ECE 6370
Homework 5
March 6, 2019
Caitlyn Caggia

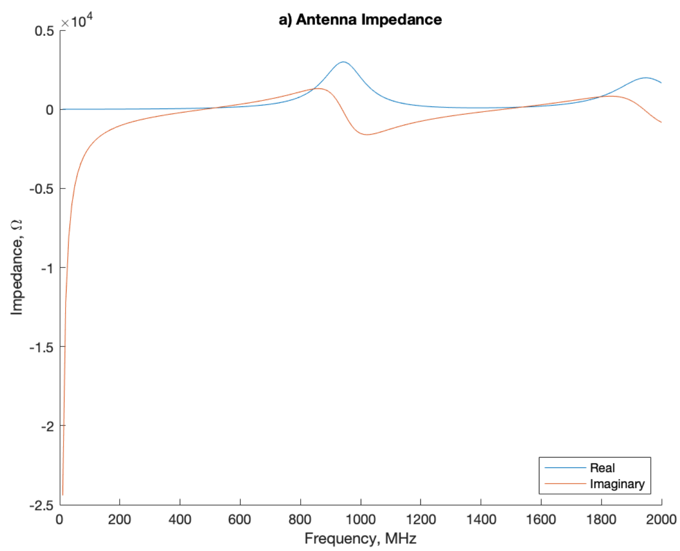
PROBLEM 1

PART 1A

Input file for part (a):

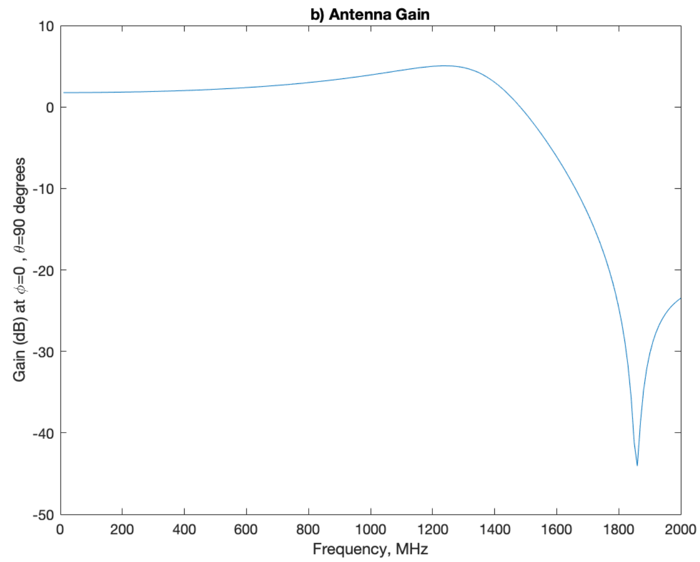
```
CM ECE 6370 - Homework 5.A
CM Caitlyn Caggia
CE CENTER FED HALF-WAVE DIPOLE
GW 1 31 0. 0. -0.15 0. 0. 0.15 0.0001
GE
EX 0  1  16  0  1.0  0.0
FR 0  200  0  0  10. 10.
RP 0  1  0  1000  90.  0.  0.  0.
EN
```

Plot generated using given Matlab plotting functions:



PART1B

Input and Matlab files were the same as used for part (a).

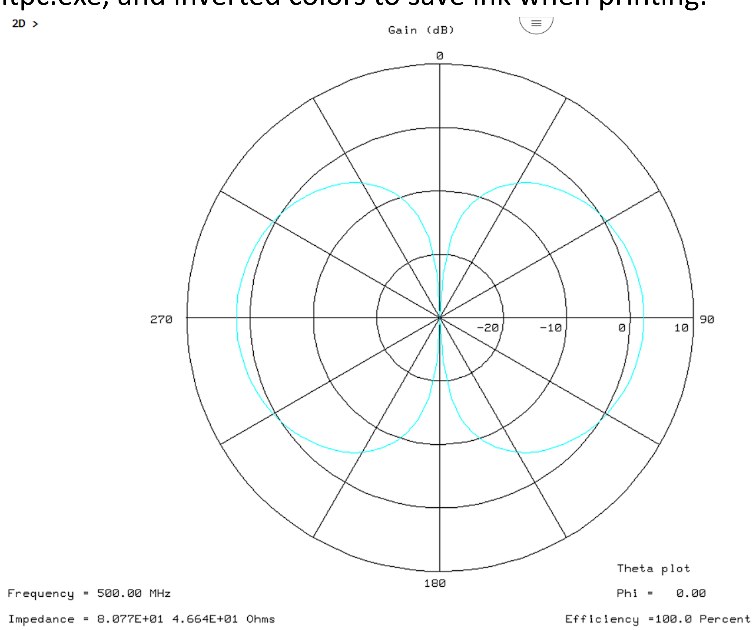


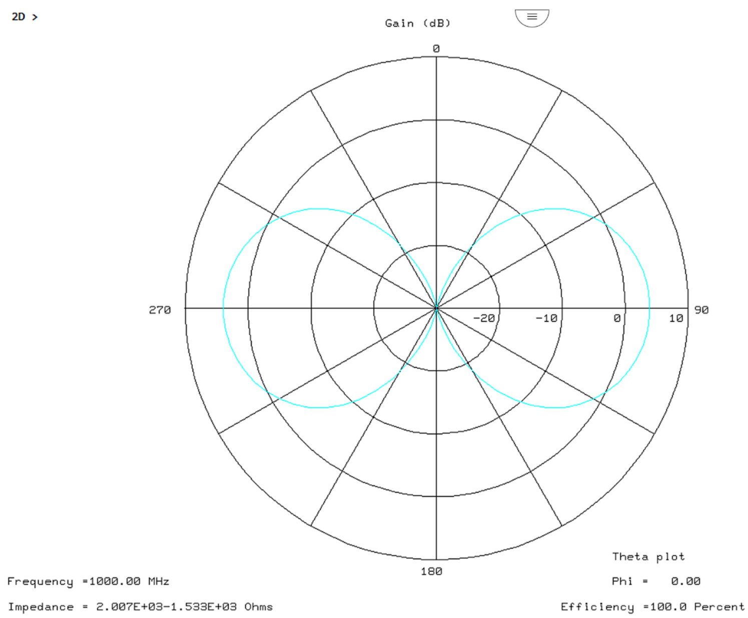
PART 1C

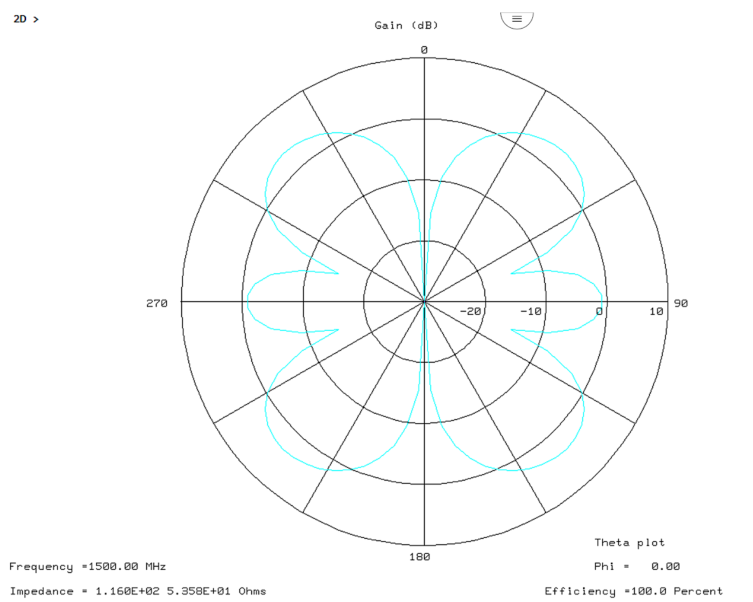
Input file for 0.5 GHz:

```
CM ECE 6370 - Homework 5.C
CM Caitlyn Caggia
CE CENTER FED HALF-WAVE DIPOLE
GW 1 31 0. 0. -0.15 0. 0. 0.15 0.0001
GE
EX 0  1  16  0  1.0  0.0
FR 0  1  0  0  500. 0.
RP 0  91  0  1000  0.  0.  4.  0.
EN
```

Plotted using patpltpc.exe, and inverted colors to save ink when printing.

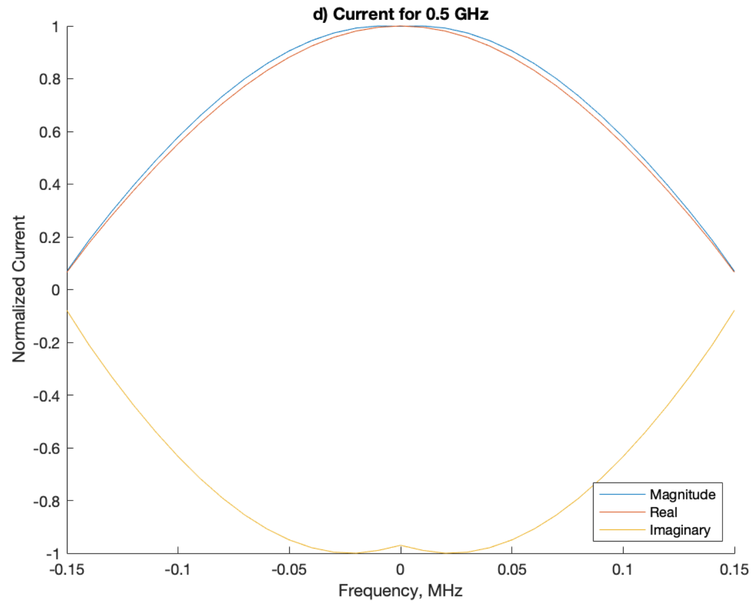


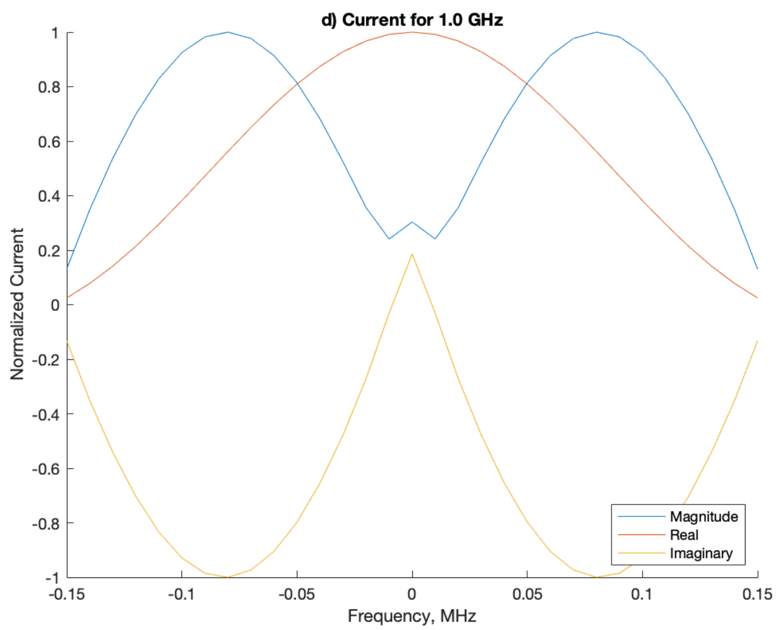


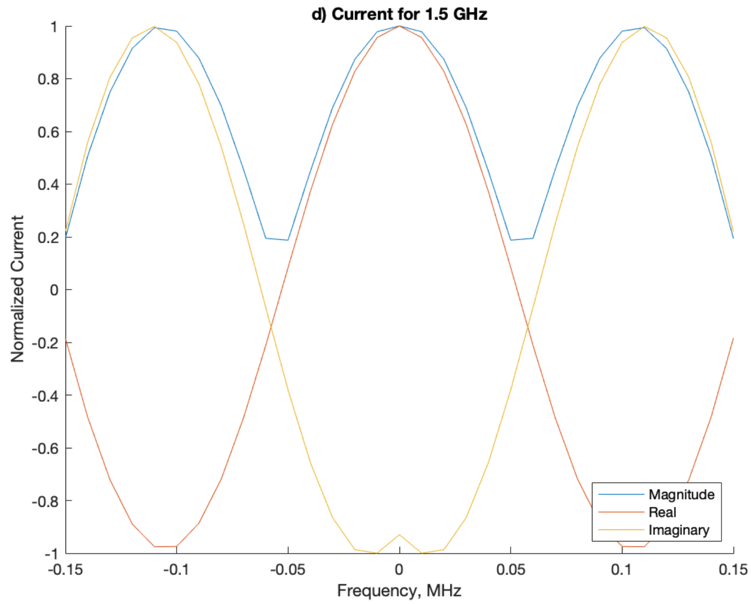


PART 1D

Same input files as used in part (c). Plots created by modifying provided Matlab plotting code.


d) Current for 0.5 GHz
Normalized Current
Frequency, MHz
Magnitude
Real
Imaginary
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
-0.15
-0.1
-0.05
0
0.05
0.1
0.15


d) Current for 1.0 GHz
Normalized Current
Frequency, MHz
Magnitude
Real
Imaginary
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
-0.15
-0.1
-0.05
0
0.05
0.1
0.15



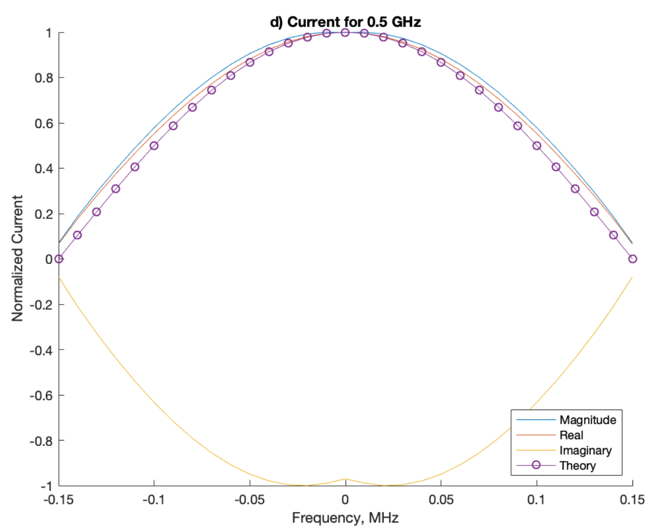
PART 1E

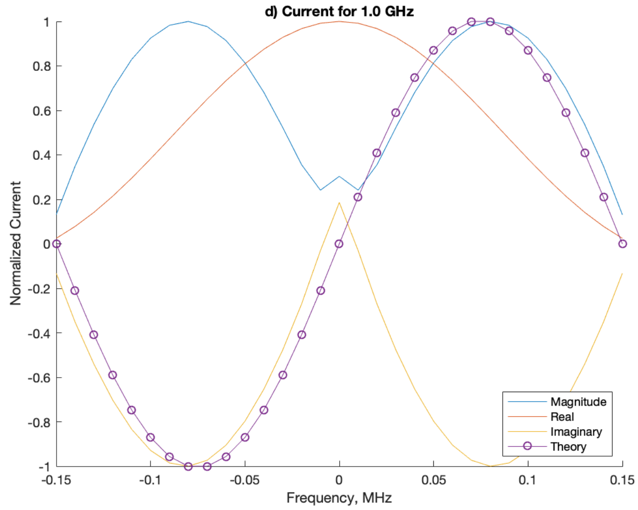
Sinusoidal theory for current:

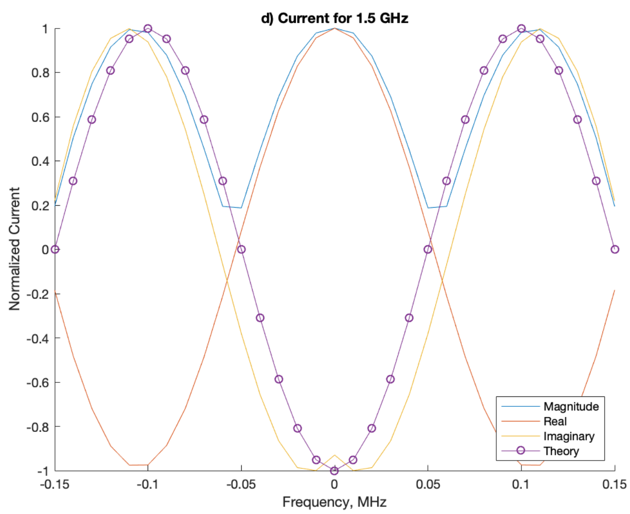
$$I(z) = \sin sin\left(\frac{2\pi f}{c}\left(\frac{L}{2} - |z|\right)\right)$$

Where f is frequency, c is the speed of light, L is the length of the antenna, and z is position.

Plots were created based on provided Matlab plotting code. The sinusoidal theory typically matches, but variation is greatest at the antenna's feed point.



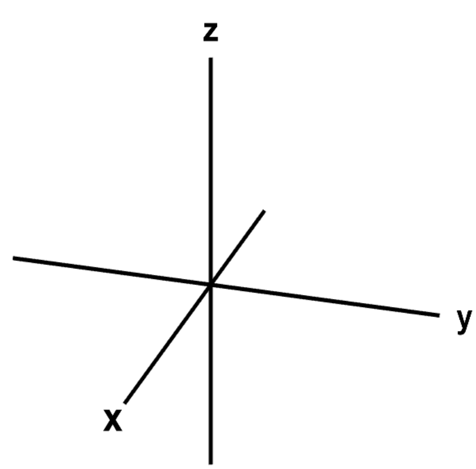




PART 1 SKETCH

The highest frequency used is 2GHz, so the smallest wavelength (λ) was 0.15m. Our wire segments must be less than 15 mm(λ/10), and our wire is 300 mm long.

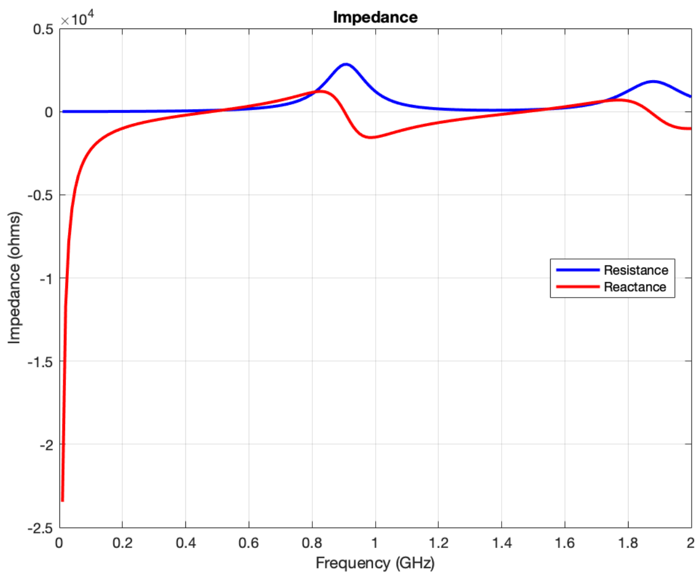
300mm/31 segments = 9.6 mm/segment
9.6 mm < 15 mm, so we will use 31 segments.



PROBLEM 2

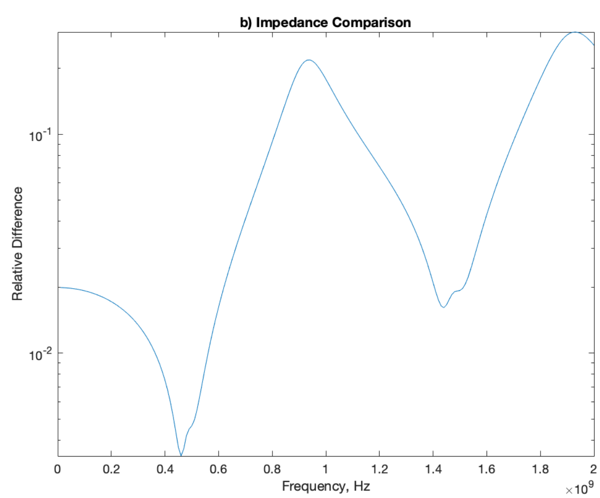
PART 2A

```
d = dipole('Length',30/100,'Width',2*0.2/1000);

% Part A: Impedance
freq = 10e6:10e6:2e9;

figure;
Zmat = impedance(d,freq);
```



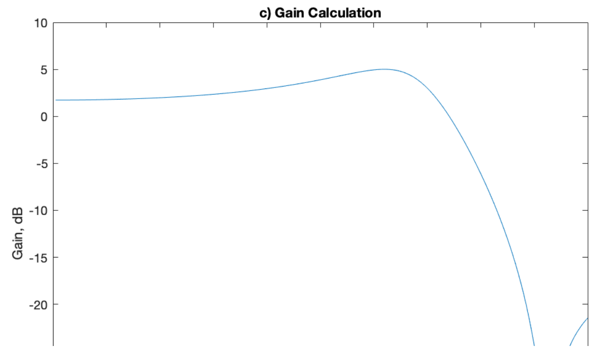
PART 2B

```
% Part B: Impedance Comparison
load NecValues.mat Z gain_t
R = abs((Z-Zmat) ./ (Z+Zmat));

figure;
semilogy(freq, R);
title('b) Impedance Comparison');
xlabel('Frequency, Hz');
ylabel('Relative Difference');
```



PART 2C

```
% Part C: Gain
Gmat = zeros(1,length(freq));
for i = 1:length(freq)
    [Gmat(i),~,~] = pattern(d,freq(i),0,0);
end

figure;
plot(freq,Gmat);
title('c) Gain Calculation');
xlabel('Frequency, Hz');
ylabel('Gain, dB');
```



PART 2D

```
% Part D: Gain Comparison
deltaG = gain_t - Gmat;

figure;
plot(freq,deltaG);
title('d) Gain Comparison');
xlabel('Frequency, Hz');
ylabel('Gain Difference, dB');
```