Structural Engineering Seminar Series
CEE 595 S

Modeling Full-Scale Vortex-Induced and Rain-Wind-Induced Stay Cable Vibrations

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Abstract:

Cable-stayed bridges frequently exhibit problematic vortex-induced and rain-wind-induced stay cable vibrations. Multiple types of models exist for vortex-induced vibration of slender structural members, and a number of models have been proposed for rain-wind-induced vibration. However, the models do not adequately address some factors that critically influence full-scale vibrations. These include that the vibrations occur in sheared flow of the atmospheric boundary layer and that both types of vibration can have contributions from multiple modes. This seminar presents unified empirical models for vortex-induced and rain-wind-induced full-scale stay cable vibrations. Based on the models, the unscented Kalman filter is used to estimate the aerodynamic damping in vibrations recorded on a cable-stayed bridge. The effectiveness of the models is demonstrated by comparing numerically reproduced vibrations based on the estimated aerodynamic damping against field measurements.

Bio:

Dr. Delong Zuo is a Professor of Civil Engineering at Texas Tech University, where he also serves as Technical Director of Wind Engineering at the National Wind Institute and Director of the NSF Industry–University Cooperative Research Center for Wind Hazard and Infrastructure Performance. He earned his Ph.D. from Johns Hopkins University and conducted research as a visiting student in the Department of Civil and Environmental Engineering at the University of Illinois Urbana-Champaign. Specializing in structural wind engineering, Dr. Zuo combines full-scale and laboratory experiments with analytical modeling and numerical simulation to investigate wind loading, structural response, and wind-induced vibrations. His recent studies center on dynamics of tornado-like vortices, tornado-like loading on low-rise building, and aerodynamic responses of slender structures.

Monday, October 26, 2026 4:00 – 5:00 p.m.
1310 Yeh Student Center