BACKSCATTERING ENHANCEMENT OF SURFACE PLASMONS FROM MULTILAYER ROUGH SURFACES

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Abstract Submission Form

2006 National Radio Science Meeting

Abstract: kuo31050

Date Received: September 19, 2005

Backscattering enhancement is a phenomenon in rough surface scattering which manifests itself as a well-defined peak in the backscattering direction and finds a number of interesting applications in remote sensing and optical probing of metal-coated dielectrics In the small roughness regime, backscattering enhancements are induced by the excitations of surface plasmons along a certain path followed by their retracing the same path in the reverse direction. In the scattering from multilayer rough surfaces, only a few studies in the mechanisms of backscattering enhancements due to surface plasmons have been reported over the past decades. In the past works, the analysis of the scattering physics of the process has focused on the development of small perturbation methods to the second order and other even orders. In this paper, an exact solution to the two-dimensional scattering from multilayer rough surfaces based on extended boundary condition method (EBCM) and scattering matrix approach is developed. The proposed solution in the paper accurately accounts for all orders of scattering and multiple bounces due to wave interactions between rough interfaces. Bistatic scattering coefficients are obtained by incoherently averaging the power computed from the Floquet modes in the scattering directions. The Floquet modes resulting from the EBCM analysis are then used to form and investigate the mechanism of backscattering enhancements. Numerical simulations are performed on a dielectric slab deposited with a silver film and the results are compared against the analytical SPM solution to two-rough-interface rough surface scattering. The emphasis is placed on the investigation of how layered rough interfaces affect the phenomenon of backscattering enhancement.

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2. B - Fields and Waves

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