

KEYNOTE TALK

Electromagnetic Modeling and Simulation

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Abstract –

Modeling and Simulation (ModSim) have become essential tools in science and engineering, enabling the precise analysis and prediction of complex systems. In Computational Electromagnetics (CEM), these techniques have advanced significantly over the past six decades, addressing increasingly sophisticated challenges and driving innovation across various industries. CEM plays a pivotal role in the design and optimization of modern electromagnetic systems. Emerging technologies, such as 5G and beyond, metasurfaces, and quantum devices, present new challenges in modeling multiscale, multiphysics, and electrically large systems. Accurate simulation of these systems requires efficient handling of billions of unknowns and the incorporation of various physical effects, demanding innovative methodologies.

Overcoming these challenges necessitates the development of hybrid numerical methods, problem decomposition strategies, and parallelization techniques optimized for advanced computing architectures. Recent hardware advancements, including Graphics Processing Units (GPUs) and specialized computational platforms, have further revolutionized the computational capabilities of CEM. Additionally, the integration of machine learning (ML) into CEM workflows has emerged as a transformative approach, offering the potential to accelerate simulations, optimize resources, and enhance accuracy.

This keynote presentation explores the latest advancements in electromagnetic modeling and simulation, with a focus on numerical methods, their challenges, and future directions. It will highlight the critical role of interdisciplinary collaboration in addressing emerging complexities and driving innovation in the field. By combining advanced numerical methods, ML, and high-performance computing, the next generation of CEM tools can significantly enhance the accuracy and efficiency of simulations, enabling breakthroughs in fields ranging from telecommunications to quantum technologies.

Speaker:



Özlem Özgün is currently a full professor in the Electrical and Electronics Engineering department of Hacettepe University, Ankara, Turkey. She received her B.Sc. and M.Sc. degrees from Bilkent University, Ankara, Turkey in 1998 and 2000, respectively, and her Ph.D. degree from Middle East Technical University (METU), Ankara, Turkey in 2007, all in Electrical and Electronics Engineering. She served as a postdoctoral researcher at Electromagnetic Communication Lab, Penn State University, USA (2007-2008). She previously worked at TUBITAK İltaren (2000-2004), Aselsan Inc. (2004-2005), METU (2008-2012), and TED University (2012-2015) before joining Hacettepe University.

Her research interests include various topics in computational electromagnetics and radiowave propagation, including electromagnetic radiation and scattering, numerical methods, domain decomposition methods, transformation electromagnetics, stochastic electromagnetic problems and optimization techniques. She has authored over 130 refereed publications in international journals, book (*MATLAB-based Finite Element Programming in Electromagnetic Modeling*, CRC Press, 2018), book chapters and conference proceedings.

Dr. Özgün is a senior member of IEEE and URSI and served as the past chair of the steering committee of URSI Turkey. She received the METU best Ph.D. thesis award in 2007, and the award for excellence in electromagnetics bestowed by Prof. Felsen Fund in 2009. She was honored in 2023 and 2024 by being named among the world's top 2% influential scientists in the career-long impact category, prepared by Stanford University and Elsevier. She is also the recipient of the IEEE AP-S Outstanding Reviewer Award (IEEE TAP) for 2023. Recently, she was honored by the "Hacettepe University 2024 Science Award".