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RSoft Application: Designing a Plasmonic Spatial Multiplexing Switch

Overview

A leading American research lab had an idea to develop a multiplexing switch based on surface plasmon technology that steers tightly focused plasmon beams between neighboring subwavelength metal-strip waveguides.

The Challenge

- One of the main bottlenecks to achieving fast computer chip performance is the speed of intra- and inter-chip connections. Surface plasmon technology offers strong potential for achieving faster chip connections.
- The goal is to develop a plasmonic multiplexing switch that routes input light into the desired output waveguide. Switching should be controlled by creating a phase shift through tilting the incident angle of the illumination source.
- The small size and extreme sensitivity of surface plasmonic devices to surface inhomogeneities require a rigorous full-vector modeling environment that provides accurate solutions for arbitrary device geometries.

The Solution

RSoft™ FullWAVE™, based on the FDTD method, provides full-vector solutions to Maxwell's equations and allows engineers to use complex material definitions, arbitrary device geometries, and sophisticated measurement techniques to create and fine-tune devices based on surface plasmon technology.

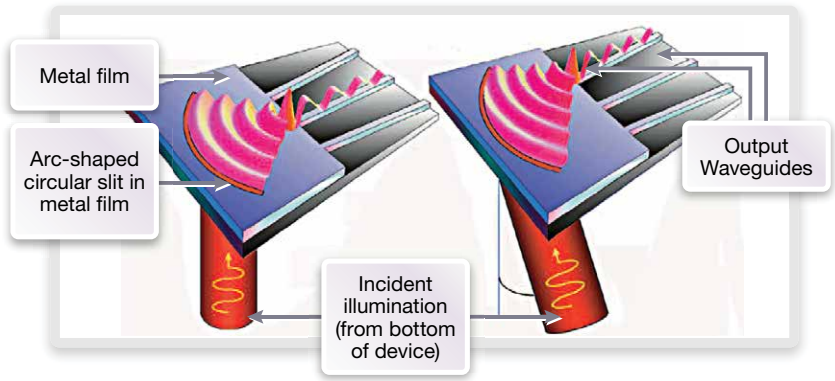

Figure 1. Plasmonic device diagram. Source: A. Imre et al., "Multiplexing surface plasmon polaritons on nanowires," *Applied Physics Letters* 91 083115 (2007).

The Result

Several 3D FullWAVE simulations were performed at various incident illumination angles to determine the optimal angles at which light is coupled into each of the three metal-strip waveguides. The field coupling into each waveguide at these optimal angles is clearly seen in Figure 2.

Factors such as the metal film thickness, fabrication errors, and misalignment can be studied to determine how the device will operate in a real-world scenario. The results of these studies can be used to further refine the device design to have less sensitivity to these factors, resulting in better performance.

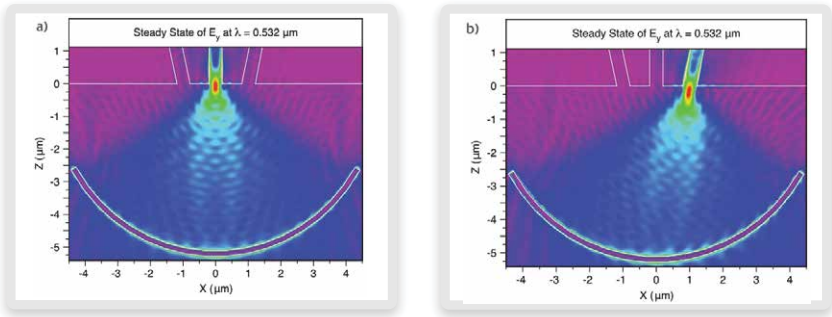

Figure 2. FullWAVE analysis results. Left: Normal incidence light coupled into waveguide. Right: Angled light coupled into one of the side waveguides.

For more information, please contact Synopsys' Optical Solutions Group at (626) 795-9101, visit http://optics.synopsys.com/rsoft/, or send an e-mail to rsoft_sales@synopsys.com.

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