Keynote Speaker Bio

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Josephine Carstensen is the Gilbert W. Winslow Career Development (Associate) Professor in MIT's Department of Civil and Environment Engineering (CEE). She leads the Carstensen Group, where her work spans from developing computational design frameworks for various structural types, scales, and design scenarios to experimental investigations that are used to inform necessary algorithmic considerations. Dr. Carstensen has received awards for both research and teaching, including the National Science Foundation CAREER award, the Maseeh Award for Excellence in Teaching, and the Ole Madsen Mentoring Award. She joined the MIT CEE faculty in 2019 after two years as a lecturer at MIT, jointly appointed in CEE and Architecture. She received her PhD from Johns Hopkins University in 2017 and holds a B.Sc. and a M.Sc. from the Technical University of Denmark.

Keynote Title:

AI Modeling of Expert Preferences in Freeform Structural Optimization

The building and construction industry is a significant source of greenhouse gas emissions. The quantities of structural materials used globally correspond to approx. 10% of the annual carbon emissions. Reducing the embodied carbon of new construction is needed, especially considering the predicted population growth and urbanization. Recommended strategies include using more environmentally friendly materials and/or structural optimization. Topology optimization is a promising design method in this context since the resulting designs often significantly outperform conventional low-weight designs. It is a computational approach that generates efficient material layouts tailored to a user's specific design requirements. To take full advantage of its exploratory power, topology optimization leaves the user as a passive observer who initiates the design process and assesses the quality of the design upon completion. The resulting structural designs are typically high-performing and have high levels of geometric complexity. However, ensuring the *physical performance* is adequately predicted by a fully automated design approach requires including all relevant operating conditions, mechanical behaviors, and fabrication constraints. This talk will discuss different strategies to include relevant considerations for topology-optimized design of low-carbon civil structures, including methods that use AI to leverage human designers' experiences.