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Designs of a reciprocal optical diode in silicon waveguide

Zhongyuan Yu and **Danfeng Zhu**
Beijing University of Posts and Telecommunications, China

The optical diode, in which light asymmetrically propagates, have attracted great interest recently for its potential applications in integrated optical circuits. An optical diode can be built by either non-reciprocal or reciprocal structures. Typically, the non-reciprocal optical diode utilizes magneto-optical effect or optical nonlinearity. However, the external conditions and high input power limit the on-chip applications. Unlike non-reciprocal optical diodes, the reciprocity of the Lorentz theorem holds in a reciprocal optical diode. Here, we present three reciprocal optical diode designs based on both forward even-to-odd mode conversion and backward blockade of even mode. The functional region of first design consists of a tapered coupler, a narrow waveguide, and a silver surface plasmonic splitter. In order to obtain $\pm\pi$ phase shift, the refractive index of one of branches has been also modified. Secondly, the functional region comprises a tapered coupler, a narrow waveguide, a triangular prism and a partial depth etched cuboid. The mechanism is combining interference principle and the partial depth etching method. At last, we also design a reciprocal optical diode based on asymmetric spatial mode conversion by totally depth etching irregular shapes obtained by topological optimization. Unlike the other reported works, we do not expand the width of the slab silicon waveguide in the function region. These devices possess some satisfactory performances like high contrast ratio, large operational bandwidth and small footprint.

Biography

Zhongyuan Yu is currently working as a Professor of State Key Laboratory of Information Photonics and Optical Communications, Beijing University of Posts and Telecommunications. She dedicates to theoretical and experimental research work in the field of optical communications and optoelectronics. She has won the first prize for scientific and technological progress of the Ministry of Electronics Industry and the third prize for science and technology of China Institute of Communications. She has published more than 130 papers and has been serving as an Editorial Board Member of *Journal of Beijing University of Posts and Telecommunications*.

yuzhongyuan30@hotmail.com

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