State Key Laboratory of Terahertz and Millimeter Waves
香港城市大學 City University of Hong Kong

IEEE (HK) Section AP/MTT

Seminar On

Computational Electromagnetics: From Physics to Intelligence

Professor Zhen Peng
University of Illinois at Urbana-Champaign, United States

Date : **1 August 2025 (Friday)**

Time : **11:00 am – 12:00 nn**

Onsite Venue : **Room 15-202, 15/F, State Key Laboratory of Terahertz and Millimeter Waves, Lau Ming Wai Academic Building, City University of Hong Kong**

Abstract

The evolution of electromagnetic (EM) systems, ranging from advanced electronic integration to smart wireless environments, demands a new paradigm in modeling and simulation. This lecture presents a problem-driven exploration of computational electromagnetics, grounded in wave physics and guided toward the frontier of machine intelligence.

We begin with the challenge of scale. As EM systems grow in size and complexity, classical full-wave solvers face fundamental bottlenecks. We introduce domain decomposition strategies that offer both algorithmic scalability and computational modularity. These methods enable system-level simulation with component-level resolution. Next, we address the prediction challenge in chaotic and confined EM environments, where wave solutions exhibit extreme sensitivity to boundary conditions and material variations. Here, we turn to the stochastic Green's function: a statistical, physics-based surrogate that captures the intricate interplay of coherence and randomness, rooted in wave chaos physics and the mathematics of random matrices. The final part of the talk explores the frontier of machine intelligence. We will discuss photon splatting and neural operators for real-time EM wave propagation, as well as quantum-based optimization techniques for inverse design and control of intelligent surfaces.

Biography

Dr. Zhen Peng is a Professor at the Department of Electrical and Computer Engineering (ECE ILLINOIS), University of Illinois at Urbana-Champaign. His research focuses on computational, statistical, and applied electromagnetics, advancing the modeling and simulation of classical and quantum electrodynamic physics using intelligent algorithms on state-of-the-art hardware. The outcome enables virtual experimentation for the prediction, discovery, and design of complex electromagnetic systems at unprecedented scales. Recent applications of his research include physical-layer modeling and innovations in NextG wireless systems, electrical analysis for heterogeneous integration, intra-system EMI/EMC in complex electronic platforms, and physics-based computing to enable autonomy and intelligence of electromagnetic systems.

His research contributions have been recognized through multiple awards, including three IEEE Transactions Paper Awards (2024 IEEE EMC Richard B. Schulz HMTP Award, 2018 IEEE CPMT Best Transaction Paper Award, and the 2014 IEEE Antennas and Propagation Sergei A. Schelkunoff Transactions Prize Paper), eight Conference Paper Awards (IEEE EMC Symposium, 2024 and 2018; EuCAP Best Electromagnetics Paper, 2022; EPEPS Best Conference Paper, 2021 and 2019; ICEAA–IEEE APWC Best Paper, 2018; IEEE Workshop on SIPI, 2016), and several Young Scientist Awards. He has also advised students who have received twelve Student Paper Awards at international conferences. In addition, he is a recipient of the NSF CAREER Award (2018) and the ACES Early Career Award (2015).

Dr. Peng is a Distinguished Lecturer of the IEEE Antennas and Propagation Society (2024–2026). He currently serves as Chair of the IEEE AP-S Technical Committee on Computational Electromagnetics, and previously served on the Board of Directors of the Applied Computational Electromagnetics Society (2019–2022). His editorial roles include serving as Associate Editor for IEEE Trans. MTT (2018-2020), IEEE Trans. CPMT (2023), IEEE OJAP (2023- present), IEEE TAP (2025- present). He also served as conference chair and co-chair for the Conference on Electrical Performance of Electronic Packaging and Systems (2022, 2021), and Technical Program Committee chair for the ACES symposium (2025).

***** ALL ARE WELCOME *****

Enquiries:
Prof. Alex M H Wong, Department of Electrical Engineering, City University of Hong Kong
Email: amhwong@cityu.edu.hk