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Characterization of all-optical Tofolli and Peres gates employing optimized SOA-NOLM

Absract

In this work, all-optical reversible gates namely Tofolli and Peres are studied and characterized. The gates utilize semiconductor optical amplifier (SOA) in nonlinear loop optical mirror (NOLM). The reversible gates are performed at data rate 10 Gb/s with narrow Gaussian pulses as input signals. Delay of 130 ps and injection current of 170 mA have displayed the optimum outputs in the SOA-NOLM. Extinction ratio is greatly reduced, thus less noise interferes the logic operation in this simple technique. It is observed that Peres gate has shown a higher output power compare to Toffoli gate. This could be due to multiple amplification that are experienced by the signals. Other than the gain, injection current and delay are shown to give major effect in producing the correct bits at the outputs. The SOA-NOLM also can be cascaded for other arithmetic signal processing operation at high frequency. It is also recorded that the design consumes low power especially in small signal gain process. Thus, the design indicates its versatility to be executed in photonic integrated circuits for ultrafast signal control through fiber networks.