**ECE 474 / EXPERIMENT 7**

 **MATLAB CODE (Beamsize.m)**

% This is receiver plane beam sizes of Gaussian beams - 23.04.2012

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

lamda = 1.51e-6; k = 2\*pi/lamda;zarr = 0:0.1e2:5e3;

% lamda = 0.5e-6; k = 2\*pi/lamda;zarr = 0:0.1e2:6e3;

Fs = 100;alfas = 1.2e-2;

%%%% Beam size expression in terms of alpha\_s and F\_s

alfar = sqrt((k^2\*alfas^4\*Fs^2 - 2\*k^2\*alfas^4\*Fs\*zarr + 4\*Fs^2\*zarr.^2 + k^2\*alfas^4\*zarr.^2)/(k^2\*alfas^2\*Fs^2));

alfaf = 2\*Fs/(k\*alfas)

zB = k^2\*alfas^4\*Fs/(4\*Fs^2 + k^2\*alfas^4) %%% Distance of beam waist from source plane

alfaB = sqrt(4\*alfas^2\*Fs^2/(4\*Fs^2 + k^2\*alfas^4)) %%% Beam waist

zR1 = (k^2\*alfas^4\*Fs - 2\*k\*alfas^2\*Fs^2)/(4\*Fs^2 + k^2\*alfas^4) %%%% Rayleigh range for convergent beam

zR2 = (k^2\*alfas^4\*Fs + 2\*k\*alfas^2\*Fs^2)/(4\*Fs^2 + k^2\*alfas^4) %%%% Rayleigh range for convergent beam

zR = 0.5\*k\*alfas^2

figure(1)

plot(zarr/1e3,alfar/1e-2,'-k','LineWidth',2);

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

axis ([min(zarr/1e3)\*1 max(zarr/1e3)\*1 0 max(alfar/1e-2)\*1.05]);

ylabel('\it\alpha\_r\rm\bf in cm - Beam size','FontSize',16,'FontWeight','bold');

xlabel('\itz\rm\bf in km - Propagation distance','FontSize',16,'FontWeight','bold')

figure(2)

% %%%%%%%% Illustration for beam diffraction %%%%%%%%%%%%%%%%%

alfar1 = -alfar;

zeroc = zeros(1,length(alfar));

plot(zarr/1e3,alfar/1e-2,'-k','LineWidth',3);hold on;plot(zarr/1e3,alfar1/1e-2,'-k','LineWidth',3);hold on

plot(zarr/1e3,zeroc,'--k','LineWidth',2);

set(gcf,'Renderer','Zbuffer');set(gcf,'Color','White');set(gca,'FontSize',16);

ylabel('\its \rm\bf or \itr \rm\bf axis in cm - Beam size borders','FontSize',16,'FontWeight','bold');

xlabel('\itz\rm\bf in km - Propagation distance','FontSize',16,'FontWeight','bold')

axis ([min(zarr/1e3)\*1 max(zarr/1e3)\*1 -max(alfar/1e-2)\*1.05 max(alfar/1e-2)\*1.05]);grid on