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DEPARTMENT OF CIVIL & ENVIRONMENTAL ENGINEERING

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"DIGITAL TWIN MODELING OF CIVIL INFRASTRUCTURE SYSTEMS: TRENDS, CHALLENGES, & OPPORTUNITIES"

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ABSTRACT

Horizontal and vertical civil infrastructure systems profoundly influence several aspects of modern society, including transportation, utilities supply, healthcare, control and mitigation of natural hazards. The Digital twin (DT) modeling paradigm brings great potential for better planning, design, construction, operation, and maintenance of such complex systems, with the ultimate goal of informing decision-making by means of a synergistic combination of numerical models and data obtained from the physical assets. This talk will first provide an overview of the latest advancements in Multiscale Computational Mechanics, Reduced Order Modeling, Artificial Intelligence (AI) and Computer Vision (CV) techniques that are currently enabling a transformative paradigm towards DT modeling of large-scale civil infrastructure systems. Current research trends will be discussed, by means of results of a review of over 3,000 recent articles, which was aided by Large Language Models (LLMs). Then, several examples of DT modeling strategies will be presented, highlighting challenges and opportunities for future research. Lastly, the talk will present state-of-the-art application of Computer Vision and Computational Mechanics techniques for both horizontal (bridges, flood protection systems) and vertical (public buildings) civil infrastructure DT models.

BIOGRAPHY

Dr. Alessandro Fascetti received his bachelor and master degrees in Civil Engineering from the Sapienza University of Rome. He obtained his Ph.D. from the same institution in 2016. He then joined the Multiscale Computational Mechanics Laboratory (MCML) in the Civil and Environmental Engineering Department at Vanderbilt University as a Postdoctoral Research Fellow. After 2 years as a Lecturer for the School of Engineering at The University of Waikato, he joined the Department of Civil and Environmental Engineering at the University of Pittsburgh in 2021. Dr. Fascetti conducts research on digital twin modeling of horizontal and vertical infrastructure for large-scale resilience assessment and operational maintenance optimization. His work focuses on failure mechanics as well as durability aspects, combining multiscale experimental information with in-situ and remote sensing techniques for the real-time assessment of complex interconnected infrastructure systems. He has authored over 40 peer-refereed manuscripts, and secured research funding in excess of $4.5M. He is the receipient of several national and international award, among which the prestigious Roberta Luxbacher Faculty Fellowship from the Swanson School of Engineering at the University of Pittsburgh.