



DEPARTMENT OF CIVIL ENGINEERING

SEMINAR

**Transmission Line Structures Under Tornadoes and Downbursts-
Numerical Development, Testing and Code Implementation**

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Time: 11:30 a.m. - 12:30 p.m.

Venue: Room 612B, 6/F Haking Wong Building, The University of Hong Kong

Abstract

Downbursts and tornadoes belong to a category of windstorms called High Intensity Wind (HIW). It was reported that more than 80% of weather-related transmission line failures have been associated with HIW events. An extensive research program was initiated about 15 years ago at the University of Western Ontario, Canada, focusing on this problem. This research was triggered by the failure of a number of towers in the provinces of Manitoba and Ontario in Canada and was supported by the two major Canadian electrical utility companies Manitoba Hydro and Hydro One Ontario. The research covered various aspects related to this problem. These include the development and experimental validation of computational fluid dynamics models to simulate downbursts and tornadoes. The HIW wind fields were incorporated into a nonlinear finite element program developed in-house that is capable of simulating all components of a transmission line system including the towers, the conductors and the insulators. The localized nature of HIW events introduces more complications as the response of long structures, like transmission lines, will vary significantly depending on the location and size of the wind event. The developed numerical model was used to conduct extensive parametric studies to assess the behavior of various guyed and self-supported towers under downbursts and tornadoes. The numerical model was also used to conduct progressive failure analyses for transmission systems to predict failure loads and modes, which were shown to coincide with field observations. The first aero-elastic tests conducted in the world on multi-span transmission model under simulated downbursts and tornadoes were carried out in this research program at the unique WindEEE dome facility recently established at the University of Western Ontario. A major outcome of this research program was the development of a set of load cases simulating the critical effects of downbursts and tornadoes on transmission line structures, which are in the final stage of implementation in the ASCE-74 guidelines, representing the first specifications available in the world to account for the effect of localized wind storms on transmission line structures.

About the Speaker

Dr. Ashraf El Damatty, Professor and Chair of the Department of Civil and Environmental Engineering at the University of Western Ontario, London, Ontario, Canada. He is a Fellow of the Canadian Society of Civil Engineering and Fellow of the Engineering Institute of Canada. He is a Research Director at the WindEEE Research Institute and Co-Editor-in-Chief of the Journal of Wind and Structures. He held the title of High End Expert at Tongji University, China. He obtained a BSc. and M.Sc. from Cairo University in 1986 and 1991, Ph.D. in Structural Engineering from McMaster University, Canada, in 1995, and an MBA in 2016 in Higher Education Management from University College, London, UK. He is the founder of the Canadian Society of Civil Engineering (CSCE) Steel Structures Committee and serves currently as the CSCE Structures Division. He has consulted on many projects in North America and the Middle East He has written over 200 publications and has secured research funding exceeding \$20.0 M. He has supervised more than 30 Ph.D. and 20 M.Sc. students and has been invited as keynote speaker in many countries around the globe. He received several awards including the Alan Yorkdale Award by ASTM, Best Paper Award at the Canadian Conference on Effective Design of Structures, Honourable Mention in 2014 Casimir Gzowski Medal Competition, 2015 CSCE Whitman Wright Award, 2016 CSCE Horst Leipholz Medal, Western University Faculty Scholar Award, and the 2018 Professional Engineers of Ontario Research and Development Award. His research work has influenced the international codes and the Engineering practice worldwide.