UNIVERSITÀ DEGLI STUDI FIRENZE | Dipartimento di Ingegneria Civile e Ambientale

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International Doctorate in Civil and Environmental Engineering

SEMINAR

STRUCTURES AS SENSORS: INDIRECT MONITORING OF INFRASTRUCTURES AND HUMANS THROUGH AMBIENT VIBRATIONS

Haeyoung Noh
University of Stanford

MONDAY
23 MARCH 2026

TIME
4:00-5:00 pm

LOCATION
Room 138 S.Marta

If interested to attend online please contact
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'Smart structures' sense, understand, and respond to structure itself, the humans within, and the surrounding environment. Traditional monitoring approaches using dedicated sensors often result in dense sensing systems that are difficult to install and maintain in large-scale structures. In this talk, I introduce the "Structures as Sensors" approach that utilizes the existing 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 the structure. Challenges lie in creating robust inference models for analyzing noisy structural response data. To this end, we developed physics-guided data analytics approaches combining statistical signal processing and machine learning with physical principles. I will present two projects as examples of this approach: 1) Telecom Fibers as Sensors: indirect infrastructure health monitoring through telecommunication fiber responses; and 2) Buildings as Sensors: occupant tracking and characterization through footstep-induced building vibrations. We developed new learning methods incorporating structural dynamics, wave propagation, and human activity models; and we evaluated our methods with real-world experiments, including our multi-year railway, eldercare center, and pig farm deployments.

Haeyoung Noh
University of Stanford

'Hae Young Noh is a Professor in the Department of Civil & Environmental Engineering (CEE) at Stanford University. Her research focuses on indirect-sensing and physics-guided data analytics using "structures as sensors" to enable scalable, non-intrusive monitoring of cyber-physical-human systems. Her work has been deployed in several real-world applications from trains, to the Amish community, to eldercare centers, to pig farms. She received her Ph.D. and M.S. degrees in CEE and EE at Stanford, and her B.S. degree in Mechanical & Aerospace Engineering at Cornell. She received several awards, including Google Faculty Research Awards, NSF CAREER Award, Huber Civil Engineering Research Prize, A. J. Durelli Award, and Best Paper Awards (ASCE, ASME, ACM, IEEE, SEM).