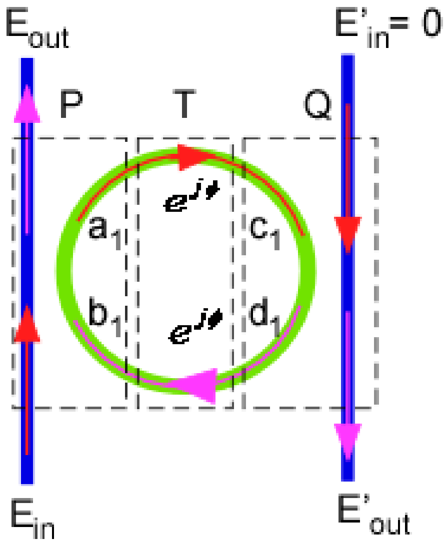
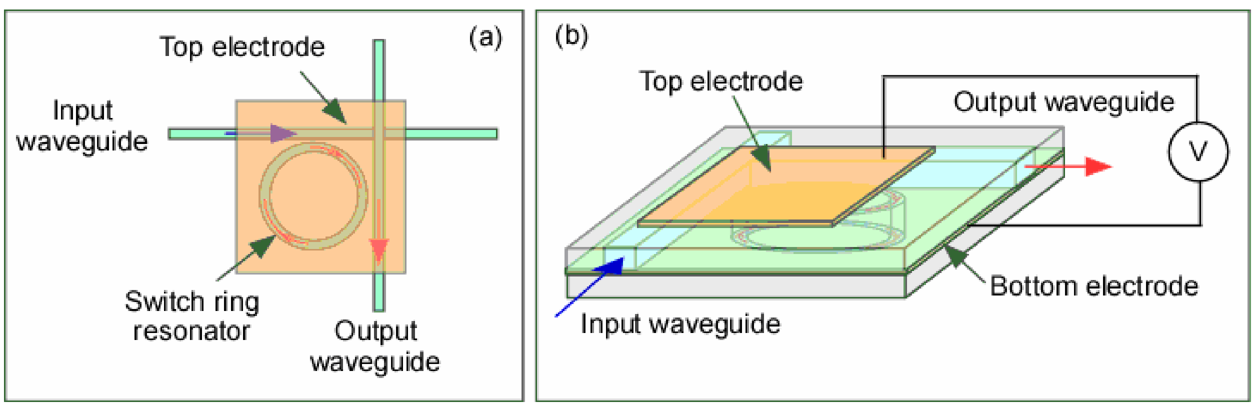
1. Ring resonator, R = 100um, neff = 2.2, coupling constant k = 0.02



(1) Calculate the passing wavelengths of the ring resonator

(2) If the ring is made of Z-cut LiNbO3, r33 = 31pm/V, determine the passing wavelengths, if applied voltage is 2V, assuming the thickness of the waveguide is 10um.



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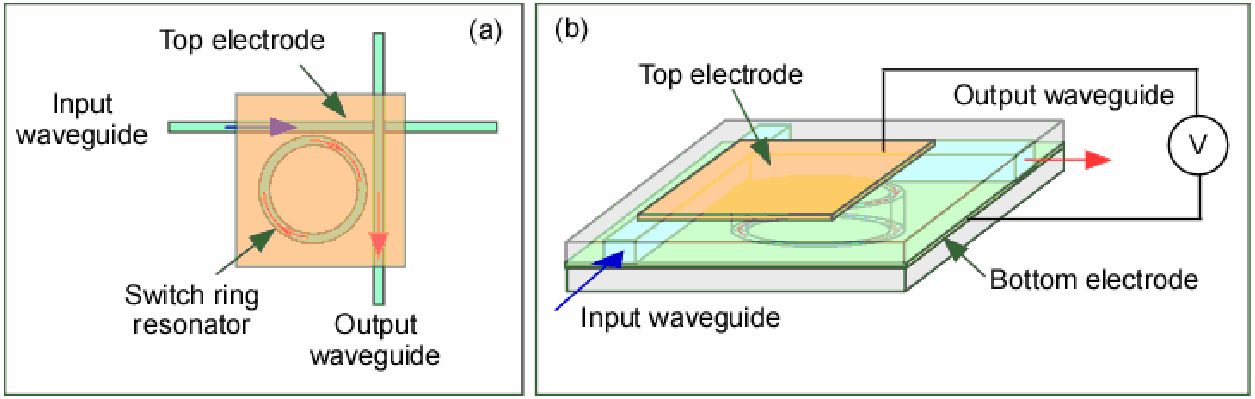


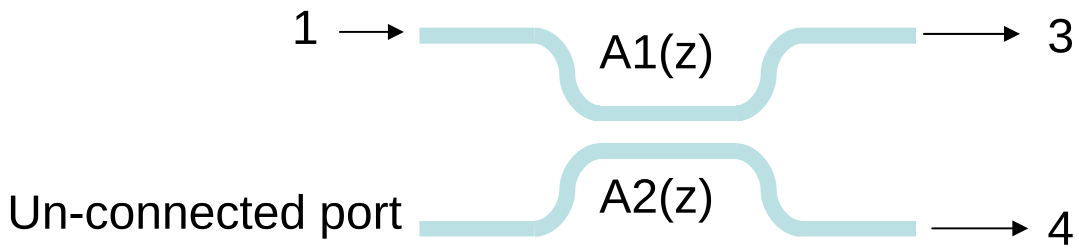
2. Ring resonator, Kerr effect R = 100um, neff = 2.2, coupling constant k = 0.02

$$\Delta\phi = k_0 \pi R \Delta n = k_0 \pi R n_2 \frac{P_r}{A_{eff}}, \quad n_2 = 1.59\times 10^{-13} cm^2 / W$$

(1) Assuming, initially at resonant wavelength, what will happen will the intensity of the input increases?

(2) Assume, the waveguide has a 2x2 cross-section, What's the input light intensity that has 80% switching efficiency? Assuming initial 100% switching efficiency.

4. <u>Directional coupler:</u> determine the voltage need to switch-on and switch-off



$$P/P_0 = \frac{|\kappa|^2}{|\kappa|^2 + \left(\frac{\Delta\beta}{2}\right)^2} \sin^2\left(\sqrt{|\kappa|^2 + \left(\frac{\Delta\beta}{2}\right)^2}\right) L$$

$$\Delta\beta = \frac{2\pi}{\lambda}\Delta n = \frac{2\pi}{\lambda}\left(-\frac{1}{2}n_0^3 r_{33} E_z\right),$$

5. Y-coupler modulator, If the waveguides are made of Z-cut LiNbO3, r33 = 31pm/V, L = 2cm, determine the Vπ voltage, assuming the thickness of the waveguide is 5um and coupling constant =0.01um^{-1}.