Novel monitoring technique for DWDM tunable lasers using an isolator and a polarizer

Chun-Liang Yang, Ching-Yun Chien, San-Liang Lee, and *Jingshown Wu
Dept. of Electronic Engineering, National Taiwan University of Science and Technology
43, Keelung Rd,. Sec. 4, Taipei, Taiwan 106, R.O.C.
*Dept. of Electric Engineering, National Taiwan University
Phone：+886-2-27376401, FAX：+886-2-27376424, E-mail：Sanlee@et.ntust.edu.tw

Abstract -- *Channel monitoring of DWDM tunable lasers can be easily performed by using the built-in isolator and an external polarizer. We applied it to monitor eight 100GHz-spaced channels and characterize fast tunable lasers.*

We propose to utilize an optical isolator, which is usually required or even built-in for a tunable laser, and a linear polarizer to monitor the wavelength of a tunable laser (Fig. 1). Fabry-Perot (FP) etalons have been commercially used for wavelength control of DWDM lasers. However, a FP etalon can not distinguish among different channels since it has periodic wavelength characteristic. This makes it difficult to monitor the mode-hopping problem that might happen in tuning a tunable laser.

The optical isolator is usually made of birefringent optical crystals and Faraday rotator. If the birefringence is not compensated in the isolator and the index dispersion is included, the output polarization will vary with the wavelength. By applying an optical polarizer at the isolator output, the transmission ratio becomes wavelength dependent. It can also be widely tunable by inserting a polarization rotator between the isolator and the output polarizer, so it can be applied in optical networking units to monitor DWDM channels.

In order to demonstrate the feasibility of the proposed approach, we investigated the monitoring characteristic with an external cavity tunable laser, a polarization independent isolator (ETEK), a polarization controller, and a linear polarizer. For monitoring different wavelength bands, the polarization controller is used to tune the spectral response. The channel monitoring module is tunable but has a stable spectral response as the polarization is fixed.

For comparison, the wavelength was also measured by a multi-wavelength meter (wavelength accuracy = 5pm). Fig. 2 shows the monitoring for eight channels of 100 GHz spacing. An excellent agreement between the results measured with the wavelength meter and our compact module can be obtained. The results also indicate very stable characteristics for all the channels after 20 minutes of operation. We also performed the test over two hours and the maximum wavelength deviation is less than ±0.13nm. The deviation is primarily due to the change in ambient condition since no temperature control was applied to the monitoring module during the measurements. We expect that the wavelength fluctuation will be greatly reduced while special care is taken to stabilize the temperature. For example, the module can be packaged with the laser chip and a thermoelectric cooler.

In summary, we demonstrated a novel approach for recognizing the channels of DWDM tunable lasers. It can have good resolution and stability. The key component of the proposed module is an optical isolator, which is usually built-in in a tunable laser module. The approach proposed in this paper is more versatile in that it can cover different wavelength bands by adjusting the polarization controller. It can also reject the unwanted reflected signal for the tunable laser on the same time.

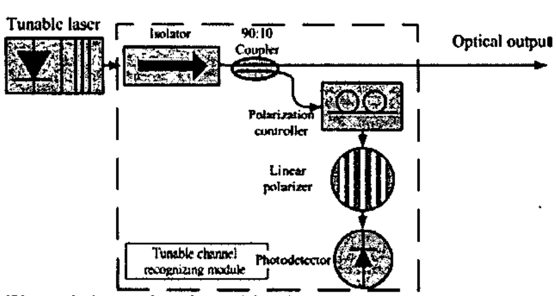

Fig. 1 Schematic of tunable channel recognizing module for a tunable laser

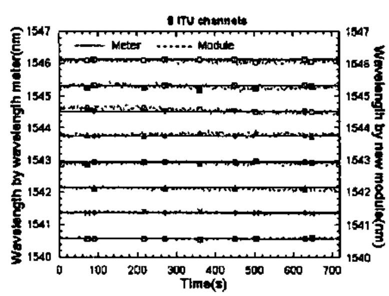

Fig.2 A stable characteristic all the time for monitoring multiple channels

0-7803-7766-4/03/$17.00 ©2003 IEEE