

Waveguide Losses

Energy Loss Mechanisms

- 1. Absorption** - The photon is annihilated. Its energy is transferred to the absorbing material.
- 2. Scattering** - The photon changes direction and possibly energy but maintains its identity.
 - A. Volume scattering** - imperfections, voids, contaminants, crystalline defects
 - B. Surface scattering** - surface roughness
- 3. Radiation** - The photon changes direction and possibly energy but maintains its identity. Radiation loss becomes significant when the guided waves break confinement because of too tight bending or reduced waveguide dimensions.

Waveguide Attenuation (Loss)

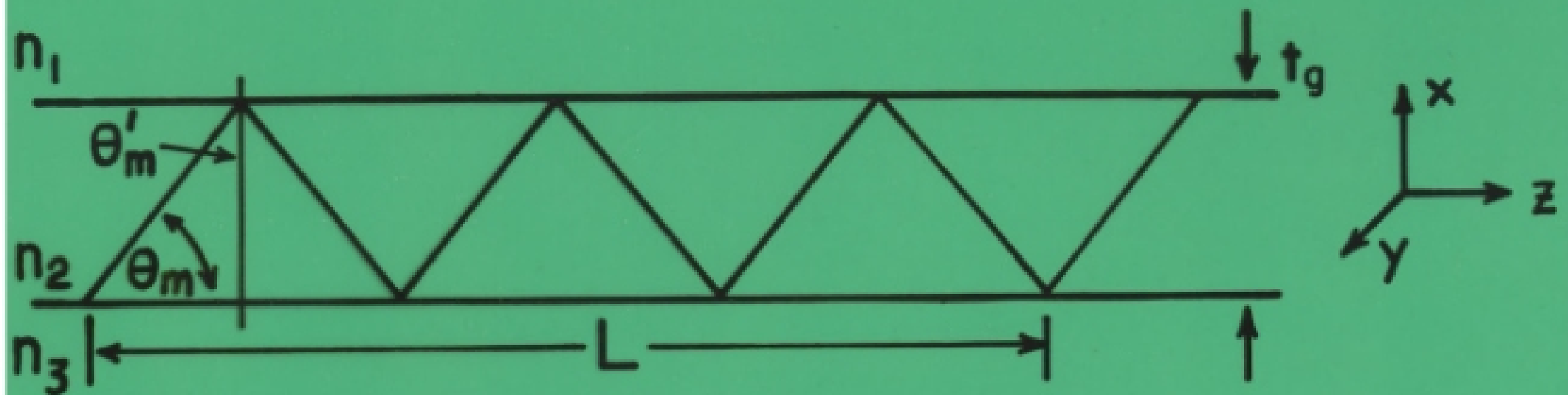
Scattering

Absorption

$$\frac{I(z)}{I_0} = e^{-\alpha z}$$

Radiation

$$\alpha \left(\frac{\text{dB}}{\text{cm}} \right) = 4.34 \alpha \left[\text{cm}^{-1} \right]$$



Number of bounces = $\frac{L}{2t_g \cot \theta_m}$