Proceedings Symposium IEEE/LEOS Benelux Chapter, 2000, Delft, The Netherlands

Intensity noise reduction in spectrum-sliced WDM systems using a saturated gain-clamped SOA

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Abstract

Reduction of intensity noise in spectrum-sliced WDM systems using a saturated gain-clamped SOA is presented. Significant suppression of the intensity noise level was found experimentally. The optical spectra of a 0.5nm broad spectral slice before and after a GC_SOA were also investigated.

I. Introduction

Spectrum-sliced WDM systems have the advantages of low cost, high wavelength selectivity and temperature stability, and so are very attractive in local access applications. Spectrum-sliced incoherent light, however, exhibits a large intensity noise that limits the bit rate and transmission distance of spectrum-sliced WDM systems. Recently, techniques for reducing the intensity noise, which are based on the non-linearity and saturation of SOA's, have been proposed and experimentally demonstrated [1,2]. We present the reduction of intensity noise using a saturated gain-clamped SOA (GC_SOA) which has a better non-linearity and a sharper saturation than normal SOA's. Significant suppression of the intensity noise level was found experimentally. The optical spectra of a 0.5nm broad spectral slice before and after a GC_SOA were also investigated.

II. Experiments

Our experimental setup is shown in fig. 1. The ASE from a SLED was spectrally sliced using a 0.5 nm bandwidth fibre Bragg gratings filter. The spectrum-sliced incoherent light centred at 1550.8 nm was amplified to 0.5 dBm using an EDFA and then injected into a gain saturated GC_SOA. The bias current of the GC_SOA was 120 mA. The saturation characteristic of the GC_SOA is shown in Fig. 2. In contrast to the normal SOA, the output power of the saturated GC_SOA is only slightly dependent on the input power. This kind of saturation is of great benefit to the reduction of intensity

noise in spectral slicing. The output of the GC_SOA was modulated using a $LiNbO_3$ external modulator. To remove the ASE from the amplifiers and the lasing-mode from the GC_SOA, a 1.2-nm bandwidth filter was used before the modulator. The filtered signal was detected using a receiver with a 1.7 GHz-bandwidth.

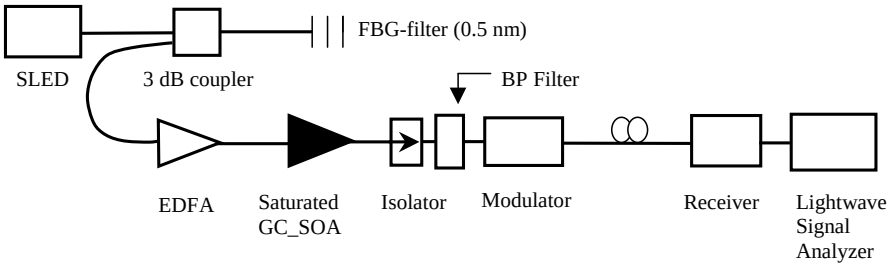


Fig. 1. Experimental setup.

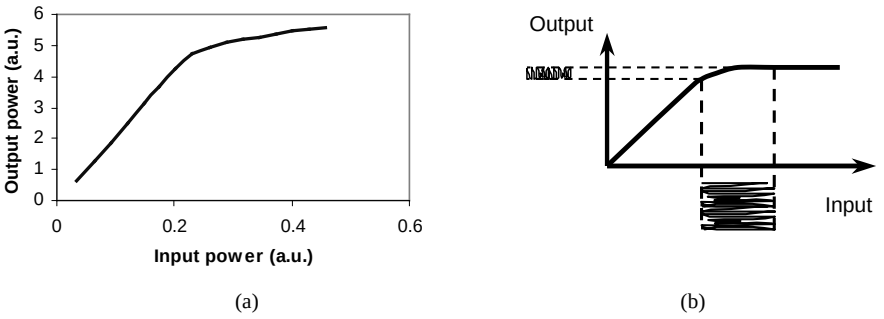


Fig. 2. Saturation characteristic of GC_SOA and intensity noise suppression (a) measured saturation characteristic of GC_SOA, bias current 110mA, (b) noise suppression using a gain saturated GCSAO.

III. Results and discussion

Figure 3 shows the measured noise (relative intensity noise) spectra of spectrum-sliced incoherent light with and without the GC_SOA. The noise level of the input was significantly suppressed over a bandwidth of several GHz. At low frequency, a noise reduction of 10 dB was obtained. The eye diagrams for 622_MHz back to back operation are shown in fig. 4. With the GC_SOA, the intensity noise is suppressed dramatically. The eye height is more than two times larger than that without GC_SOA.

The optical spectra of 0.5nm-spectrum-sliced incoherent light before and after the GC_SOA, are shown in Fig. 5. No noticeable change in the bandwidth was observed.

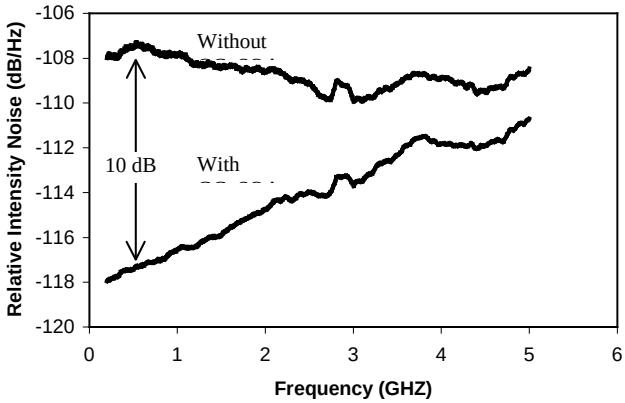
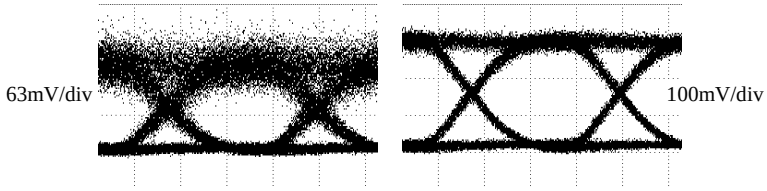


Fig. 3. Measured relative intensity noise without and with a gain-saturated GC_SOA



(a) (b)

Fig. 4. Eye diagrams at back to back operation for signal frequency of 622MHz
(a) without GC_SOA and (b) with GC_SOA

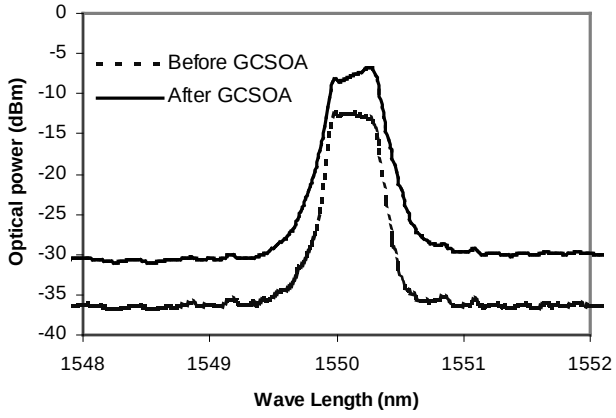


Fig. 5. Optical spectra of spectrum-sliced incoherent light before and after a gain saturated GC_SOA.

IV. Conclusion

We have presented the suppression of intensity noise in spectrum-sliced incoherent light source using a gain saturated GC_SOA. A noise reduction of 10 dB was obtained in low frequency range.

Acknowledgements

This work has been supported by the Flemish Government-IWT.

References:

[1]. S. J. Kim, J. H. Han, J. S. Lee and C. S. Park, "Intensity noise suppression in spectrum-sliced incoherent light communication systems using a gain-saturated SOA", *Photonics Technology Letters*, Vol. 11, No. 8, 1999, P 1042-1044.

[2]. Y. Katagiri, K. Suzuki and K. Aida, "Intensity stabilisation of spectrum-sliced Gaussian radiation based on amplitude squeezing using SOA with gain saturation", *Electronics Letters*, Vol. 35, No. 16, 1999, P1362-1364.