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Polarization based filtering in a wavelength converter

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A new scheme is demonstrated to filter signals after a wavelength converter based on integrated polarization components. This allows polarization independent conversion, co-propagating operation without a tuneable filter, and it facilitates conversion to the same wavelength.

Introduction

Wavelength converters are key-components in future optical networks. Wavelength converters experience some problems: polarization dependent operation, need for expensive tuneable filters and problems in converting to the same wavelength.
The POLARIS (POlarisation LAbelling for Rejection and Isolation of Signals) wavelength converter can deal with these problems.

Principle

The concept of POLARIS is depicted in Fig. 1. The signal from the network arrives in an arbitrary polarization. This signal is split in the polarization splitter (PS) into two orthogonal polarizations. In one branch, the polarization is rotated in the polarization converter (PC) to have the signal in both branches in the same polarization (TE). These signals are injected into the Mach Zehnder Interferometers (MZI) together with the locally generated CW light in the orthogonal polarization (TM). After interacting in the MZI the signal is transferred to the CW wavelength and both signals have to be separated. This is done by rotating the polarization of the upper branch and then using a PS to combine both branches. As only TE in the upper and TM in the lower input will couple to the output, filtering of the unwanted signal occurs. Simulations show polarization independent behavior and promising BER, ER and isolation [1]. All components (MZI, PC, PS) can be monolithically integrated. The polarization components will be treated below.

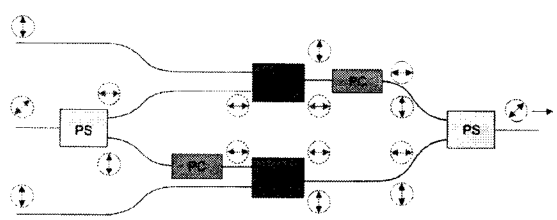

Figure 1: Schematic of the POLARIS wavelength converter

Polarization converter

An improved design for a PC is proposed (Fig. 2(a)) that uses the same topcladding as an active device and can be integrated with the other components [2]. It consists of a

waveguide with a vertical and a slanted side. Because of the latter, the modes in the converter are tilted. Both modes are excited when either TE or TM polarized light is input. After half a beatlength the two modes are completely out of phase and recombine in the orthogonal polarization.
The maximum conversion from TE to TM and vice versa (for this device 97.5%) occurs at 131 μm length, and back to zero at the full beat length (Fig. 2(c)).

(a) Schematic overview (b) SEM photograph (c) Measured conversion

Figure 2: Polarization converter

Polarization splitter

A short (600 μm long), interference based splitter integrated with a polarization converter is demonstrated. The device consists of a Mach Zehnder Interferometer with polarization converters in both arms (Fig. 3) [3].
The device is fabricated and first measurements show a splitting of 10 dB and a conversion of 90 %.

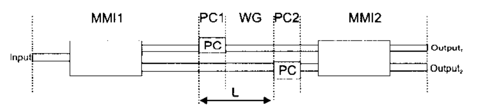

Figure 3: Schematic of the MZI polarization splitter/converter

Conclusions

An improved scheme for filtering in wavelength conversion is shown. Polarization components needed for monolithic integration are demonstrated. Polarization conversion up to 97.5% is shown, polarization splitting of 10 dB is achieved.

References

[1] R. Hanfoug, J. J. G. M. van der Tol, L. M. Augustin, and M. K. Smit. Wavelength conversion with polarisation labelling for rejection and isolation of signals (POLARIS). In *Proc. 11th Eur. Conf. on Int. Opt. (ECIO '03)*, pages 105–108. Prague, Czech Republic, April 2-4 2003.

[2] L.M. Augustin, J.J.G.M. van der Tol, and M.K. Smit. A compact passive polarization converter for active-passive integration on InP/InGaAsP. In *Proc. 13th Eur. Conf. on Int. Opt. (ECIO '07)*, Copenhagen, Denmark, April 25–27 2007.

[3] L.M. Augustin, J.J.G.M. van der Tol, R. Hanfoug, W.J.M. de Laat, and M.K. Smit. An integrated polarization splitter and converter. In *Proc. IEEE/LEOS Symposium (Benelux Chapter)*, pages 89–92. Eindhoven, The Netherlands, December 2006.