Spectral Properties of Plasmonic Vertical Nano-Gap Array Resonators

In recent decades, metallic nanostructured devices have deployed plasmonic resonant excitations to enhance both absorption and field enhancements. The spectral properties of a plasmonic vertical nano-gap resonator is investigated numerically using the finite difference time domain (FDTD) method. A circuit model is proposed to predict the resonance wavelengths at certain dimensions and material for the resonator. The FDTD results are compared with that of the circuit model. Incident electromagnetic wave intensity is enhanced in the resonator, mid in the dielectric layer, to be as high as 450 times. Design curves are obtained to facilitate the construction of gap array resonators at resonance wavelengths in the visible and near-infrared regimes including telecom wavelengths, 1300 and 1500 nm. It is found that the relation between the resonance wavelength and resonator dimensions is linear. The proposed design is simple to be manufactured and quite efficient for various applications e.g., in nanophotonics, surface enhanced Raman spectroscopy, and photovoltaics.