Homework 2: ECE 6390 Summer 2015

Aperture/Dish Antennas

In class, we worked through an analytical example using acoustic diffraction theory to find the radiation pattern due to a circular aperture of radius *R* with uniform field illumination. In this homework problem, you will explore how the patterns of dish antennas change as the illumination changes. Solution will require a relatively straight-forward numerical evaluation of the area integration we derived in class. You may use any software package or technique available to you (be sure to attach your code/inputs).

The electric field illumination that we will use across the circular aperture will take the form:

$$E_{\lozenge}(\rho) = \frac{E_o}{R}\left|R^n - \rho^n\right|^{\frac{1}{n}} \text{ for } |\rho| \le R$$

where E_o is an arbitrary constant and n is the unitless "aperture taper factor" (n=infinity corresponds to uniform illumination).

1. Plot the logarithmic radiation pattern over the interval $-\frac{\pi}{2} \le \theta \le \frac{\pi}{2}$ for a circular aperture of radius 5λ for taper factors of n = 1, 2, 3, and infinity. For each of these cases, tabulate the peak gain, 3dB beamwidth, and side-lobe level.

2. Repeat part 1 for a radius of 10λ.