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Data-Driven Methods to Solve Maxwell's equations

Tuesday, March 3, 2026 4:00 PM (45 minutes)

Understanding and predicting solutions to Maxwell's equations lies at the heart of research in optics and photonics. Traditionally, mostly physics-based approaches were used for that purpose, i.e., analytical and, very often, numerical methods. However, over time, we have been accumulating plenty of data on structure-property relations, i.e., we know how a given optical structure responds to illumination. This growing resource opens the door to complementary, data-driven approaches for exploring electromagnetic scattering phenomena.

In this talk, we present an overview of our recent efforts to leverage such data for solving and interpreting optical scattering problems. We describe our progress in developing standardized formats for storing Maxwell-related data and in building a web-based database that enables broad access to curated scattering datasets. We further highlight several data-driven methodologies that range from surrogate modeling to generalization strategies, which exploit these datasets to address forward and inverse scattering tasks.

Our work is carried out in close collaboration with the wider optics community, with the goal of establishing shared infrastructure and best practices that advance data-centric research in photonics.

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