3D Modelling of Plasmon Excitation By Grating

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Abstract

Grating-assisted optical coupling into long-range modes of strip plasmonic waveguides is analyzed by a 3D numerical simulation with COMSOL Multiphysics. We used the RF Module and its scattering formulation. A comparison with results obtained using the common 2D approximated analysis is shown for the case of 1D grating coupler and input Gaussian beam. Excited diffracted modal field distribution is calculated as it evolves in propagation. The computation is demanding because of the large box size (40x30x4 lambda^3) and has been carried out on a Linux workstation with 96 GB of RAM. Some peculiar features of 3D analysis compared to 2D analysis are pointed out such as frequency shift of the maximum and higher order mode excitation.

Reference

[1] P. Berini "Plasmon-polariton waves guided by thin lossy metal films of finite width: bound modes of symmetric structures", Physical Review B, 61, 2000, pp. 10484-10503.
[2] R. Charbonneau, N. Lahoud, G. Mattiussi and P. Berini, "Demonstration of integrated optics elements based on long-ranging surface plasmon polaritons", Opt. Express, Vol. 13, No. 3, (2005) pp.977-984.
[3] J. Jin Ju, S. Park, Min-su Kim, J. Tae Kim, S. K. Park Y. J. Park and Myung-Hyun Lee, "Polymer-Based Long-Range Surface Plasmon Polariton Waveguides for 10-Gbps Optical Signal Transmission Applications", J. Lightw. Technol., vol. 26, No. 11, (2008), pp. 1510-1518.

Figures used in the abstract

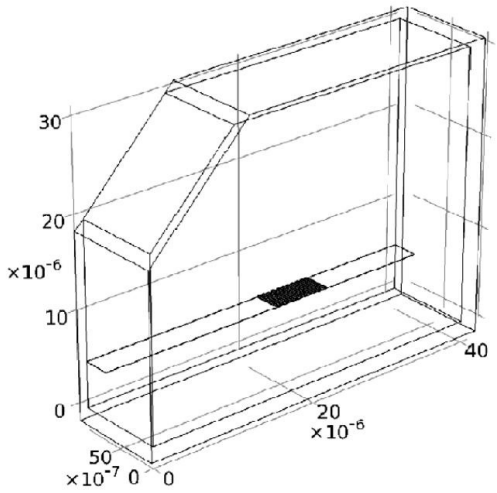

Figure 1: Grating geometry.

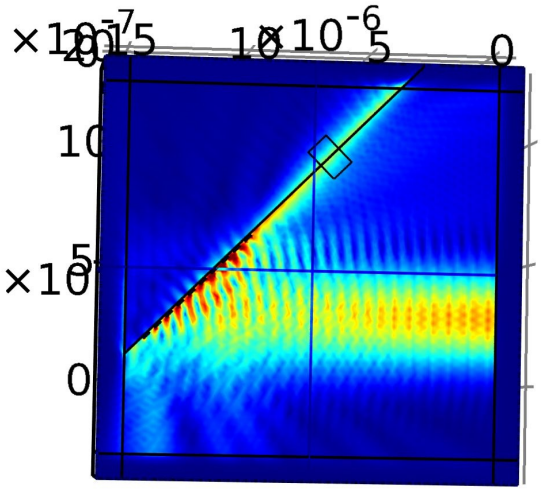

Figure 2: Plasmonic wave excited by the coupler.