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Electron Energy-Loss Spectroscopy (EELS)Calculation in Finite-Difference Time-Domain (FDTD)Package: EELS-FDTD[1] NICOLAS LARGE, YANG CAO, ALEJANDRO MANJAVACAS, PETER NORDLANDER, Rice University — Electron energy-loss spectroscopy (EELS) is a unique tool that is extensively used to investigate the plasmonic response of metallic nanostructures since the early works in the '50s. To be able to interpret and theoretically investigate EELS results, a myriad of different numerical techniques have been developed for EELS simulations (BEM, DDA, FEM, GDTD, Green dyadic functions). Although these techniques are able to predict and reproduce experimental results, they possess significant drawbacks and are often limited to highly symmetrical geometries, non-penetrating trajectories, small nanostructures, and free standing nanostructures. We present here a novel approach for EELS calculations using the Finite-difference time-domain (FDTD) method: EELS-FDTD. We benchmark our approach by direct comparison with results from the well-established boundary element method (BEM) and published experimental results. In particular, we compute EELS spectra for spherical nanoparticles, nanoparticle dimers, nanodisks supported by various substrates, and gold bowtie antennas on a silicon nitride substrate. Our EELS-FDTD implementation can be easily extended to more complex geometries and configurations and can be directly implemented within other numerical methods.

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