



IEEE Antennas and Propagation Society Distinguished Lecture

Scientific Machine Learning for Electromagnetic Field Computations

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Date : 16 October 2026 (Friday)
Time : 10:00 am – 11:00 noon (Hong Kong Time, GMT +08:00)
Venue : Online (Zoom Meeting)
Zoom : <https://cityu.zoom.us/j/84482402226?pwd=GTrqSo02e4kN4UsgimxbxbYaHyaPoZ.1>
Meeting : Meeting ID: 844 8240 2226
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Abstract

A recent report by the US Department of Energy defines the area of scientific machine learning as “a core component of artificial intelligence (AI) and a computational technology that can be trained, with scientific data, to augment or automate human skills”, which has “the potential to transform science and energy research”. In this presentation, we discuss the potential of scientific machine learning methods to problems in computational electromagnetics starting from standard electromagnetic structure analysis and multi-physics modeling in the time-domain, employing unsupervised, supervised and reinforcement learning.

An unsupervised learning strategy is based on a modified Physics-Informed Neural Network (PINN). PINNs directly integrate physical laws into their loss function, so that the training process does not rely on the generation of training ground truth data from simulations. We introduce a physics-informed deep-operator-network (PI-DON) for Maxwell's equations. We show applications of the PI-DON to the analysis, design and uncertainty quantification study of finite and defect periodic structures, including frequency selective surfaces and metasurfaces.

Moreover, we demonstrate the impact of machine learning on the computational modeling of radiowave propagation scenarios and reconfigurable intelligent surfaces, using supervised learning. We build convolutional neural network models that can process the geometry of indoor environments, along with physics-inspired parameters, to rapidly estimate received signal strength (RSS) maps. Emphasis is placed on the generalizability of these models, which is their ability to “learn” the physics of radiowave propagation and produce accurate modeling predictions in new geometries well beyond those included in their training set.

Finally, the use of reinforcement learning for the optimization of reconfigurable intelligent surfaces will be discussed.

Biography



Costas Sarris is a Professor with the Department of Electrical and Computer Engineering, University of Toronto. His research area is computational electromagnetics, with an emphasis on time-domain modeling. He also works on physics-based wireless propagation models (with full-wave, asymptotic, and hybrid techniques), uncertainty quantification, and scientific machine learning.

Dr. Sarris is an IEEE Fellow and a Distinguished Lecturer of the IEEE Antennas and Propagation Society for 2024-2026. He was a recipient of the 2021 Premium Award for Best Paper in IET Microwaves, Antennas & Propagation, and the IEEE MTT-S Outstanding Young Engineer Award in 2013. He was the TPC Chair of the 2015 IEEE AP-S International Symposium on

Antennas and Propagation and the CNC/USNC Joint Meeting, the 2019 and 2023 MTT-S Numerical Electromagnetics, Multiphysics and Optimization (NEMO) Conference, the TPC Vice-Chair of the 2012 IEEE MTT-S International Microwave Symposium, and the Chair of the MTT-S Technical Committee on Field Theory and Numerical Electromagnetics (2018–2020). In 2019-2024, he was the Editor-in-Chief of the IEEE JOURNAL ON MULTISCALE AND MULTIPHYSICS COMPUTATIONAL TECHNIQUES.

*** ALL ARE WELCOME ***

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