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International Doctoral Program in
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SEMINAR

Unsupervised and Supervised Approaches for Structural Health Monitoring of Railway Bridges

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Location:
UNIPG Campus of Engineering
Via G. Duranti, 93, Perugia
Room 16

Timetable:
December 4th 2024 - 12:30 p.m. (CET)

Abstract

This study presents a comprehensive Structural Health Monitoring (SHM) system tailored for railway bridges. Strategically placed sensors capture diverse, real-time data across various operational conditions, applying both supervised and unsupervised methods to enhance detection and classification. Measurements are taken during both ambient (no train load) and train passage conditions, providing data to build baselines and develop damage indexes (DIs) in an unsupervised manner. Under ambient conditions, acceleration responses are processed via Operational Modal Analysis (OMA) to extract modal parameters, with environmental variability compensated ex-post through regression models. During train passage, strain and displacement responses are directly adjusted for environmental factors. For both conditions, DIs are constructed using Mahalanobis distance relative to the baselines. The efficacy of these DIs in anomaly detection is validated through a supervised approach using pseudo-data from updated finite element models. This integrated approach offers a holistic understanding of bridge behavior, supporting accurate health assessments and predictive maintenance to ensure structural integrity and safety.

Soroosh Kamali is a postdoctoral research fellow in the Department of Civil, Chemical, Environmental, and Materials Engineering (DICAM) at the University of Bologna, specializing in Structural Health Monitoring (SHM). He earned his master's and PhD in Civil-Earthquake Engineering from Shiraz University of Technology, Iran, in 2018 and 2023, respectively. Since joining the University of Bologna in 2022, he has contributed to the research and development of monitoring systems for railway bridges. His research expertise includes operational modal analysis, finite element model updating, inverse problems, and integrating machine learning techniques into SHM.

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