

Experiment Title : Investigation and Calculation of Numerical Aperture for Step Index and Graded Index Fibres

The experiment file named NA_SI_GI_2012, coded in MATLAB is given on the course webpage, ece474.cankaya.edu.tr.

1. Download the experiment file into your PC and run it with the current settings.
2. This m file plots the numerical aperture (NA) of step index and graded index fibres given by the following expressions

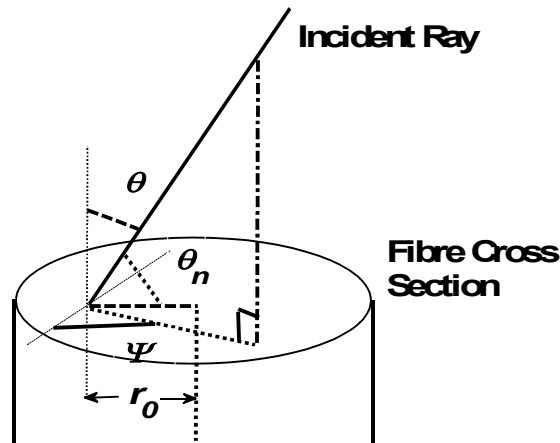
$$NA_{SI} = (n_1^2 - n_2^2)^{0.5} \left\{ 1 + \left[\frac{(r_0/a) \sin \psi_1}{1 + (r_0/a) \cos \psi_1} \right] \right\}^{0.5}$$

$$NA_{GI} = \left[\frac{n_1^2 (r_0) - n_2^2}{1 - (r_0/a) \cos^2 \psi} \right]^{0.5}$$

$$\psi_1 = \cos^{-1} [-(r_0/a) \cos \psi] + \psi$$

where the related geometry is shown below

Illustration of a Skew Ray Incidence



3. For at least three different numerical settings of n_1 , n_2 , q , (all together 9 settings) obtain the NA plots for both step index and graded index fibres. From these graphs, comment how NA depends on these parameters. Test the limit of $q \rightarrow \infty$.
4. Include in your report, all graphs and comments.