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MACHINE LEARNING ADVANCES IN ELECTROMAGENTICS

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ABSTRACT

Computational electromagnetics has long been a foundational technology for the design and analysis of electrical systems, including transformers, electric machines, and printed circuit boards. As modern engineering demands increasingly complex geometries, multi-physics coupling, and higher accuracy, the limitations of conventional solvers such as the finite-difference time-domain (FDTD) and finite element methods (FEM) have become more pronounced due to their rapidly growing computational cost. Moreover, the intrinsic complexity of solving partial differential equations derived from Maxwell's equations poses fundamental challenges that are difficult to overcome by algorithmic improvements alone.

This mini-symposium envisions a paradigm shift in computational electromagnetics driven by machine learning. By integrating data-driven models with physical laws, emerging approaches such as physics-informed neural networks (PINNs), neural operators, and AI-assisted inverse modelling offer new possibilities for fast, scalable, and adaptive electromagnetic analysis. The symposium aims to bring together researchers exploring how artificial intelligence can complement or redefine traditional numerical methods, enabling real-time simulation, uncertainty-aware modelling, and automated discovery in electromagnetic field analysis. Through this dialogue, we seek to illuminate future directions toward next-generation electromagnetic solvers that seamlessly combine physics, data, and computation.