Wavelength Tunable Lasers in Future Optical Communication Systems

P. M. Anandarajah, *Member, IEEE,* A. Kaszubowska, *Member, IEEE,* R. Maher and L. P. Barry, *Member, IEEE*
Research Institute for Networks and Communications Engineering, Dublin City University
Glasnevin, Dublin 9, Ireland
Tel: (3531) 700 7537, Fax: (3531) 700 5508, e-mail: prince.anandarajah@dcu.ie

EXTENDED ABSTRACT

Monolithic tunable lasers (TL) have been an important component in dense wavelength division multiplexed (DWDM) systems mainly because of their ability to reduce inventory costs associated with different part numbers for fixed wavelength distributed feedback (DFB) lasers. Moreover, the use of wavelength agile laser diodes in DWDM networks has gained a lot of interest in recent years, due to emerging new applications such as optical switching and routing, which require fast switching lasers in the nanosecond regime [1, 2]. Employment of such lasers as tunable transmitters in wavelength packet switched (WPS) networks is one of the possible applications of these devices. In such systems, the information to be transmitted could be encoded onto a destination dependent wavelength and the routing of traffic could be performed on a packet-by-packet basis. The utilization of TLs in an optical switching and routing environment would put stringent requirements on its performance. This would include increased tuning range, high side mode suppression ratio (SMSR), reduced switching time and excellent wavelength stability. The sampled-grating distributed Bragg reflector (SG DBR) TL proves to be an ideal candidate, due to its large tuning range (40 nm), high output power (10 dBm), high side mode suppression ratio (SMSR > 30 dB) and simplicity of integration.

In this paper we focus on some of the most important aspects of TL performance (switching speed, settling time, wavelength stability etc.) with respect to its possible application in high-speed optical wavelength packet switched networks. The device under test (DUT) is a fast wavelength tuning Sampled Grating Distributed Bragg Reflector (SG-DBR) supplied by Intune Networks. This device is capable of switching between any set of 50 GHz spaced ITU channels, within the conventional (C) band, with a 200 ns switching time and 200 ns settling time.

Another aspect of TL operation examined, in order to verify its usefulness for short reach applications, is its performance under direct modulation. As the demand for broadband connectivity increases, it is expected that tunable lasers will be employed in metro and access networks within DWDM systems. Such systems would be able to provide significant capacity to many users. However, market adoption of such a solution would be based on its cost efficiency. A solution to this cost cutting measure could be achieved by adopting the technique of direct modulation, which is one of the most simple and efficient ways to modulate the lightwave signal.

Keywords: tunable lasers, laser stability, dense wavelength division multiplexing (DWDM), direct intensity modulation, optical fibre communications.

ACKNOWLEDGEMENTS

The authors wish to acknowledge the support of Enterprise Ireland and Science Foundation Ireland.

REFERENCES

[1] L. A. Coldren, "Monolithic tunable diode lasers," *IEEE Selected Topics in Quantum Electronics*, vol. 6, pp. 988-999, 2000.

[2] I. White, R. Penty, M. Webster, Y. J. Chai, A. Wonfor and S. Shahkooh, “Wavelength Switching Components for Future Photonic Networks,” *IEEE Commun. Mag*., vol. 40, no. 9, pp. 74-81, Sep. 2002.