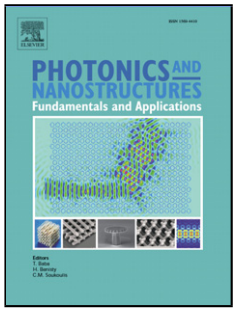

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All-optical photonic crystal logic gates using nonlinear directional coupler

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Highlights

1. Nonlinear directional coupler and junctions is proposed to design all-optical logic gates.
2. New topologies for all-optical XNOR, NOR and AND logic gates is proposed.
3. Silicon nano-crystal has been used as nonlinear efficient material.

Abstract

In this paper, a nonlinear photonic crystal structure consisting of a nonlinear directional coupler and junctions for the design of all-optical logic gates is proposed. A bi-functional photonic crystal structure is initially designed which provides different two XOR or OR logic operations. Thereafter, by applying some modifications in the basic structure, new topologies for all-optical XNOR, NOR and AND logic gates are proposed. Nonlinear rods of the proposed structure are made of silicon nanocrystal to create required phase shift. The finite difference time domain and plane wave expansion methods are used to evaluate the proposed structures. Our simulation results show that the proposed gates can operate with a bit rate of more than 1 Tbits/s and also, inputs and output of the proposed logic gates are homogeneous with the required power of 3W for switching operation.

Keywords: All-optical logic gate, Photonic crystal, Kerr effect, Directional coupler.