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# Improved Plasmonic Cut-off Filter

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**ABSTRACT— In this paper, a novel cut-off filter is proposed and numerically analyzed by using the two-dimensional (2D) finite difference time domain (FDTD) method. The impact of different parameters on the transmission spectrum is scrutinized.**

**KEYWORDS:** Integrated optics devices, Metal-insulator-metal (MIM) waveguide, Optical plasmonic filter, Surface Plasmon Polariton, cut-off filter, Nanodisk resonator.

## I. INTRODUCTION

For a long time, limitations on localization of lightwave were an impediment for higher speed and wider bandwidth. Modern electronic devices are rapidly approaching their fundamental speed and bandwidth limitations, which is a serious impediment for new applications and requirements. Carrying information by light and replacing electronic signals by lightwave is an auspicious solution towards higher speeds. The diffraction limit did not allow the localization of light in areas smaller than wavelength; therefore, miniaturization and integration of photonic circuits were impossible [1]. Excitation of surface plasmons is one of the most feasible ways to guide electromagnetic waves beyond the diffraction limit to control light in the nanometer scales. Estimations show that data rates of 10 Tbit/s are achievable by decreasing the photonic devices to subwavelength scales [2].

Plasmon is a quasi-particle and quantum of plasma oscillation of free electrons. Plasmons with collective electron oscillations confined to an interface of a metal and a dielectric are called surface plasmons (SPs). When a photon (a quantum of electromagnetic wave) is coupled to an SP, the quasi-particle, of surface plasmon polariton (SPP), is produced. SPPs are surface electromagnetic waves propagating along the metal-dielectric interface and evanescently confining in the perpendicular direction of the interface. In a cylindrical metal nanowire, when the diameter is reduced below the light wavelength, a strong monotonic increase in localization of light takes place and as a result, the diameter of the waveguide can be decreased to just a few nanometers, which