

Experiment 4 : Ray propagation in graded index fibres

Experiment coded in MATLAB, with file name, “Ray_tracing_GI_Exp4.m” is given on webpage of ECE 474.

1. Copy the experiment file into the directory of your name.
2. Run the file, observe the OPs, Try to follow what is intended and what is happening
3. This experiment is intended to illustrate the ray propagation in graded index fibre and the minimum and maximum turning points, i.e., r_{\min} , r_{\max} of ray trajectory. The launching conditions, are specified by parameters x_0 , y_0 , $t_{\text{etx}0}$ and $t_{\text{ety}0}$ on line 5 of the m code (x_0 , y_0 , θ_{x_0} and θ_{y_0} in (2.18) of the Notes on Propagation in GI fibres_Feb 2013_HTE). Line 4 of the code gives the fibre specifications.
4. When you run the code two outputs are obtained, one is the 3D visual propagation of the given ray in the fibre, the other is the turning points, r_{\min} and r_{\max} . By rotating the 3D visual propagation plot, it is possible to obtain, the projection of ray trajectory onto fibre end face (or fibre cross section).
5. By adjusting parameters (apart from z related ones) on line 5 of the code, see how ray trajectory is affected. From the rotated ray trajectory, find r_{\min} and r_{\max} by pointing data cursor to them and test if these are the same as r_{\min} and r_{\max} written on command window.
6. By selecting at least ten different sets of x_0 , y_0 , $t_{\text{etx}0}$ and $t_{\text{ety}0}$, find the corresponding r_{\min} and r_{\max} both from the ray trajectory plot and from the command window and determine if they agree. Bearing in mind that meridional rays will a line type projection, where $r_{\min} = 0$, the skew rays will draw an ellipse, determine which set of x_0 , y_0 , $t_{\text{etx}0}$ and $t_{\text{ety}0}$ give meridional, and which set of x_0 , y_0 , $t_{\text{etx}0}$ and $t_{\text{ety}0}$ give skew rays.
7. Record the outputs to print them in your experiment report.
8. Include your comments for the experiment.