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Analysis and designs of plasmonic nano-ring resonators based on metal-insulator-metal waveguides

Chyong-Hua Chen

National Chiao Tung University, Taiwan

Abstract

Plasmonic nano-ring resonators are essential components in the plasmonic photonic circuits due to their compactness, wide free-spectral range, easy fabrication and potential for monolithic integration. Here, we analytically investigate the nano-ring resonators by the equivalent circuits based on the analogy between metal-insulator-metal waveguides and microwave transmission. The propagation characteristics of the metal-insulator-metal waveguides are introduced, and then the equivalent circuit model for both finite-length metal-insulator-metal waveguides and nano-ring resonator structures are implemented. Then we develop systematic methodologies to design ultra-compact nano-ring plasmonic devices by using this circuit model, and the appropriate design parameters for each device can be obtained without lengthy computation time. We numerically present two illustrative examples of the photonic devices based on the nano-ring resonator structures, including power splitters and optical filters.The accuracies of these approaches are confirmed by comparing the numerical results with full-wave finite-difference time domain (FDTD) method.

Biography

Chyong-Hua Chen received her BS and MS degrees in Electrical Engineering from National Tsing Hua University, Taiwan, in 1995 and 1997, respectively, and Ph.D. degree in Electrical and Computer Engineering from the University of California, San Diego, USA, in 2006. In February 2006, she is an assistant professor in the department of Photonics of National Chiao Tung University, Taiwan. Her research interests include photonic integrated circuits, photonic crystals, and surface plasmon resonances with the applications of the optical communication systems, the optical sensing systems and the optical display systems.