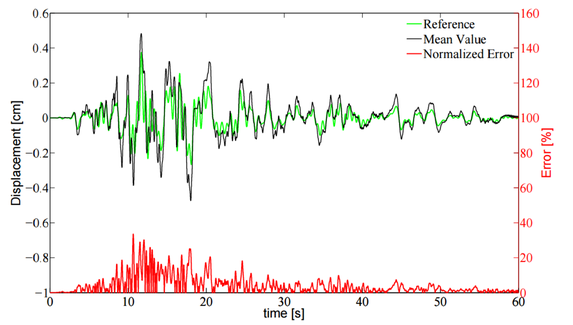
Empirical Evaluation

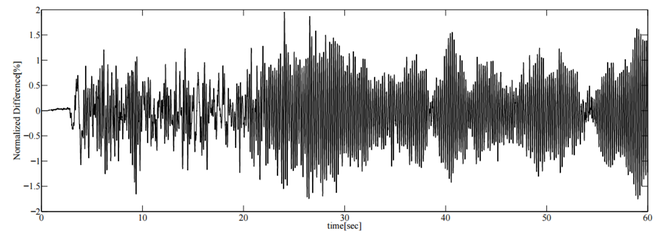
- vRTHS modeling of large scale fully parallelized RTHS



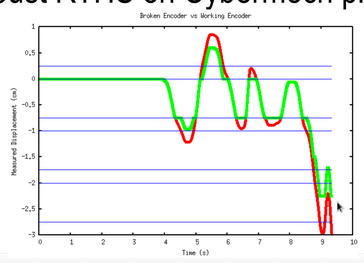


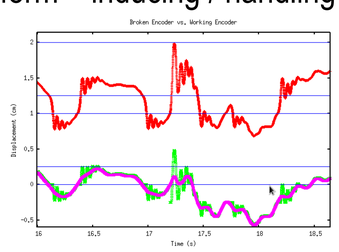
- Robust RTHS on CyberMech platform – reproducible experimentatio

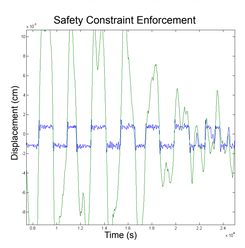




- Robust RTHS on Cybermech platform – inducing / handling hardware failures at runtime







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