

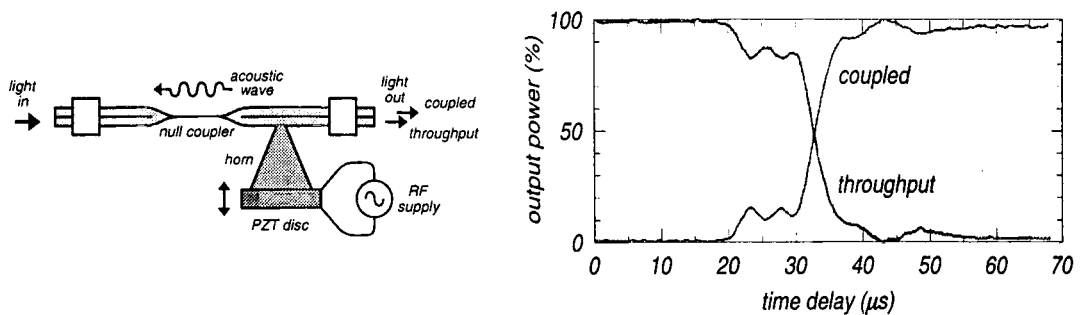
LOW-POWER LOW-LOSS ACOUSTO-OPTIC FIBRE SWITCH

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We have previously reported a new design of all-fibre acousto-optic frequency shifter[1,2]. It is based on a special asymmetric fused taper coupler which in the passive state does not actually couple light at any wavelength: the null coupler. An appropriate flexural acoustic wave imposed on the coupler causes light to couple between the fibres. This device can equally well function as a 2x2 all-fibre optical routing switch: the switch is in the "cross" state when the acoustic wave is on, and is in the "bar" state when the acoustic wave is off. Of particular interest are the switching time, insertion loss, crosstalk and drive power.

A null coupler was made with standard single-mode telecom fibre. The coupler had an excess loss of less than 0.05 dB and a maximum splitting ratio of 1:15000 (giving a crosstalk better than -40 dB in the bar state). The uniform coupler waist was 25 mm long and 6 μm in diameter, giving an acousto-optic resonance at 11.8 MHz for light with a wavelength of 1550 nm. The acoustic source was connected as shown in the figure. With polarisation control, over 99.4 % coupling (giving a crosstalk better than -22 dB in the cross state) was possible for an RF drive power of roughly 2.5 mW. The optical powers in each output fibre are plotted against the time from the switching-on of the RF drive. The switching time is 60 μs : the delay of 20 μs before switching starts corresponds to the time taken by the acoustic energy to travel from its source to the coupler. Over 90 % of the light is then switched within a further 20 μs . The responses were similar when the RF drive was switched off.



The assembly of an all-fibre acousto-optic switch; the switching response of the device.

This acousto-optic switch is an all-fibre construction based on familiar low-cost fused coupler technology. It provides an insertion loss of 0.05 dB, crosstalk better than -22 dB, RF drive power of 2.5 mW and switching time of 60 μs . These characteristics compare favourably with the best commercially available thermo-optic and mechanical fibre switches.

- [1] T. A. Birks et al, Optics Letters, **19**, 1994, pp. 1964-1966.
- [2] D. O. Culverhouse et al, CLEO 1995, paper CMG6.