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An overview of discrete dipole approximation by means of Graphics Processing Unit, Fast Fourier Transform, and Complex Conjugate Gradient in MATLAB MASOUD SHABANINEZHAD NAVROOD, MUAAZ GUL AWAN, GUDA RAMAKRISHNA, Western Michigan University — In this work, we review discrete dipole approximation (DDA) as a numerical method to calculate the optical properties of arbitrary shaped metallic nanoparticles (NPs). In this method, the target particle will be divided into N-cubes which each one representing a point dipole with polarizability of α_{i} that interacts with the electric field of the incident light and N-1 other dipoles. We discuss polarizability function, induced dipoles and dipole interaction matrix, and consequently we explained how to calculate absorption, scattering, and extinction efficiencies, field enhancement around single nanoparticle and hot spot in the dimer structures. To calculate dipole moments, Fast Fourier Transform (FFT) and Biconjugate Gradient (BCG) along with their corresponding numerical aspects have been reviewed to accelerate the computation time and to reduce the required memory. In the end, we applied a graphic processing unit (GPU) algorithm to reduce the time and required computational memory. By applying GPU, the simulation significantly reduced in compare to CPU. It is worth mentioning that all of the codes is developed by our group in MATLAB software.

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