Spectral-element Discontinuous Galerkin (SEDG) Simulations for Metallic Nanoparticles

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We present higher-order computational methods to study the dynamic nature of electromagnetic waves interacting with metallic nanoparticles where strong surface plasmon excitations can occur. In the study of light interacting with a nanoscale object, a particular computational issue is that the problem includes sharp discontinuities in the dielectric function along the surface of the nanoscale object. In such cases, standard lower-order methods such as FDTD method require considerable computational work in order to achieve a certain expected accuracy. The drawback comes from the slow rate of convergence of the methods for problems whose solutions have less regularity in smoothness. We propose to use higher-order numerical techniques with phase-preserving nature: a spectral-element discontinuous Galerkin (SEDG) method. The method is based on multidomain body-conforming approach. The exponential accuracy of this method without stair-stepping phenomena will be discussed. Computational performance of 3D structures and simulation for metallic nanosphere waveguide will be demonstrated.