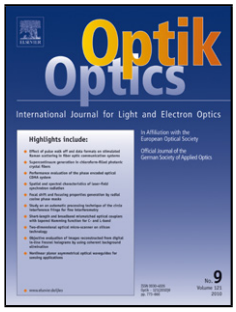

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Design and Simulation of all optical Decoder based on nonlinear PhCRRs

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Abstract

An all optical 2*4 decoder will be designed and proposed in this paper. Nonlinear photonic crystal ring resonators are used for realizing the proposed decoder. Nonlinear photonic crystal ring resonators will be achieved by introducing nonlinear rods made of doped glass around the core section of the resonator. In the proposed structure X and Y port was used to switch the optical beams coming from E betweencO_0, O_1, O_2 and O_3 output ports. The optical intensity required for performing the switching task is about 50 W/μm^2. The maximum switching frequency and the total footprint of the proposed are 10 GHz, and 581 μm^2. Reduced input optical intensity and compactness are the main characteristics of the present work. Numerical methods such as plane wave expansion and finite difference time domain were used for performing the required calculations.

Keyword: Photonic crystal, optical decoder, photonic band gap, Kerr effect.

1. Introduction

Ever increasing demands for higher band width and data rates are going toward the point, in which electronics are not capable of providing desirable quality. Currently optical communication and optical networks are the best choices for achieving ultra-high band width and data rates. In order to make optimum use of optical communication advantages, we have to avoid any electronics in the network. For such a goal we need all optical devices such as optical filters[1–4], de-multiplexers[5–9], switches[10–13] and logic gates[14–18].

An essential device which plays a crucial role in implementing all optical signal processing is optical decoder. An electro-optical decoder switch was proposed by Chen et al[19]. Another optical decoder has been realized using two cascaded micro-ring resonators, which was capable of generating 4-bit optical signal from a 2-bit electrical signal[20]. This device could operate at 10 Kbps. Moniem[21] combined photonic crystal ring resonators with photonic crystal (PhC) power splitters to realize a PhC-based 2*4 decoder. Combining nonlinear Kerr effect with photonic crystal ring resonators (PhCRRs) used for designing 1*2 and 2*4 optical decoders, which require very high optical intensity as much as 1 kW/μm^2, for performing the decoding functions[22,23].