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Title:Novel method of designing all optical frequency-encoded Fredkin and Toffoli logic gates using semiconductor optical amplifiers
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Abstract:Reversible logic gates have attracted significant attention to the researchers in the field of optics and optoelectronics as it has wide applications in sequential and combinational circuit of optical computing, optical signal processing and in multi-valued logic operations. Several all-optical reversible logic gates have been proposed such as controlled NOT (Feynman gate), Fredkin gate, Toffoli gate, New Gate, Peres gate etc. The beauty of all these reversible conservative logic gates is that all types of arithmetic and logical operation can be performed with these gates with lower hardware complexity and without loss of any input information. To perform these logic operations, encoding and decoding of optical signals are of great important issues. In this communication the author presents a method of designing all optical Fredkin gate and Toffoli gate using frequency encoding/decoding techniques because of several inherent advantages of this encoding/decoding. To develop the method of designing these two reversible logic gates, non-linear polarisation rotation of the probe beam, frequency routing and frequency conversion properties of semiconductor optical amplifiers have been exploited which will give very high operational speed (of the order of THz) with very good on/off contrast ratio.
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