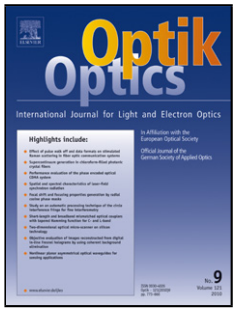

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Design and analysis of an optical full-adder based on nonlinear photonic crystal ring resonators

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Abstract:

In this paper, first we have used a photonic crystal ring resonator in a two-dimensional structure composed of GaAs rods for designing a channel drop filter (CDF). Then the CDF is used to design a 1-bit full-adder. The structure has two nonlinear ring resonators which are combined with eight waveguides. The nonlinear ring resonators have Kerr-type nonlinearity which causes the resonant mode of photonic crystal resonators to depend on intensity of input power launched into the structure. The proposed structure has three input and two output ports which are dubbed "A", "B" and "C" as input and "Sum" and "Carry" as output. The maximum delay time of the structure is about 3 ps. The structure has been simulated and analyzed using finite difference time domain (FDTD) and Plane Wave Expansion (PWE) methods. The main advantages of the proposed structure are compactness, reduction of the delay time, reduction of the optical power intensity required at input ports and reduction of the backward reflection toward the input ports.

Keywords: Ring resonators, channel drop filter, full-adder, Kerr effect, photonic crystals.