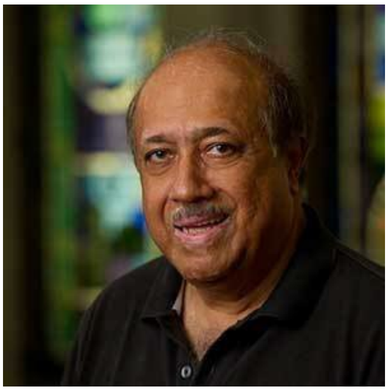
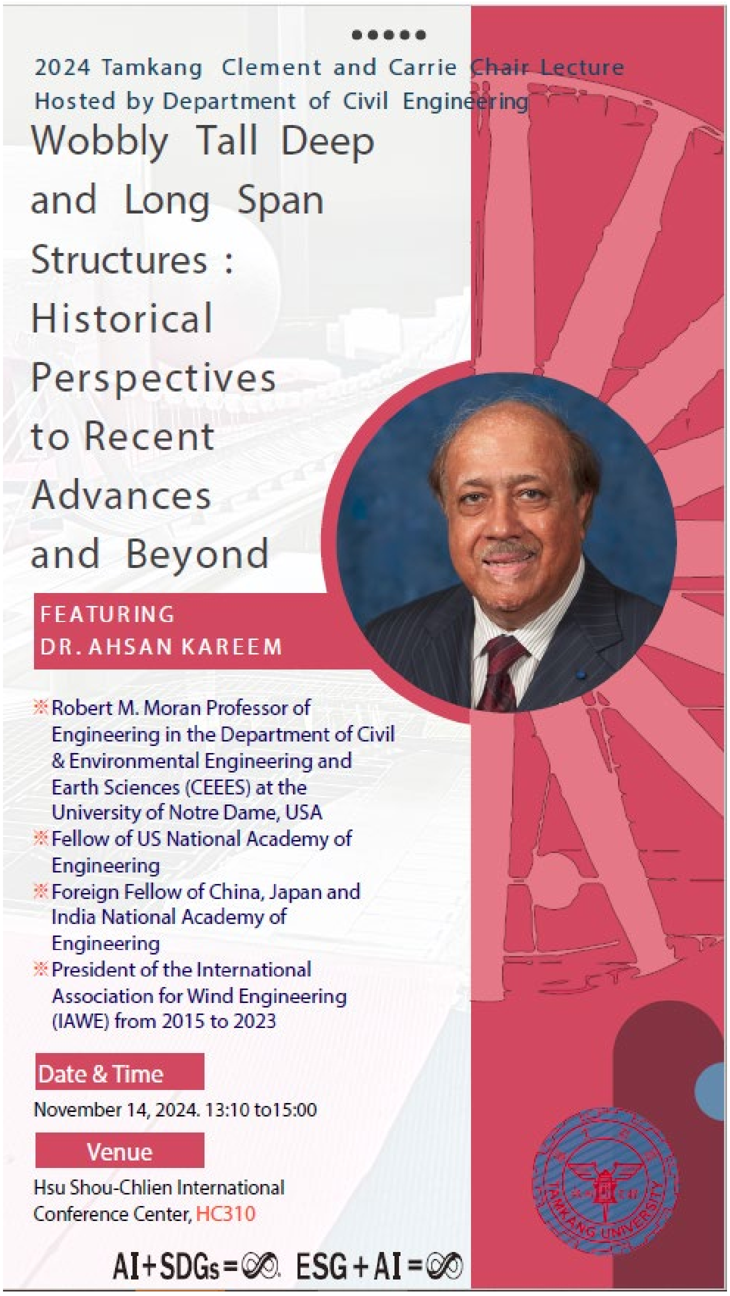
LECTURE 31



Prof. Ahsan Kareem

- Robert M. Moran Professor of Engineering in the Department of Civil & Environmental Engineering and Earth Sciences (CEEES) at the University of Notre Dame, USA
- Fellow of US National Academy of Engineering
- Foreign Fellow of China, Japan and India National Academy of Engineering
- President of the International Association for Wind Engineering (IAWE) from 2015 to 2023

Date: 11.14.2024



Speaker

Ahsan Kareem, Ph.D. (Robert M. Moran Professor of Engineering in the Department of Civil & Environmental Engineering and Earth Sciences (CEEES) at the University of Notre Dame.) And director of the Nathaz Modeling Laboratory and served as the past Chair at the Department of CEEES at the University of Notre Dame.

Speaker Introduction

Professor's work is on quantifying load effects caused by various natural hazards on structures and to develop innovative strategies to manage and mitigate their effects. The characterization and formulation of dynamic load effects due to wind, waves and earthquakes on tall buildings, long-span bridges, offshore structures, and other structures is carried out via fundamental analytical computational methods, and experiments at laboratory, and full-scale.

In 2009, Kareem was elected a member of the National Academy of Engineering for contributions to analyses and designs to account for wind effects on tall buildings, long-span bridges, and other structures.

Topic: Wobbly Tall Deep and Long Span Structures: Historical Perspectives to Recent Advances and Beyond

ABSTRACT

The seminar will briefly summarize the historical development in the dynamics of tall buildings, deep offshore platforms, and long-span bridges. We will begin with the assertion that everything in the world is an oscillator with wobbly features. This seamlessly connects to wobbly tall buildings, deep offshore structures, and long-span bridges. The discussion will follow the design of the World Trade Center Towers, the evolution of compliant offshore systems, and lessons from the Tacoma Narrow Bridge to present-day advancements and beyond. First of all, the equations of fluid motion are mathematically intractable, which has led to reliance on physical modeling in wind tunnels of tall buildings and long-span bridges as well as offshore platforms. From earlier studies at the National Physical Laboratory in the UK involving the World Trade Center Towers, it was realized that it was essential to model the inflow that was reflective of the atmospheric boundary layer rather than a uniform flow in an aeronautical tunnel. At that juncture, the dynamic response was evaluated using base-pivoted aeroelastic models while a search for a more expeditious means of assessing wind loads was in progress, which led to the development of various force balances. In bridge aerodynamics, the role of turbulence in the evaluation of flutter velocity has been a subject of focused interest. In this context, a general overview of the basic techniques for the quantification of wind loads and their dynamic effects using analytical, experimental, computational fluid dynamics (CFD) and model-based and data-driven

simulation schemes, database-enabled platforms, code, and standards-based procedures and lessons from full-scale monitoring will be presented in a historical perspective as applied to tall buildings, long-span bridges, and deep water offshore platforms. This will be followed by a synopsis of the emerging frontiers in CFD from isolated buildings to cityscapes, mesoscale to micro-scale, physics-informed simulations, shape, and topological optimization, the vulnerability of glass cladding in extreme winds, the role of organic damping and damping devices for the mitigation of structural motion.

TIME

November 14, 2024, Thursday / 13:10-15:00

PLACE

Hsu Shou-Chlien International Conference Center, HC310