thought to be due to excess loss in one channel of the delay line array. This imbalance cannot be compensated for because both pulses are derived from the same laser amplifier.

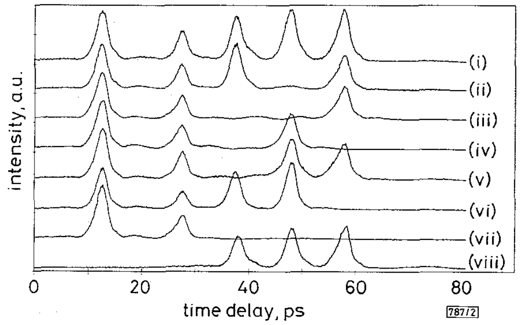

Fig. 2 *Output of device for various settings of semiconductor switches*

(i) MM′111, (ii) MM′101, (iii) MM′001, (iv) MM′010, (v) MM′011, (vi) MM′110, (vii) MM′000 and (viii) 00111
MM′ denotes presence of marker pulse pair

However, by adjusting the biases on the other amplifiers, we can equalise the intensities of the data pulses and compensate for any other differential losses. Typical bias currents employed in these measurements were ~200mA.

Conclusions: We have demonstrated the operation of a programmable optical pattern generating device suitable for ultrafast (>100Gbit/s) networks. The device was constructed using hybrid semiconductor/passive optical waveguide technology. This basic technology is a key step on the way towards a new generation of ultrahigh capacity networks.

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Horizontal directional coupler filter suitable for integration in a 1.3⁺/1.3⁻μm duplexer

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Indexing terms: Directional couplers, Grating demultiplexers, Optical couplers, Wavelength division multiplexing

The authors report the design and first realisation of a grating-assisted horizontal directional coupler filter exibiting a highly reduced polarisation sensitivity (below 1dB on the filtered channel) and a high sidelobe suppression ratio (>25dB for both polarisations). This filter is particulary suitable for integration in a $1.3^+/1.3^-$ μm duplexer.

Introduction: The realisation of an integrated '$1.3^+/1.3^-$' duplexer, associating the emission and the reception of two 10nm-wide channels, centred around 1.28μm and 1.32μm, respectively, requires the design of a high-performance filter.

To our knowledge, only 1.3μm/1.5μm duplexers have been integrated so far on InP [1, 2]. The use of close channels within the same window and the desire of not perturbing the 1.5μm transmission window implies single bandpass isotropic filters, centred either around 1.32μm or 1.28μm, with a 3dB bandwidth compatible with the channel width and a high sidelobe suppression ratio (>20dB for both polarisations).

Grating-assisted directional couplers (GADC), unlike Mach-Zehnder interferometers, yield single bandpass response. Horizontal directional couplers allow an easier technological process than the vertical coupler and provide a wide bandwidth, well suited to our application. This kind of structure has been realised, and a 10dB sidelobe suppression ratio was measured [3].

A higher sidelobe suppression ratio can be obtained by introducing a spacially varying coupling coefficient along the guided propagation axis [4]. Variation of the coupling coefficient can be obtained by a varying interwaveguide separation [5]. However, this technique results generally in strong polarisation dependence (around 20nm shift between the TE and TM central wavelengths), as reported in [6].

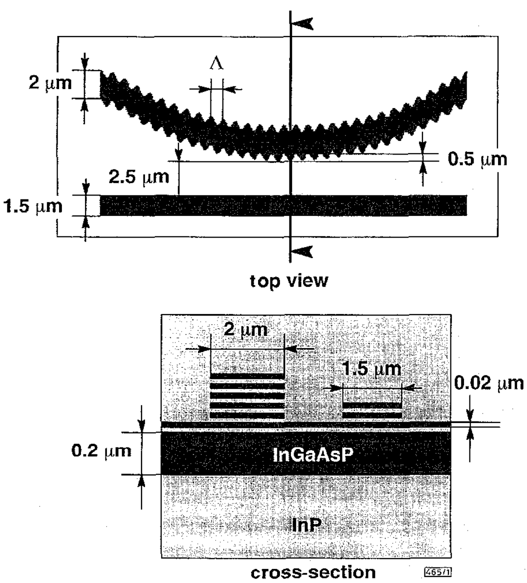

Fig. 1 *Schematic diagram of weighted coupling meander-type filter (top view and cross-section)*

This Letter reports on the realisation of a weighted coupling meander-type filter [6] (Fig. 1) based on specially designed waveguides, exhibiting a highly reduced polarisation sensitivity (around 2nm shift between TE and TM central wavelengths) and a high sidelobe suppression ratio (>25dB for both polarisations).

Filter design and fabrication: First, TE and TM guided eigenmodes and dispersion characteristics are calculated using a two-dimensional finite element method. The beam propagation method (BPM) [7] (Fig. 2) simulations are then carried out to evaluate the coupling length, the additional losses induced by the grating and the filter wavelength responses (bar and cross channel for both polarisations).

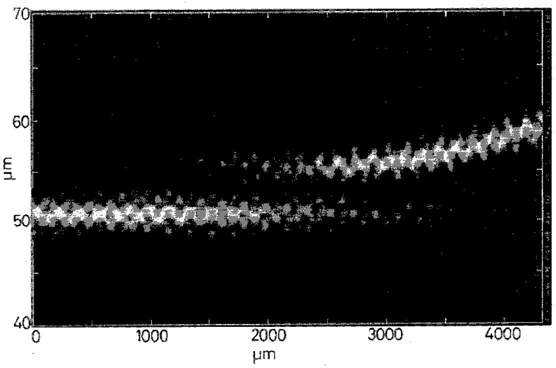

Fig. 2 *BPM simulation for weighted coupling meander-type filter at filter central wavelength (1.28µm)*

To reduce the polarisation dependence of the GADC, we have looked for two waveguides exibiting the same birefringence, so as to obtain the same TE and TM central wavelengths. The optogeometric characteristics of the two waveguides are thus very precisely defined, and both material composition and layer thicknesses have to be carefully controlled. The guide core is thus overlaid alternately by InP and InGaAsP thin layers (Fig. 1), allowing easier control of the waveguide thickness.

Fig. 1 shows the precise geometry of the coupler, constituted of two buried rib waveguides. The epitaxial layers are grown by AP-MOCVD. The waveguide structure is achieved in a two-step self-aligned process by dry etching (RIBE), and is finally buried with undoped InP.

Experimental results: Couplers with different grating periods have been measured using a pigtailed LED source centered around 1.3 µm. The output signals from both output waveguides were measured with an optical spectrum analyser.

Filters centred around 1.28µm and 1.32µm (Fig. 3) are obtained for grating periods of 132µm and 144µm, respectively.

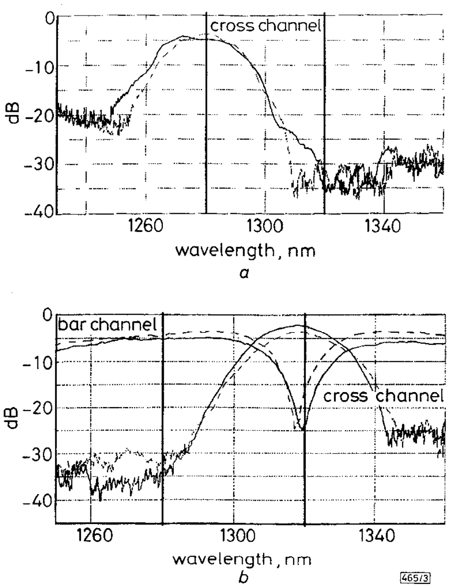

Fig. 3 *Filter responses for TE and TM polarisations*

a Filter centred around 1.28µm for grating period Λ = 132µm
b Filter centred around 1.32µm for Λ = 144µm
——— TE
– – – – TM

The gap between TE and TM central wavelengths is below the resolution of the measurement setup (2nm). This should be compared to the 20nm obtained in [6]. The polarisation dependence remains below 1dB on the whole filtered channels. A good extinction (around 20dB) of the bar channel is obtained. The rejection ratio between the two channels (centred at 1.28µm and 1.32µm) is higher than 25dB for both polarisations in both cases. Measured propagation losses are 4dB (not including coupling losses).

Conclusion: We have reported the design and the first realisation of a grating-assisted horizontal coupler filter centred either around 1.28µm or 1.32µm, exhibiting a highly reduced polarisation sensitivity (below 1dB on the filtered channel) and a sidelobe suppression ratio higher than 25dB for both polarizations, suitable for integration in a $1.3^{+}/1.3^{-}$ µm duplexer.

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7 BPM_CNET (ALCOR) software developed and distributed by France Telecom, CNET

Micro-opto mechanical switch integrated on silicon

E. Ollier, P. Labeye and F. Revol

Indexing terms: Micromechanical devices, Integrated optics, Micromachining

A micro-opto-mechanical switch 1*2 has been achieved using a combination of two technologies, integrated optics and micromachining on silicon. The commutation is obtained by means of the mechanical deflection of a cantilever beam driven by an electrostatic force. The first functional results are reported.

Introduction: Owing to the increasing complexity of optical networks, low-speed, polarisation and wavelength-insensitive fibre compatible optical switches are becoming more and more interesting, especially for network safety and network reconfiguration. Although such devices, based on a mechanical displacement of fibres, are already commercially available, they remain very expensive, and cannot be used for a large amount of channels. To overcome these problems, we propose in this Letter an integrated optomechanical switch by combining two mass-production technologies: integrated optics on silicon and silicon micromachining.