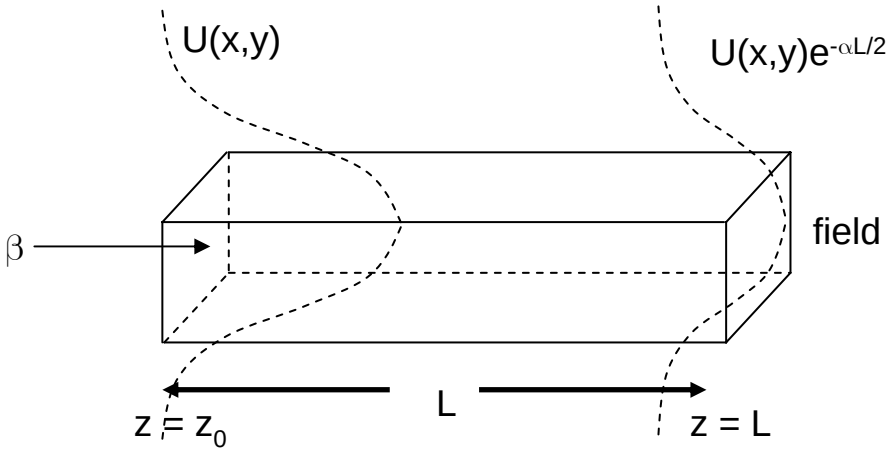
Waveguide Loss



Confinement factor

$$\Gamma = \frac{\int_{core} |u(x,y)|^2 \, dxdy}{\int_{all\ space} |u(x,y)|^2 \, dxdy}$$

roughness at waveguide core/cladding interface	leakage out of a curved waveguide	absorption within core (Γ) or within cladding (1-Γ)	evanescent leakage to Si substrate

$$\alpha = \alpha_{scattering} + \alpha_{radiative} + \Gamma\alpha_{abs,core} + (1-\Gamma)\alpha_{abs,cladding} + \alpha_{substrate}$$

$$P(z_0) = \int \left| U(x,y) e^{-i\beta z_0} e^{-\alpha z_0/2} \right|^2 dxdy = \left\{ \int |U(x,y)|^2 \, dxdy \right\} e^{-\alpha z_0}$$

$$= Ae^{-\alpha z_0}$$

$$P(z_0 + L) = Ae^{-\alpha(z_0+L)}$$

$$Loss = \frac{P(z_0+L)}{P(z_0)} = e^{-\alpha L}$$

$$-\alpha L(dB) \equiv 10\log\left(\frac{P_{out}}{P_{in}}\right)$$

$$= 10\log\left(e^{-\alpha L}\right)$$

$$= -\alpha L \cdot 10\log(e)$$

$$\alpha L(dB) \cong 4.34 \cdot \alpha L$$

$$\alpha(dB/cm) \cong 4.34 \cdot \alpha(cm^{-1})$$