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Sonny Astani

Department of Civil and Environmental Engineering

USC **Viterbi**
School of Engineering

Seminar Presentation by

Hae Young Noh
*Associate Professor, Department of Civil and
Environmental Engineering, Stanford University*

Tuesday, April 6, 2021
11:00am – 12:00pm
**https://usc.zoom.us/j/97228056404**
Meeting ID: 972 2805 6404
Passcode: 864779

Structures as Sensors: Indirectly Monitoring Humans and Surroundings with Ambient Structural Responses

Abstract:

Smart structures are designed to sense, understand, and respond to structure itself, the humans within, and the surrounding environment. However, traditional monitoring approaches using dedicated sensors often result in dense sensing systems that are difficult to install and maintain in large-scale structures. This talk introduces "structures as sensors" approach that utilizes the structure itself as a sensing medium to indirectly infer multiple types of information (e.g., occupant activity, surrounding infrastructure states) through their influence on the physical response of structure. This is by realizing that the conditions of the structure itself, the environment around, and the activities of users within all have a direct impact on the physical responses of the structure. Challenges lie, however, in creating robust inference models for analyzing noisy structural response data. To this end, we developed physics-guided data analytics approaches that combine statistical signal processing and machine learning with physical principles. Specifically, I will present two projects as examples of this approach; 1) Vehicles as Sensors: indirect infrastructure health monitoring through vehicle responses; and 2) Buildings as Sensors: occupant tracking and characterization through footstep-induced building vibrations. In these projects, new learning wave methods are developed incorporating structural dynamics, methods are propagation, and human activity models. These including our evaluated with real-world experiments, deployments. 6-year railway and eldercare center
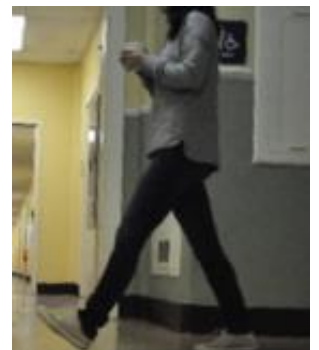
Bio:

Hae Young Noh is an Associate Professor in the Department of Civil and Environmental Engineering at Stanford University. Her research focuses on indirect sensing and physics-guided data analytics to enable low-cost non-intrusive monitoring of cyber-physical-human systems. She is particularly interested in developing structures to be self-, user-, and surrounding-aware to improve users' quality of life and provide safe and sustainable built environment. The results of her work have been deployed in a number of real-world applications from trains, to the Amish community, to eldercare centers, to pig farms. Before joining Stanford, she was a faculty member at Carnegie Mellon University. She received her Ph.D. and M.S. degrees in Civil and Environmental Engineering and the second M.S. degree in Electrical Engineering at Stanford University. She earned her B.S. degree in Mechanical and Aerospace Engineering at Cornell University. She received several awards, including the Google Faculty Research Awards (2013, 2016), the Dean's Early Career Fellowship (2018), and the NSF CAREER Award (2017).