Comp. by: Vpugazhenthi Stage: Revises1 Chapter No.: 4 Title Name: LIU
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Figure 4.5 Codirectional coupling between two modes of propagation constants β_a and β_b (a) in the same waveguide and (b) in two parallel waveguides. A perturbation is required for codirectional coupling in the same waveguide but is not required for codirectional coupling between two waveguides.

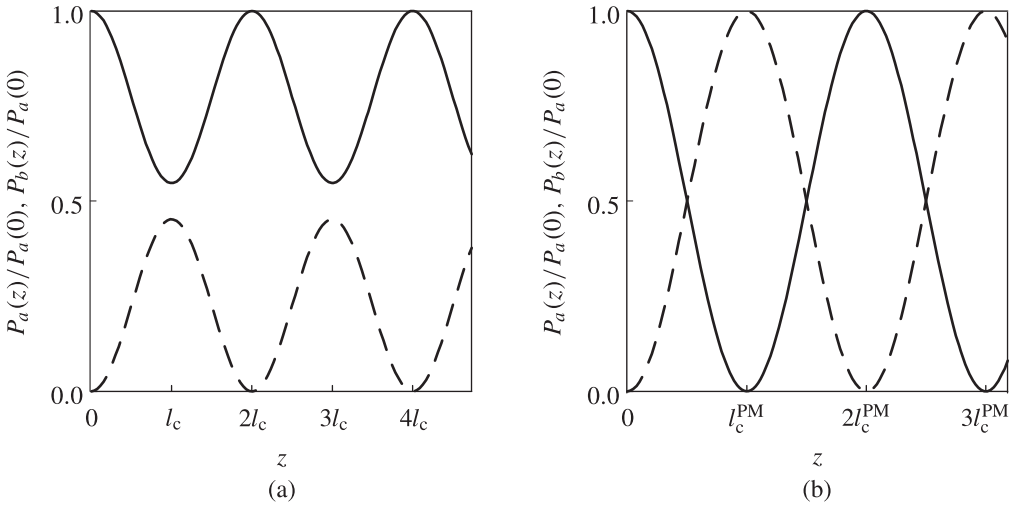

Figure 4.6 Periodic power exchange between two codirectionally coupled modes for (a) the phase-mismatched condition $\delta \neq 0$ and (b) the phase-matched condition $\delta = 0$. The solid curves represent $P_a(z)/P_a(0)$, and the dashed curves represent $P_b(z)/P_a(0)$.

$$\tilde{A}(z) = \tilde{A}(0)\left(\cos\beta_c z - \frac{i\delta}{\beta_c}\sin\beta_c z\right)e^{i\delta z}, \tag{4.51}$$

$$\tilde{B}(z) = \tilde{B}(0)\left(\frac{i\kappa_{ba}}{\beta_c}\sin\beta_c z\right)e^{-i\delta z}. \tag{4.52}$$

The power in the two modes varies with z as

$$\frac{P_a(z)}{P_a(0)} = \left|\frac{\tilde{A}(z)}{\tilde{A}(0)}\right|^2 = \frac{\kappa_{ab}\kappa_{ba}}{\beta_c^2}\cos^2\beta_c z + \frac{\delta^2}{\beta_c^2}, \tag{4.53}$$

$$\frac{P_b(z)}{P_a(0)} = \left|\frac{\tilde{B}(z)}{\tilde{A}(0)}\right|^2 = \frac{|\kappa_{ba}|^2}{\beta_c^2}\sin^2\beta_c z. \tag{4.54}$$

The *coupling efficiency* for codirectional coupling over a length of l is

$$\eta = \frac{P_b(l)}{P_a(0)} = \frac{|\kappa_{ba}|^2}{\beta_c^2}\sin^2\beta_c l. \tag{4.55}$$