EE6370--Antennas
Homework #5
Spring Semester 2019
Due: March 6, 2019

1. Analyze a center-fed dipole antenna with a total length of 30 cm and a **diameter** of 0.2 mm using NEC. The dipole lies on the z-axis and is centered on the x-y plane.

   a) Calculate and graph the real and imaginary parts of the impedance from 10 MHz to 2 GHz in 10 MHz steps.
   b) Calculate and graph the gain in dB for the broadside direction (θ = 90 degrees) from 10 MHz to 2 GHz in 10 MHz steps.
   c) At 0.5 GHz, 1.0 GHz and 1.5 GHz, calculate and graph the E-plane pattern.
   d) At 0.5 GHz, 1.0 GHz and 1.5 GHz, calculate and graph the normalized current $I_n(z) = I(z)/I(z_m)$ on a linear scale where $I(z)$ is the actual current as a function of *z* and $z_m = \mathrm{argmax}_z(|I(z)|)$ is the position at which the maximum current occurs along the antenna. Graph the magnitude, real, and imaginary parts of the current.
   e) How do the current distributions and patterns compare to those predicted by the sinusoidal theory? Graph the real part of the theoretical current on the graphs from part 4.

   Include the NEC input file and a sketch of the antenna showing how it was divided up into segments.

2. Re-analyze the antenna from 1. with the Matlab antenna toolbox. The toolbox can model a strip dipole which is a thin conductor with a finite width. The parameters for the strip dipole will approximate that of the round dipole when the width of the strip is set twice the diameter of the round wire dipole. The strip dipole can be created with the Matlab command: d = dipole('Length',30/100,'Width',2*0.2/1000) .

   a) Calculate and graph the real and imaginary parts of the impedance from 10 MHz to 2 GHz in 10 MHz steps. The Matlab command impedance will do this.
   b) Make a graph of the relative difference between the impedance calculated using NEC and Matlab: $\mathrm{R} = \left|\frac{Z_{NEC}-Z_{Matlab}}{Z_{NEC}+Z_{Matlab}}\right|$. Graph the relative difference on a log scale.
   c) Calculate and graph the gain in dB for the broadside direction (θ = 90 degrees) from 10 MHz to 2 GHz in 10 MHz steps. The Matlab pattern command will compute the directivity at a single frequency (assume the antenna is lossless): directivity(k)=pattern(d,f(k),0,0) . G
   d) Make a graph of the difference between the gain in dB from NEC and Matlab. $\Delta G_{dB} = G_{NEC,dB} - G_{Matlab,dB}$