Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Surface Integral Formulations for the Design of Plasmonic Nanostructures CARLO FORESTIERE, Boston University, GIOVANNI IADAROLA, GUGLIELMO RUBINACCI, Universita' degli Studi di Napoli Federico II, ANTONELLO TAMBURRINO, Universita' di Cassino e del Lazio Meridionale, LUCA DAL NEGRO, Boston University, GIOVANNI MIANO, Universita' degli Studi di Napoli Federico II, BOSTON UNIVERSITY TEAM, UNIVERSITA' DEGLI STUDI DI NAPOLI FEDERICO II TEAM, UNIVERSITA' DI CASSINO E DEL LAZIO MERIDIONALE TEAM — Numerical formulations based on surface integral equations (SIEs) provide an accurate and efficient framework for the solution of the electromagnetic scattering problem by three-dimensional plasmonic nanostructures in the frequency domain. In this work, we present a unified description of SIE formulations with both singular and nonsingular kernel and we study their accuracy in solving the scattering problem by metallic nanoparticles with spherical and nonspherical shape. In fact, the accuracy of the numerical solution, especially in the near zone, is of great importance in the analysis and design of plasmonic nanostructures, whose operation critically depends on the manipulation of electromagnetic hot spots. Four formulation types are considered: the N-combined region integral equations, the T-combined region integral equations, the combined field integral equations and the null field integral equations. A detailed comparison between their numerical solutions obtained for several nanoparticle shapes is performed by examining convergence rate and accuracy in both the far and near zone of the scatterer as a function of the number of degrees of freedom. A rigorous analysis of SIE formulations can have a high impact on the engineering of numerous nano-scale optical devices.

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Date submitted: 16 Nov 2012 Electronic form version 1.4