

CPS: Medium: Collaborative Research: Cyber-Physical Co-Design of Wireless Monitoring and Control for Civil Infrastructure

Submitted by [Shirley Dyke](#) on Thu, 04/07/2011 - 5:24pm

Project Details

Lead PI: [Shirley Dyke](#)

Performance Period: 10/01/10 - 09/30/15

Institution(s): Purdue University

Sponsor(s): National Science Foundation

Project URL: <https://engineering.purdue.edu/CE/Bowen/Projects/All/cyberphysical-codesign-of-w...>

Award Number: [1035748](#)

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Abstract: Abstract The objective of this research is to develop advanced distributed monitoring and control systems for civil infrastructure. The approach uses a cyber-physical co-design of wireless sensor-actuator networks and structural monitoring and control algorithms. The unified cyber-physical system architecture and abstractions employ reusable middleware services to develop hierarchical structural monitoring and control systems. The intellectual merit of this multi-disciplinary research includes (1) a unified middleware architecture and abstractions for hierarchical sensing and control; (2) a reusable middleware service library for hierarchical structural monitoring and control; (3) customizable time synchronization and synchronized sensing routines; (4) a holistic energy management scheme that maps structural monitoring and control onto a distributed wireless sensor-actuator architecture; (5) dynamic sensor and actuator activation strategies to optimize for the requirements of monitoring, computing, and control; and (6) deployment and empirical validation of structural health monitoring and control systems on representative lab structures and in-service multi-span bridges. While the system constitutes a case study, it will enable the development of general principles that would be applicable to a broad range of engineering cyber-physical systems. This research will result in a reduction in the lifecycle costs and risks related to our civil infrastructure. The multi-disciplinary team will disseminate results throughout the international research community through open-source software

and sensor board hardware. Education and outreach activities will be held in conjunction with the Asia-Pacific Summer School in Smart Structures Technology jointly hosted by the US, Japan, China, and Korea.



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