DEPARTMENT of ISE
UNIVERSITY of HOUSTON

ISE FRIDAY SEMINAR
BROADEN HORIZONS | EXTEND MINDS

Professor Miguel A. Jaller
Chair of Civil and Environmental Engineering
University of California, Davis
Davis, CA

Date: Friday, April 17, 2026

Time: 1 - 1:50 pm

Location: SW 101

Freight Decarbonization through Truck Electrification: Infrastructure, Operations, and System-Level Tradeoffs

Abstract: The decarbonization of freight transportation is central to achieving climate and air quality goals, yet electrifying medium- and heavy-duty trucking presents complex operational and infrastructure challenges. While battery electric trucks (BETs) offer a promising pathway, their large-scale deployment depends on how well charging infrastructure, logistics operations, and power systems are jointly designed. This talk presents a data-driven, optimization-based framework for evaluating the transition to electric freight systems. Leveraging millions of real-world truckload movements, the research integrates vehicle routing, charging infrastructure siting, and grid-aware operations using advanced optimization methods. Results highlight that electrification is not constrained by technology alone, but by system design choices. Hybrid charging strategies that combine depot and public fast-charging can reduce operational costs and improve route feasibility, while poorly coordinated infrastructure risks creating "charging deserts" and inefficiencies. The talk also explores the interaction between freight electrification and the power grid, showing how charging strategies can be aligned with grid conditions to reduce costs and mitigate the impacts of peak demand. Across scenarios, findings reveal key tradeoffs between infrastructure investment, operational efficiency, and system reliability, with implications that vary significantly across short-haul, regional, and long-haul freight operations. Overall, this presentation provides insights into how to strategically deploy charging infrastructure and design freight operations to enable scalable, cost-effective, and equitable decarbonization of the freight sector.

Biography: Miguel A. Jaller is Professor and Chair of Civil and Environmental Engineering at the University of California, Davis, and Co-Director of the Sustainable Freight Research Program at the Institute of Transportation Studies. His work focuses on addressing large-scale challenges in freight and logistics systems under climate, technological, and economic transitions. Dr. Jaller develops integrated, data-driven decision frameworks grounded in quantitative systems analysis and optimization to evaluate freight decarbonization strategies, zero-emission truck deployment, infrastructure investment, and supply chain resilience. His research examines how engineering design, operational strategy, and policy interact to shape the transition toward sustainable, competitive, and resilient goods movement systems. He collaborates extensively with state and federal agencies to translate research into implementable strategies, particularly in the context of California's transition to zero-emission freight. In addition to his academic role, he serves as an Amazon Scholar, contributing to large-scale operational and system design challenges in technology-enabled environments. His work bridges engineering, operations, and policy to support scalable and real-world infrastructure and logistics transformations.

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