**ECE 474 / EXPERIMENT 3**

**MATLAB CODE**

% This prog plots k\_r plot of WKB approximation

function ECE\_635\_WKB

close all;clear;clc;clf reset

global n1 q delta k0 L a beta

n1 = 1.5; n2 = 1.485;a = 12e-6;q = 2;rn = 0:0.01:1;rnc = 1.01:0.01:2;

delta = (n1^2 - n2^2)/(2\*n1^2);%n1 = 1.50;n2 = 1.47;

nr = n1\*sqrt(1 - 2\*rn.^q\*delta);L = 0;m = 2;%%%%% Graded index

%nr = n1;L = 0;m = 1; %%%%% Step index

lamda = 1.55e-6;k0 = 2\*pi/lamda;k1 = 2\*pi\*n1/lamda;k2 = 2\*pi\*n2/lamda;

beta = sqrt(a\*k0^2\*n1^2 - 4\*k0\*n1\*sqrt(2\*delta)\*(m + L/2))/sqrt(a)

[k1 k2]

%beta = 0.95\*k0\*n2; %%%% Selecting beta for refracting ray

kr2cor = nr.^2\*k0^2 - L^2./(a^2\*rn.^2) - beta^2;

kr2clad = n2.^2\*k0^2 - L^2./(a^2\*rnc.^2) - beta^2;

kr2 = [kr2cor kr2clad];rnp = [rn rnc];

plot(rnp, kr2, '-k ', 'LineWidth',3);hold on

plot(rnp, zeros(1,length(rnp)), '--k ', 'LineWidth',2);

hold off;

set(gcf,'Color',[1 1 1]);set(gca,'FontSize',18)

%title('Plot of \itk\_r over core and cladding regions','FontSize',12,'FontWeight','bold');

xlabel('\itr\rm\bf\_n = \itr / a','FontSize',22,'FontWeight','bold');

ylabel('\itk\_r\rm\bf^2 ( \itr\rm\bf )','FontSize',22,'FontWeight','bold');

axis ([min(rnp)\*1 max(rnp)\*1 -1e12 max(kr2)\*1.2]);

%%%% Test %%%%

%[a\*k0\*n1\*sqrt(delta)/(2\*sqrt(2)) m + L/2]

%%%%% Finding turning points

%root\_r\_L = fzero(@funkr,[0.01 0.5])

root\_R\_L = fzero(@funkr,[0.5 1])

function fB = funkr(rx)

global n1 q delta k0 L a beta

fB = (n1\*sqrt(1 - 2\*rx.^q\*delta)).^2\*k0^2 - L^2./(a^2\*rx.^2) - beta^2;