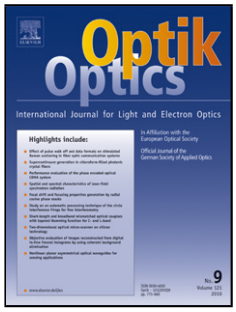

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A Low-Power All Optical Decoder Based on Photonic Crystal Nonlinear Ring Resonators

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Abstract: In this paper, an all-optical 2-to-4 decoder based on photonic crystal nonlinear ring resonators is proposed. The designed decoder has one enable port which can control decoding operation. Using nano-crystal ring resonators, the threshold switching intensity is decreased to 13 W/μm^2. The maximum frequency and total size of the device are obtained to be 160 GHz and 16×23 μm^2 respectively. All output characteristics of the proposed decoder seem to be beneficial for being employed in optical integrated circuits.

Keywords: Kerr Effect, Optical Decoder, Photonic Crystal, Ring Resonator.

1. Introduction

Optical devices play significant roles in communication networking, optical computing and signal processing because of their high operation speed, low signal distortion, low material usage, small size, low cost and more importantly immunity to electrical interference, in comparison with conventional electrical devices [1-3]. Photonic crystals (PhCs) are periodic dielectric structures which can guide and control the propagation of light. Integration possibility and scalability make PhCs as interesting structures for designing all-optical devices [4]. In recent years, some PhC-based optical devices such as optical add/drop filters [5-8], sensors [3,9-10], logic gates and switches [11-23], demultiplexers [24-26], analog to digital converters [27-30], digital to analog converters [31], encoders [32-35], adders [36-37] and power splitters [38-40] have been proposed.

In optical systems, the number of users sharing one common bus has been increasing and as a result, the receiver should be able to choose appropriate data. Digitizing optical circuits has obliged researchers to design optical logic gates being able to control output ports depending on input states, which is called decoder. Several approaches have been done and various all-optical decoders have recently been proposed [41-45]. The fundamental element in all-optical decoders is