NATIONAL TECHNICAL UNIVERSITY OF ATHENS
SCHOOL OF CIVIL ENGINEERING
INSTITUTE OF STEEL STRUCTURES

Lecture

By Prof. Girma Bitsuamlak, Western University, Canada

Advances in computational and experimental wind engineering for wind-resilient and sustainable buildings

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Abstract: Wind design plays a crucial role in ensuring the safety and sustainability of buildings and other civil infrastructure. To achieve this, it is essential to model wind and its interactions with structures. During the presentation, we will explore the generation of various wind systems, such as typical strong winds, hurricanes, downbursts, and tornadoes in a controlled environment. This will be accomplished through two approaches: (i) Computational Fluid Dynamics (CFD)-based modeling using the high-performance computing resources of SHARCNET, which allows for detailed analysis and simulations. (ii) Physical testing conducted at either the WindEEE Dome or the Boundary Layer Wind Tunnel Laboratory. The WindEEE Dome possesses unique capabilities for generating both stationary and nonstationary wind systems. It also offers novel flow measurement and visualization techniques. The data obtained from the WindEEE Dome is of high quality and serves to validate the numerical models used in wind-resilient design. The validated numerical models, in turn, enable the study of multi-scale wind systems that may extend beyond the capabilities of experimental facilities. We will present recent examples of building designs considering typical wind conditions and nonstationary wind systems, such as tornadoes.

Bio: Dr. Girma Bitsuamlak (https://bitsuamlak.com/) is a Professor of Wind Engineering, with expertise in climate-resilient and sustainable buildings and neighborhoods. His current research focuses on two key areas: (i) modeling extreme wind effects on civil infrastructure, such as hurricanes and tornadoes, and (ii) analyzing the interplay between aerodynamics and other micro-climate stressors to assess sustainable building thermal and energy performance. Dr. Bitsuamlak combines computational fluid dynamics-based simulations (aided by Artificial Intelligence) with high-performance computing and physical experiments conducted at the world-class WindEEE Research Facilities (www.windee.ca). As Director of both the WindEEE Research Institute and WindEEE Research Facilities (The Dome + BLWTL + 3LP) at Western University, he has led numerous groundbreaking studies in wind engineering. Dr. Bitsuamlak is a Fellow of the Canadian Society of Civil Engineers and serves as Western University's site leader for the Sharcnet computing center. He has also executed wind-induced load and response studies for socially and historically significant super tall buildings such as the Freedom Tower in New York, the International Commerce Center in Hong Kong, the Burj Khalifa in Dubai and various tall mass timber buildings.