**ECE 474 / EXPERIMENT 2**

**MATLAB CODE**

% Experiment 2 of ECE 474

% This prog is based on my derivation, which is a modified version of Eq. (1.3.17) of Salehi.

close all;clear;clc;clf reset

n1 = 1.50;n2 = 1.47;delta = (n1 - n2)/n1;a = 25e-6;

z = 0:0.1:50;z = z\*a;x0 = 0.2\*a\*1;y0 = 0.2\*a\*1;tetx0 = 0.08736;tety0 = 0.0873;

zf = 0:0.02:50;zf = zf\*a\*100;

x\_z = x0\*cos(sqrt(2\*delta)\*z/a) + a\*tetx0\*sin(sqrt(2\*delta)\*z/a)/sqrt(2\*delta);

y\_z = y0\*cos(sqrt(2\*delta)\*z/a) + a\*tety0\*sin(sqrt(2\*delta)\*z/a)/sqrt(2\*delta);

set(gcf,'Renderer','Zbuffer');set(gcf,'Color',[1 1 1]);

plot3(x\_z,y\_z,z,'-r','LineWidth',4);set(gca,'FontSize',13);%colormap colorcube;%view([-21.5 60.0])

%title('3D Plot of Characteristic Equation for HE and EH Modes','FontSize',12,'FontWeight','bold');

grid on

axis([-a a -a a min(z) max(z)]);hold on

plot3(a\*cos(sqrt(2\*delta)\*zf/a),a\*sin(sqrt(2\*delta)\*zf/a),zf/100,'--g','LineWidth',0.1);

axis square

xlabel('\itx\rm\bf axis','FontSize',12,'FontWeight','bold');

ylabel('\ity\rm\bf axis','FontSize',12,'FontWeight','bold');

zlabel('\itz\rm\bf axis','FontSize',12,'FontWeight','bold');

n1str = ['\itn\rm\bf\_1 = ' num2str(n1,'%3.2f')];n2str = ['\itn\rm\bf\_2 = ' num2str(n2,'%3.2f')];

astr = ['\ita\rm\bf = ' num2str(a/1e-6,'%3.0f') ' \mum'];

x0str = ['\itx\rm\bf\_0\it\_n = \rm\bf ' num2str(x0/a)];y0str = ['\ity\rm\bf\_0\it\_n = \rm\bf ' num2str(y0/a)];

tetx0str = ['\it\theta\rm\bf\_0\it\_x = \rm\bf ' num2str(tetx0\*180/pi,'%3.0f') '^0'];

tety0str = ['\it\theta\rm\bf\_0\it\_y = \rm\bf ' num2str(tety0\*180/pi,'%3.0f') '^0'];

legc = {n1str;' ';n2str;' ';astr;' ';x0str;' ';y0str;' ';tetx0str;' ';tety0str};

text(max(x\_z)\*0.8,max(y\_z),max(z)\*0.8,legc,'FontSize',14,'FontWeight','bold','BackgroundColor','white');

arctan = atan(2\*(x0\*tetx0 +y0\*tety0)/ ...

(sqrt(2\*delta)/a\*(x0^2 + y0^2) - a/sqrt(2\*delta)\*(tetx0^2 + tety0^2)));

zp = 0.5\*a/sqrt(2\*delta)\*arctan;

x\_zp = x0\*cos(sqrt(2\*delta)\*zp/a) + a\*tetx0\*sin(sqrt(2\*delta)\*zp/a)/sqrt(2\*delta);

y\_zp = y0\*cos(sqrt(2\*delta)\*zp/a) + a\*tety0\*sin(sqrt(2\*delta)\*zp/a)/sqrt(2\*delta);

r\_min = sqrt(x\_zp^2 + y\_zp^2)

arctan = arctan + pi;zp = 0.5\*a/sqrt(2\*delta)\*arctan;

x\_zp = x0\*cos(sqrt(2\*delta)\*zp/a) + a\*tetx0\*sin(sqrt(2\*delta)\*zp/a)/sqrt(2\*delta);

y\_zp = y0\*cos(sqrt(2\*delta)\*zp/a) + a\*tety0\*sin(sqrt(2\*delta)\*zp/a)/sqrt(2\*delta);

r\_max = sqrt(x\_zp^2 + y\_zp^2)