Prism Coupling Method To Measure The Effective indices of The Fiber Modes

The method works the same way as the conventional prism-film coupling technique used in Integerated Optics (see e.g., Tamir, 1975).

- refractive index of Prism: $n_p >$ n of waveguide
- So the Prism interacts with the waveguide modes through the evanescent fields

- For integrated waveguides, prism is kept directly on top of the waveguide
- But for fiber, where the modal filed is normally not accessible,
  Fiber is side polished and prism is placed on top of the polished surface

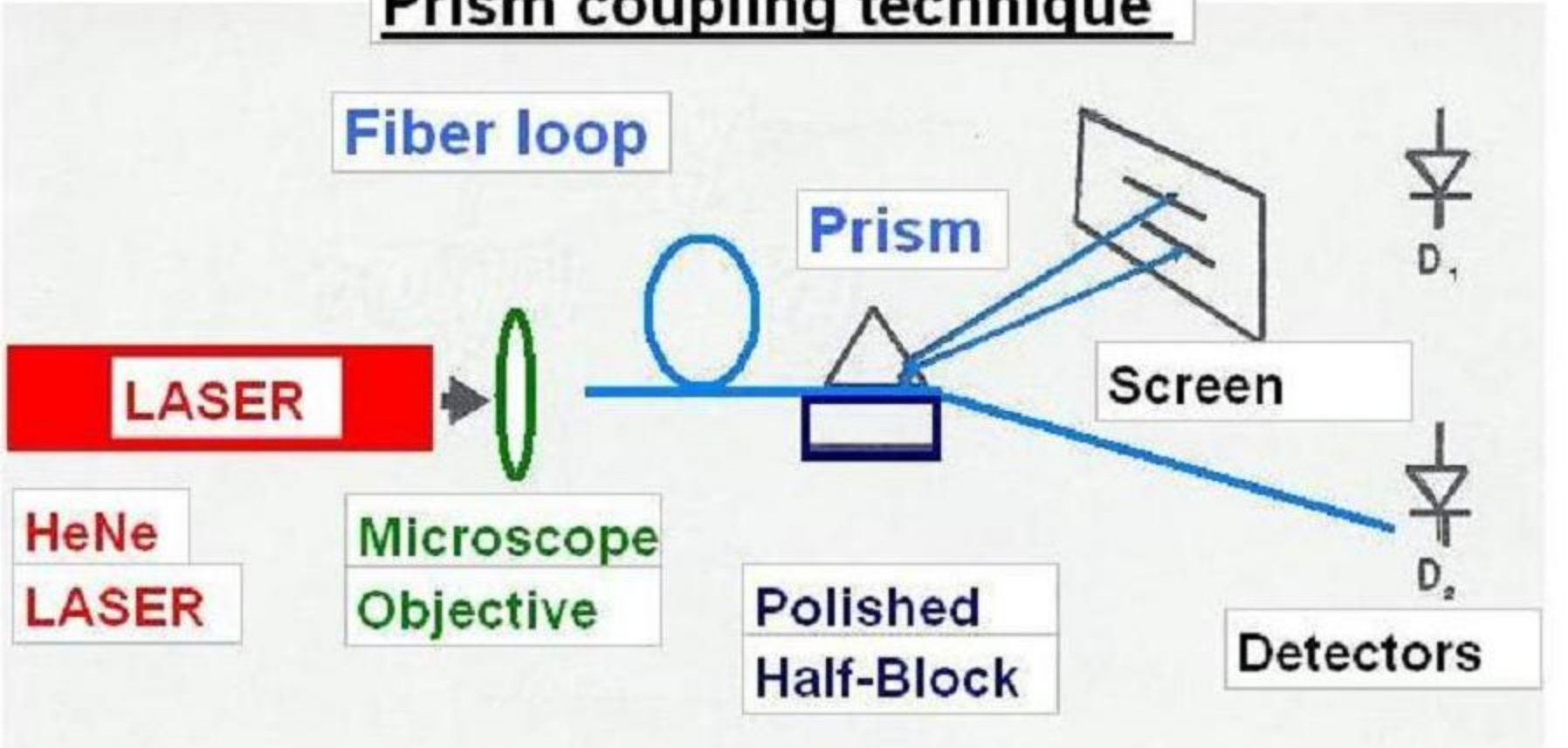
Ref. : Such a technique has been used earlier

Midwinter, 1979 : to selectively excite particular groups of modes in a multimode fiber

Sorin *et* al., (1986) : for the measurement of propagation constant of LP_{01} and $LP02$ modes of a dual-mode fiber

Thyagarajan *et* al, (1986): measuring the bire-fringence of a high-birefringent fiber

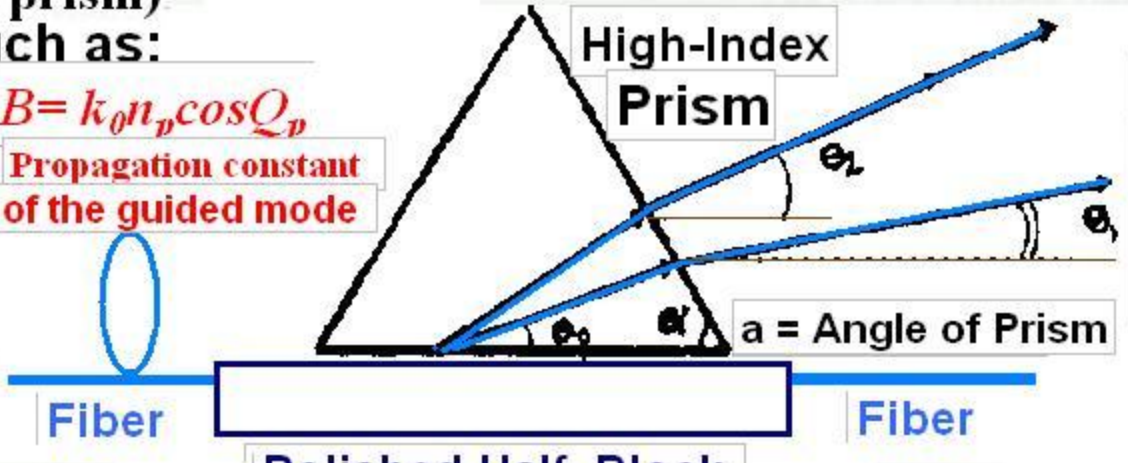
Prism coupling technique



Each guided mode is decoupled leaving the fiber at a specific angle Qp (in prism) such as:

$B = k_0 n_p \cos Q_p$

Propagation constant of the guided mode



Q1 and Q2 correspond to the output coupling angles of LP01 & LP02 modes respectively

Effective index of the modes can be calculated by the this formula

$$\frac{\beta_m}{k_o} = n_p \sin\left\{\alpha + \sin^{-1}\frac{\cos(\alpha+\theta_m)}{n_p}\right\} \qquad m = 1,2$$

In our Experiments with SMF

wavelength of laser = 0.633 micrometer
Angle of Prism (a) = 57.31 degree
Prism index (np) = 1.525
measured angle for LP01 = 8.03 degree
Calculated effective index for LP01 (B/k0) = 1.4619

In our Experiments with DMF

wavelength of laser = 0.543 micrometer
Angle of Prism (a) = 57.31 degree
Prism index (np) = 1.525
measured angle for LP01 (Q1) = 7.29 degree
measured angle for LP01 (Q2) = 7.98 degree
Calculated effective index for LP01 (B01/k0) = 1.4633
Calculated effective index for LP11 (B11/k0) = 1.4602

END

Thanks