QuickWave-3D: Efficient FDTD Models for Analysis & CAD of Microwave Systems. Applications in Antennas and Propagation

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Keywords: computational electromagnetics (CEM), finite-difference time-domain (FDTD) method, transmitting and receiving antennas, absorbing boundary conditions, radiation patterns, radiation efficiency.

The lecture reviews general requirements for defining transmitting and receiving antenna scenarios in FDTD simulation software. Various types of absorbing boundary conditions (ABCs) and near-to-far (NTF) field transformation field procedures are summarized. Practical hints are given with respect to proper relative positioning of antenna elements, ABCs, and NTF box. Feasibility of electromagnetic optimization is addressed. Concluding remarks are dedicated to axisymmetrical antennas, which can be analyzed with enhanced efficiency with vector two dimensional FDTD algorithms such as *QW-V2D*.

The constellation of topics considered in the lecture material includes:

1. Two types of antenna scenarios for EM analysis:
   - transmitting antennas
   - receiving antennas.
2. Absorbing boundary conditions for FDTD antenna analysis:
   - resistive boundaries,
   - extrapolation of the wave equation,
   - matched lossy layers,
   - PML.
3. Near-to-Far transformation:
   - requirements for FDTD scenarios,
   - frequency-domain NTF,
   - time-domain (fixed-angle) NTF.
4. Radiation patterns variants:
   - scaling options (directive gain, power gain, absolute gain, absolute fields at 1 m),
   - polarization types (linear, circular, co- & cross-polar),
   - scalar parameters (radiation efficiency),
   - dielectric and lossy background media.
5. Optimization:
   - goal functions,
   - variables and parameters.
6. Axisymmetrical antennas:
   - vector two-dimensional (V2D) FDTD formulations in cylindrical coordinates,
   - advantages of *QW-V2D* approach.

The specific topics for this lecture are adjusted to the audience interests and background knowledge of the subject.