Semiconductor microring processor using wavelength channel control

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【Outline of survey】

In the next-generation photonic network and the optical cross connect, a compact and integrated all-optical signal processing device using wavelength channel is needed for the high-speed and flexible control of signal pass. The purpose of this research project is to realize an all-optical signal processor named "semiconductor microring processor", utilizing the self-phase modulation (SPM), cross-gain modulation (XGM), and cross-phase modulation (XPM) in a microring resonator consisting of semiconductor optical amplifier (SOA). This device can realize many signal processing functions, such as the peak level limiter, signal equalization, wavelength conversion, and logic such as exclusive OR (XOR) using two different wavelength channels. In addition, if the injection current exceeds the lasing threshold, a high-speed flip-flop will be possible by the injection locking in a semiconductor microring laser using two different wavelength signals.

【Expected results】

The cross connect circuit which controls the pass of high-speed and a large capacity signal transmission are essential to the chip-to-chip and intra-board interconnects as well as photonic networks. However, the electronic routing is approaching the limit of speed and power consumption, thus all-optical signal routing will be necessary within 5-10 years. The realization of the microring processor will open up a new era of photonic routing, enabling the high-speed all-optical control of high bit rate optical signal higher than several tens Gbps by a compact integrated device.

【References by the principal investigator】

- Y. Goebuchi, M. Hisada, T. Kato, Y. Kokubun, "Optical cross-connect circuit using hit-less wavelength selective switch", *Optics Express*, vol.16, no.2, pp.535-548, 2008.
- Y. Kokubun, "High index contrast optical waveguides and their applications to microring filter circuit and wavelength selective switch," (Invited), *IEICE Trans. Electronics*, vol.E90-C, no.5, pp.1037-1045, May 2007.

【Term of project】 FY2008－2012	【Budget allocation】 138,700,000 yen (direct cost)

【Homepage address】 http://www.dnj.ynu.ac.jp/kokubun-lab/index.html