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Department of Civil and  
Environmental Engineering

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*Series*

## Uncertainty in the Vulnerability of Metro Transit Networks: A Global Perspective on Infrastructure Resilience

Presented by:

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**Friday, November 14, 3:00 PM - 4:20 PM PT**  
**McDonnell Douglas Auditorium (MDEA)**

**Abstract:** Urban metro systems are vital to economic productivity and daily mobility, yet they are increasingly exposed to disruptions from technical failures, natural hazards, and targeted attacks. Traditional approaches to measuring vulnerability often reduce complex transit systems to a single score, overlooking the variability and uncertainty inherent in real-world disruptions. This talk introduces a new framework for quantifying uncertainty in metro transit vulnerability through a systematic analysis of 50 global metro systems. By linking topological network metrics to vulnerability outcomes under both benign (random) and malicious (targeted) disruptions, the study reveals how network structure strongly influences resilience patterns. Findings show that connectivity measures are most predictive of vulnerability under targeted disruptions, while benign disruptions display weaker or nonlinear associations. Importantly, results highlight that metro resilience cannot be assessed through static measures alone; instead, it requires accounting for variability across disruption scenarios and differences in network size and topology. The talk concludes with implications for designing adaptive strategies, strengthening interdependencies with other urban systems, and guiding investment priorities to enhance the resilience of critical transportation infrastructure worldwide.

**Bio:** Nazanin Tajik, Ph.D. is an Assistant Professor in the Department of Industrial and Systems Engineering at Mississippi State University and Director of the Intelligent Nexus of Operations Research and Data Science (INORDS) Lab. Her research focuses on resilience and equitable solutions for critical infrastructure systems, particularly transportation, housing, and food systems, under extreme events. She integrates network science, optimization, agent-based modeling, and artificial intelligence to develop data-driven decision-support tools that enhance community resilience against natural hazards and cascading disruptions. Dr. Tajik serves as PI and Co-PI on multiple NSF-funded projects, including recent initiatives on affordable housing resilience and decision aids for disaster sheltering.

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Join us after the seminar for a reception hosted by  
**Civil and Environmental Engineering  
Graduate Association**

Students, researchers, faculty & guests are invited

Located at Engineering Hall EH-2430 Colloquia Patio

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