Çankaya University – ECE Department – ECE 474

2012 Spring Term **23.04.2012**

Experiment : Investigation of Gaussian beam on source and receiver planes

Experiment coded in MATLAB is given on course webpage, ece474.cankaya.edu.tr.
with file names of GaussianbeamS.m and GaussianbeamR.m

1. Download the experiment files into your computer.
2. Run the file, observe the OPs. Try to follow what is intended and what is happening
3. This experiment is intended to show you the variation of Gaussian beam intensity profiles with source size, focusing parameter and wavelength of operation. In the files, these are named as alfas, Fs and lamda corresponding to the mathematical symbols of α_s , F_s and λ. In both m files three types of four subplots are generated. The first one is 3 dimensional, second is contour plot, third is the 2 dimensional plot cut along the slanted axis.
4. Initially run GaussianbeamS.m, at $\alpha_s = 1 \text{ cm}, 2 \text{ cm}, 5 \text{ cm}, 10 \text{ cm}$. Observe the three subplots and measure the source size from the 2 dimensional subplots (or the others) and see if it matches with the given numeric values. Keep in mind that in line with (G3) of Notes on free space propagation for ECE 474_Nisan 2012, when the radial coordinate *s* is equal to the source size α_s, the intensity level is $I_s(s,\phi_s) = \exp(-2) = 0.135$, assuming $A_c = 1$. Upon changes in the source size, the sxst multipliers on line 6 should be adjusted accordingly to fit the intensity profile into the observed transverse plane.
5. Now investigate whether the source intensity profiles change with changes in λ and F_s . If you see no variation, explain and write the reason for this in your experiment report.
6. Now run GaussianbeamR.m, at $\alpha_s = 1 \text{ cm}, 2 \text{ cm}, 5 \text{ cm}, 10 \text{ cm}$. Observe and record the outputs. From the 2 dimensional subplots, measure α_r at $z = 100 \text{ m}, 1 \text{ km}, 2\text{km}, 5 \text{ km}$ for each of the source sizes given above. Make a comparison between the measure values and those calculated using (G24) of Notes on free space propagation for ECE 474_Nisan 2012.
7. Now change the setting F_s from infinity to of $F_s = 500 \text{ m}, 1 \text{ km}, 2 \text{ km}$. Repeat the measurements in 6.
8. Now change the wavelength of operation to $\lambda = 1.31 \ \mu\text{m}, \lambda = 1.7 \ \mu\text{m}$ and repeat the measurements.
9. Include your general comments in the experiment report.