References

1. C. Bintjas et al., "20 Gb/s All-Optical XOR with UNI gate", IEEE PTL 12, 834–36 (2000).
2. T. Fjelde et al., "Demonstration of 20 Gbit/s all-optical logic XOR in integrated SOA-based interferometric wavelength converter", IEE EL. 36, 1863–64 (2000).
3. T. Fjelde et al., "Novel Scheme for Simple Label-Swapping Employing XOR Logic in an Integrated Interferometric Wavelength Converter", IEEE PTL, 13, 750–52 (2001).
4. G. Theophilopolous et al., "40 GHz All-Optical XOR with UNI Gate", in Techn. Digest OFC 2001, MB2-1.

CThAA2 **5:00 pm**

Suppression of Pattern Distortion in Semiconductor Optical Amplifier by Using Fiber Loop Mirror

K. Chan, C.K. Chan, F. Tong, W. Hung, L.K. Chen, Information Engineering Dept, The Chinese University of Hong Kong, Shatin, N.T., Hong Kong, China, Email:kchan0@ie.cuhk.edu.hk

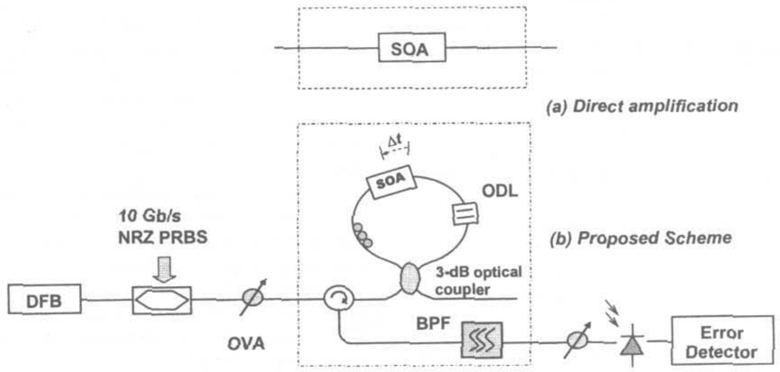
Introduction

Semiconductor optical amplifier (SOA) attracts much interest because of its wide application for in-line amplification. Its attractive features including broad gain bandwidth, compactness, and potentially low cost, make it a promising device for future lightwave networks. However, the fast gain dynamics of the SOA causes waveform distortion and hence limits its practical implementation. Different schemes have been proposed to suppress the waveform distortion, including light injection,[1] shifting the output wavelength,[2] etc. Here we present a novel scheme to alleviate the waveform distortion in gain-saturated SOAs. Gain variation due to fast gain dynamic of SOA is compensated by an interferometer formed by a simple fiber loop mirror. Over 5-dB enhancement in input power dynamic range is obtained.

Proposed Scheme and Experiment

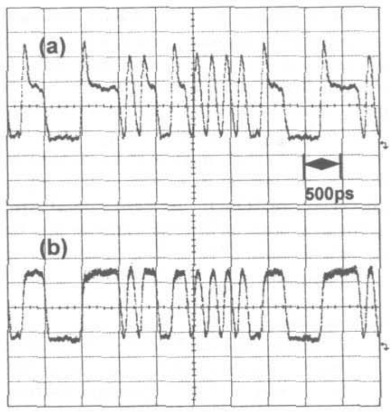
The experimental setup is shown in Fig. 1. Light from the DFB laser was modulated by a $LiNbO_3$ modulator using 10-Gbit/s $2^{23} - 1$ NRZ PRBS. The optical variable attenuator (OVA) was carefully adjusted for different optical input power to the SOA. The SOA was put in a fiber loop mirror with an offset of Δt from the loop center. The reflected signal output from the loop mirror was directed out via an optical circulator (OC). For comparison, a direct amplification experiment was also performed as shown in Fig. 1(a).

For SOA operating in saturation regime, the decrease of carrier density results in gain variation, which not only leads to waveform distortion but also simultaneously causes phase modulation of the signal inside the SOA. In the proposed scheme, as the SOA is located with a certain offset from fiber loop center (as shown in Fig. 1), the clockwise propagating signal enters the SOA earlier and its rising edge experiences much larger gain variation and phase modulation, as compared to that of the counter-clockwise propagating signal, which enters the SOA at a later time. As a result, a large phase difference is present only at rising edge of the two counter-propagating signals. When they are combined again at the 3-dB coupler, destructive interference due to such phase difference at the rising edge occurs and this effectively leads to suppression of the waveform distortion at the output of the fiber loop mirror.



CThAA2 **Fig. 1.** Experiment setup. OVA: optical variable attenuator; SOA: semiconductor optical amplifier; ODL: optical delay line; BPF: optical bandpass filter.

Fig. 2 shows the pulse pattern from the SOA for (a) direct amplification case and (b) proposed scheme using fiber loop mirror. It was found that the power variation at the rising edges of "1" was much suppressed by using our proposed scheme. We have also measured the SOA input power dynamic range in both cases and the results were depicted in Fig. 3. The power penalty was obtained at a BER of 10^{-9} against different signal input powers. It was shown that input power dynamic range was extended over 5-dB, for a power penalty of 3-dB. The eye diagrams in the insets were captured with input power at –12 dBm.



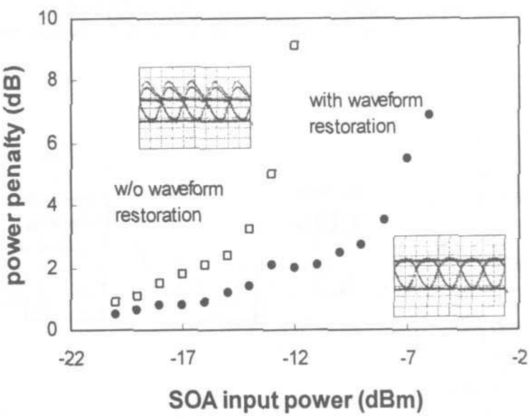
CThAA2 **Fig. 2.** SOA output waveforms (a) Direct amplification (b) Proposed Scheme.

Summary

An interferometric approach for pulse pattern effect reduction in SOA is proposed and demonstrated. Suppression of waveform distortion is achieved by using fiber loop mirror. Over 5-dB input power dynamic range enhancement is obtained.

References

1. K.P. Ho, S.K. Liaw and C. Lin, *Electron. Lett.*, 1996, 32, *pp.* 2210–2211.
2. J. Yu and P. Jeppesen, *JLT*, vol 19, 2001, *pp.* 1316–1326.



CThAA2 **Fig. 3.** Power penalty at 10^{-9} against input signal power. Inset: eye diagrams for signal input power at –12 dBm.