

# Çankaya University – ECE Department – ECE 572

2012 Spring Term

24.02.2012

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

The experiment file named **NA\_MT1\_2007**, coded in **MATLAB** is given on the course webpage, [ece572.cankaya.edu.tr](http://ece572.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

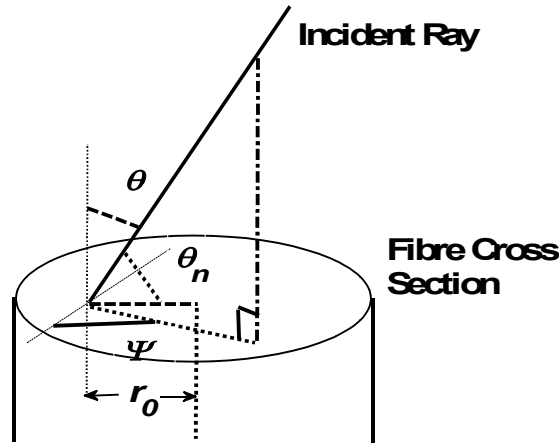
$$NA_{SI} = (n_1^2 - n_2^2)^{0.5} \left\{ 1 + \left[ \frac{(r_0 / a) \sin \psi_1}{1 + (r_0 / a) \cos \psi_1} \right] \right\}^{0.5}$$

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

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

where the related geometry is shown below

## Illustration of a Skew Ray Incidence



3. For at least three different numerical settings of  $n_1$ ,  $n_2$ ,  $q$ , obtain the  $NA$  plots. From these graphs, comment how  $NA$  depends on these parameters.
4. Include in your report, all graphs and comments.