Convergence of Simulation, Cloud Computing and Artificial Intelligence in Electromagnetics

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ABSTRACT

Simulation-driven design changed product development forever, enabling engineers to reduce design, iterations, and prototype testing. Increasing scientific computing power expanded the opportunity to apply analysis, making large design studies possible within the timing constraints of a program. Now engineering adoption of Artificial Intelligence (AI) and Machine Learning (ML) is transforming product development again. Combination of physics-based simulation-driven design with machine learning, leveraging the latest in high-performance cloud computing, enables industry to explore more and identify high-potential designs – while rejecting low-potential concepts – even earlier in development cycles.

With the increase in connected devices and platforms (such as 5G, 6G, C-V2X, ADAS etc.), advanced computational electromagnetic (CEM) tools have become part of the product design cycle. Now numerical simulations can be performed to evaluate the effects of antenna design, placement, radiation hazard, EMC/EMI, etc. for wide ranging industry applications. Interfacing with propagation tools, system level design can be accomplished that includes operating environment of the devices for device connectivity and throughput. Advent of cloud computing and AI/ML, and convergence with CEM simulations made connected, smart device design faster with reduced time from concept to the market propelling productivity and innovation.

This talk will focus on advanced CEM simulation tools that incorporate numerical methods, such as Method of Moments (MoM), Multilevel Fast Multipole Method (MLFMM), Finite Element Method (FEM), Finite Difference Time Domain (FDTD), Physical Optics (PO), Ray Lunching Geometrical Optics (RL-GO) (also known as Shooting and Bouncing Ray – SBR method), and Uniform Theory of Diffraction (UTD). As the complexity of connected devices increases each day, designers are taking advantage of AI/ML to generate trained models for their physical antenna designs and perform fast and intelligent optimization on these trained models. Using the trained models, different optimization algorithms and goals can be run quickly, in seconds, that can be utilized for comparison studies, stochastic analysis for tolerance studies etc. Use of cloud computing combined with AI/ML, many design iterations can be performed in a short period and reducing the time to market. This talk will also focus on future trends in cloud computing for physics-based simulations.

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