修士論文要旨

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論文題目　　　PC-QDSOAを用いた全光ANDゲートの提案と性能評価

Proposal and performance evaluation for all-optical AND gate using PC-QDSOA

In this paper, we propose an all-optical AND gate using Photonic Crystal Quantum Dot Semiconductor Optical Amplifiers (PC-QDSOA). Two PC-QDSOAs compose the proposed gate which reduces device volume and energy consumption required for an all-optical AND gate. The proposed gate exploits Cross-Gain-Modulation (XGM) in the PC-QDSOAs.

Two input signals and clock signal are injected into the proposed gate. Suppose that the two input signals are represented as input A and B, respectively, input A and clock signal are injected into one PC-QDSOA. The power of signal outputs from the PC-QDSOA depends on the power of input A. When the power of input A is large, then the power of signal outputs from the PC-QDSOA is small, and when the power of input A is small, then the power of signal outputs from the PC-QDSOA is large. Likewise, input B and signal outputs from the PC-QDSOA are injected into another PC-QDSOA. Then, because the second PC-QDSOA operates as well as the first PC-QDSOA does, the proposed gate outputs a bit which represents A AND B only when the power of input A and B are significantly large.

In order to show the proposed gate feasibly operates as AND gate at 160Gbps, we show the input-output characteristics by simulation, and the result shows the proposed gate is feasible. Moreover, we use extinction ratio (ER) and quality factor (Q-factor) to evaluate the proposed gate with varying parameter. The results show more current injection achieves improvement of ER and Q-factor. In addition, to obtain same ER and Q-factor which QDSOA AND gate achieves, the proposed gate requires device volume and injected current one out of sixteens, and one out of six hundred only, respectively. In other words, the proposed gate reduces device volume and energy consumption required for an all-optical AND gate.