Title: AI-Empowered Performance-Based Wind Engineering

Abstract: Recent advancements in performance-based wind engineering have placed new demands on wind characterization (e.g., duration consideration), aerodynamics modeling (e.g., transient feature) and structural analysis (e.g., nonlinear response). While conventional approaches in computational and experimental wind engineering provide valuable tools to overcome many of these emerging challenges, noticeable increase in use of artificial intelligence (AI) suggests its great promise in facilitating the implementation of performance-based wind design methodology. This talk will discuss state-of-the-art machine learning tools (e.g., knowledge-enhanced deep learning and deep reinforcement learning) that are successfully applied to wind climate analysis, transient aerodynamics, nonlinear structural dynamics, shape optimization and vibration control. The final part of this talk will extend the application of AI tools to enhance the coastal city resilience under hurricane hazards (wind, rain, and surge).

Bio Sketch: Dr. Teng Wu is a Professor and the Director of Graduate Studies in the Department of Civil, Structural and Environmental Engineering at the University at Buffalo (UB). Wu's research interest is the development of analytical and computational methods focusing on nonlinear and transient structural aerodynamics, performance-based wind design, and community resilience to hurricane (wind, rain and surge hazards). His contributions have been recognized through the 2013 American Society of Civil Engineers (ASCE) O.H. Ammann Research Fellowship, 2014 American Association for Wind Engineering (AAWE) Best Paper Award, 2016 ASCE Alfred Noble Prize, 2017 AAWE Robert Scanlan Award, 2017 International Association for Wind Engineering (IAWE) Junior Award, 2018 International Association for Bridge and Structural Engineering (IABSE) Prize, 2023 and 2024 IABSE Outstanding Paper Award. Wu currently serves as the Editor-in-Chief of two international journals (including Advances in Wind Engineering) and Associate Editor of six international journals (including ASCE Journal of Bridge Engineering, ASCE Journal of Structural Engineering and IABSE Structural Engineering International). He is the Chair of ASCE/SEI Cable-Supported Bridges Committee, ASCE/EMI Fluid Dynamics Committee, and ASCE/Changing Climate Technical Committee on Future Weather and Climate Extremes. Wu is an executive board member of IAWE, a member of AAWE board of directors, and an executive committee member of ASCE Infrastructure Resilience Division.