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파장선택형 8채널 WDM 광원

Wavelength Selectable 8 Channel WDM Transmitter

Jeha Kim, Yong-Duck Chung, Sang-Wan Ryu, Jae-Sik Sim, Sung-Bock Kim
Basic Research Laboratories, ETRI
jeha@etri.re.kr

We developed a wavelength selectable 8-channel WDM otpical transmitter. The module consisted of two 4-channel DFB-LD arrays monolithically integrated with a 1x4 power combiner and an SOA. It operated at 1550 nm and 200 GHz spacing.

Recent progress in the wavelength division multiplexing technologies for broadband fiber optic communication systems has called for a multiple wavelength light source. Integration of lasers into a multi-wavelength laser array (MLA) has been presented as a promising approach to reduce the cost per wavelength so that the cost of packaging and of the required pigtail optics can be shared by a large number of wavelengths.[1,2,3] There are two different technologies for MLA: hybrid and monolithic integration. Though the hybrid integration is more advanced in technology,[1] monolithically integrated WDM source has many advantages and would be a key device of metro and access networks.

In this paper, we present a wavelength selectable 8-channel WDM otpical transmitter that consisted of two 4-channel SG-DFB-LD array module and an external wavelength locker.

The asymmetric SG-DFB-LD array consisted of two sections along the laser cavity that were electrically pumped together. The laser waveguide of 800 m were evenly divided and it was embedded with two different sampled gratings of their own periods (asymmetric sampled grating; SG). By adjusting the sampling period of each section, we could make both reflection peaks of the two mirrors coincide at the 1st order reflection wavelength. The overlap of 1st order reflection wavelength rather than at the Bragg wavelength.[4,5] An operating wavelength of each channel was determined by adjusting the sampling periods of both sections. The 4-channel laser array was fabricated in a standard laser process. Channel spacing was set at 400 GHz (3.2 nm). The threshold currents of the lasers were between 9~13 mA and slop efficiency was about 0.21 W/A. The average power was about 11 mW and the deviation of output power was 0.8 dB at the injection current of 80 mA.

We monolithically integrated a power combiner and an SOA with a 4-channel SG-DFB-LD array as shown in Fig. 1. In the passive area, two-step cascade Y-branches were utilized as a power combiner. Based on Beam propagation method(BPM) simulation, the curvature radius was set for negligible bending loss of the Y-branch. Then, an SOA was added to the output port of the power combiner to compensate for the insertion loss. The SOA was 500 μm long and had the same

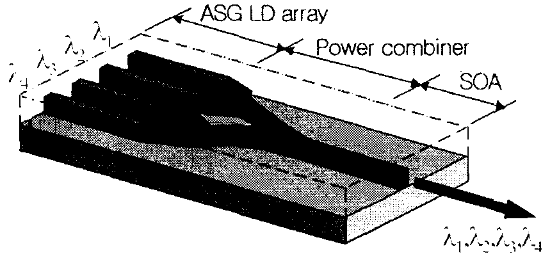
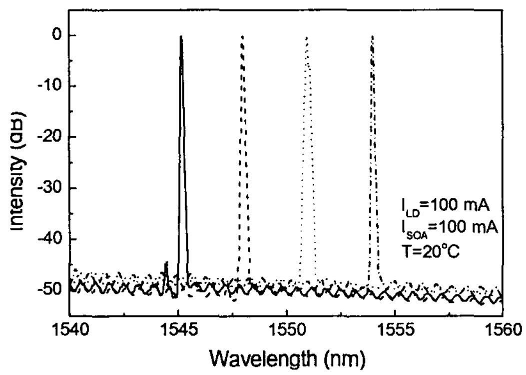


Fig. 1 Monolithic 4ch-DFB-LD array

structure with the laser active area. The integrated SG-DFB-LD array chip was packaged into a 22 pin butterfly housing.

Fig. 2 shows typical lasing spectra at the LD current of 100 mA and the SOA current of 100 mA. All the channel spacings were agreed to the desired value (3.2 nm) within ≤ 0.4 nm. The results showed that both the lasing wavelength and the channel spacing were well controllable as designed. In addition, all the lasers revealed SMSR over 44 dB.

We developed a module of wavelength selectable 8-channel WDM optical transmitter, as shown in Fig. 3. The transmitter consisted of two 4-channel LD array modules and a wavelength locker for maintaining the output wavelength to the ITU-grid. Two sets of 4 wavelength of 400 GHz spacing were interleaved so that the WDM module operated at 8 ITU-grid wavelengths of 200 GHz channel spacing. The optical transmitter was interfaced with the computer through an RS232 cable. The control board was designed to operate at the rate of 1.25 Gb/s.



The value of an SOA and a LD power could be set. The wavelengths were controlled at ITU-grid by changing the module temperature and the micro heater in association with the external wavelength locker. In the transmitter, we obtained 8 wavelengths in C-band and 200 GHz channel spacing. The set of operating 4 wavelengths could be set by the module temperature in any C-band. Channel selection could be easily performed in a sequence of commands by a programmed or a manual mode

In conclusion, the wavelength selectable 8-channel WDM transmitter that operates at 1.25 Gbps would be a key device of metro and access networks.

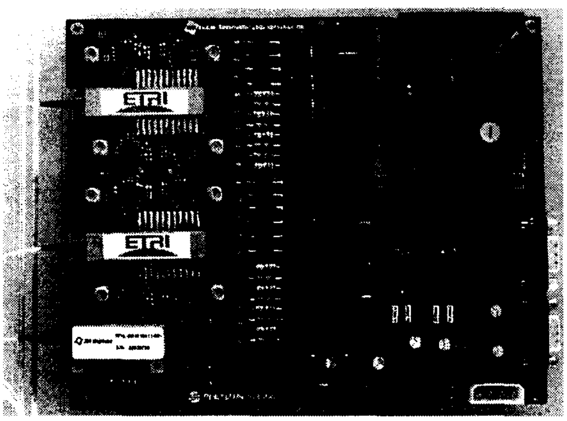


Fig. 3 Monolithic 8-ch WDM transmitter

참고문헌

1 T. Tanaka, et. al., *Electron. Lett.*, Vol. 37, No. 2, 95-96 (2001).
2 K. Kudo, et. al., *Electron. Lett.*, Vol. 36, No. 8, 745-747 (2000).
3 S. -L. Lee, et. al., *IEEE J. Selected Topics Quantum Electron.*, Vol. 6, No. 1, 197-206 (2000).
4 S. -W. Ryu and J. Kim, *ETRI Journal*, Vol. 24, No. 5, pp. 341 - 348, (2002).
5 S. -W. Ryu, et. al. *IEEE J. Select. Topics Quantum Electron.* Vol. 6 No. 6, 1358 - 1365 (2002).