

Acceptance Angle and Numerical aperture

$$\frac{\sin i}{\sin r} = \frac{n_1}{n_0}$$

$$\sin i = \left(\frac{n_1}{n_0}\right) \sin r \quad \text{--- (1)}$$

From  $\triangle ABB$

$$\angle r = (90^\circ - \theta)$$

~~$$\sin r =$$~~

$$\sin r = \sin (90^\circ - \theta)$$

$$\sin r = \cos \theta$$

From eqn (1) putting value of  $\sin r$

$$\sin i = \left(\frac{n_1}{n_0}\right) \cos \theta \quad \text{--- (2)}$$

From maximum acceptance angle

$$\sin i = \left(\frac{n_1}{n_0}\right) \cos \theta_c$$

$$\sin i_{\max} = \left(\frac{n_1}{n_0}\right) \sqrt{1 - \sin^2 \theta_c}$$

$$\sin \theta_c = \frac{n_2}{n_1} \quad \left\{ \because \theta_c = \sin^{-1} \left( \frac{n_2}{n_1} \right) \right\}$$

$$\begin{aligned} \sin i &= \frac{n_1}{n_0} \sqrt{1 - \left(\frac{n_2}{n_1}\right)^2} \\ &= \frac{n_1}{n_0} \sqrt{\frac{n_1^2 - n_2^2}{n_1^2}} \end{aligned}$$

$$\sin i_{\max} = \sqrt{n_1^2 - n_2^2}$$

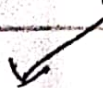


This expression is called numerical aperture.

$$i_{\max} = \sin^{-1} \sqrt{n_1^2 - n_2^2}$$

if considered  $i_{\max} = i_0$

$$i_0 = \sin^{-1} \sqrt{n_1^2 - n_2^2}$$



This expression is called acceptance angle.