**ECE 474 / EXPERIMENT 6**

 **MATLAB CODE (GaussianbeamS.m)**

% This is source plane intensities of Gaussian beams - 25.10.2011

clear;clc;clf;warning off MATLAB:divideByZero;close all

lamda = 1.55e-6; k = 2\*pi/lamda;Ac = 1;

sxst = -1.e-1:0.2e-2:1e-1;syst = sxst;

sxset1 = sxst\*0.02;syset1 = sxset1;sxset2 = sxst\*0.2;syset2 = sxset2;sxset3 = sxst\*0.4;syset3 = sxset3;sxset4 = sxst\*1;syset4 = sxset4;

sxmat = [sxset1; sxset2; sxset3; sxset4];symat = [syset1; syset2; syset3; syset4];

%%%%%%%%%%%%%%%%%%%%%%%%%% Gaussian BEAM %%%%%%%%%%%%%%%%%%%%%%%%%%%%%

%[sx,sy]=meshgrid(sxset,syset);[Fis, s] = cart2pol(sx,sy);

%%%%% Source settings %%%%%%%%%%

Fsarr = [1e15 1e15 1e15 1e15];%s = sqrt(sx.^2 + sy.^2);

%sxn = sx / 1e-2;syn = sy / 1e-2;

alfasarr = [0.1e-2 1e-2 2e-2 5e-2];alfaarr = 1./(k\*alfasarr.^2) + j./(2\*Fsarr);

%%%%%%%%%%%%% Source Beam %%%%%%%%%%%%%%%%%%

I\_sarr = [];

for ib = 1:length(alfasarr)

alfa = alfaarr(ib);sxset = sxmat(ib,:);syset = symat(ib,:);[sx,sy]=meshgrid(sxset,syset);[Fis, s] = cart2pol(sx,sy);

Us = Ac\*exp(-k\*alfa\*s.^2); % In cylindrical coordinates

I\_s = Us.\*conj(Us);maxgen = max(max(I\_s));I\_s = I\_s / max(max(I\_s));

I\_sarr = cat(3,I\_sarr,I\_s);

end

figure(1)

%%%%%%%% Four Individual 3D Intensity Plots %%%%%%%%%%%%%%%%%

for ib = 1:length(alfasarr)

I\_s = I\_sarr(:,:,ib);subplot(2,2,ib);

sxset = sxmat(ib,:);syset = symat(ib,:);[sx,sy]=meshgrid(sxset,syset);sxn = sx / 1e-2;syn = sy / 1e-2;

meshc(sxn,syn,real(I\_s));view([35 45]);colormap([0 0 0])

xlabel('\its\_x\rm\bf axis in cm','FontSize',10,'FontWeight','bold','Rotation',-12);

ylabel('\its\_y\rm\bf axis in cm','FontSize',10,'FontWeight','bold','Rotation',25)

zlabel('\fontname{Verdana}\fontsize{12}\itI\_s\_N','FontSize',12,'FontWeight','bold')

alfasstr = [' \it\alpha\_s \rm\bf= ' num2str(alfasarr(ib)/1e-2,'%3.1f') ' cm '];

leg1 = ['Source intensity plot for Gaussian beam with ' alfasstr];

title(leg1,'FontSize',10)

set(gcf,'Renderer','Zbuffer');set(gcf,'Color','White');set(gca,'FontSize',11);

axis ([min(min(sxn))\*1 max(max(sxn))\*1 min(min(syn))\*1 max(max(syn))\*1 0 1]);

end

figure(2)

%%%%%%%% Four Individual Contour Plots %%%%%%%%%%%%%%%%%

for ib = 1:length(alfasarr)

I\_s = I\_sarr(:,:,ib);subplot(2,2,ib);

sxset = sxmat(ib,:);syset = symat(ib,:);[sx,sy]=meshgrid(sxset,syset);sxn = sx / 1e-2;syn = sy / 1e-2;

[C,h] = contour(sxn,syn,I\_s,'-k');axis square;fax = 1;

axis ([min(min(sxn))\*1 max(max(sxn))\*1 min(min(syn))\*1 max(max(syn))\*1]);

line([min(min(sxn))\*fax max(max(sxn))\*fax],[0 0],'LineWidth',1.8,'color','black','LineStyle','--');

line([0 0],[min(min(syn))\*fax max(max(syn))\*fax],'LineWidth',1.8,'color','black','LineStyle','--');

xlabel('\its\_x\rm\bf axis in cm','FontSize',10,'FontWeight','bold');

ylabel('\its\_y\rm\bf axis in cm','FontSize',10,'FontWeight','bold');

alfasstr = [' \it\alpha\_s \rm\bf= ' num2str(alfasarr(ib)/1e-2,'%3.1f') ' cm '];

leg1 = ['Source intensity plot for Gaussian beam with ' alfasstr];

title(leg1,'FontSize',10)

%set(gcf,'Renderer','Zbuffer');set(gcf,'Color','White');set(gca,'FontSize',11);

set(h,'LineWidth',1.2);H = clabel(C,h);set(H,'FontSize',6,'LineWidth',3)

set(gca,'FontSize',11);set(gcf,'Color',[1 1 1])

end

figure(3)

%%%%%%%% Four Individual Crosssection Plots %%%%%%%%%%%%%%%%%

for ib = 1:length(alfasarr)

I\_s = I\_sarr(:,:,ib);subplot(2,2,ib);

sxset = sxmat(ib,:);syset = symat(ib,:);

R = sqrt(sxset.^2+syset.^2);RS = [-R(1:round(numel(R)/2)) R(round(numel(R)/2)+1:end)];RSn = RS / 1e-2;

plot(RSn,diag(I\_s),'-k','LineWidth',2);

set(gcf,'Renderer','Zbuffer');set(gcf,'Color','White');set(gca,'FontSize',14);grid on;

axis ([min(RSn)\*1 max(RSn)\*1 0 max(max(I\_s))\*1.05]);

xlabel('\its\rm\bf axis in cm','FontSize',10,'FontWeight','bold');

ylabel('\fontname{Verdana}\fontsize{12}\itI\_s\_N','FontSize',12,'FontWeight','bold')

end