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EE 417 Lab 2

Introduction:

This week in lab, we revisited simulating antenna in CST Studio. Similar to Lab 0, we made a wire antenna project and followed different design and testing procedures. CST Studio is a powerful tool that can be used to monitor and simulate a variety of factors including E-field, H-field, Power flow and power loss.

Lab:

I started out by creating a wire antenna following the specifications in the lab manual. We were tasked with creating a half-wave dipole which saw us creating a cylindrical wire in CST, remove a small portion from the middle, and then simulate the E-filed, H-field, and S11. We first tested the antenna using the Integral Equation Solver. We found S11, shown in Figure 1, and observed the results of the E and H field in Figures 2 – 4 below at 0.8, 1, and 1.2 GHz respectively.
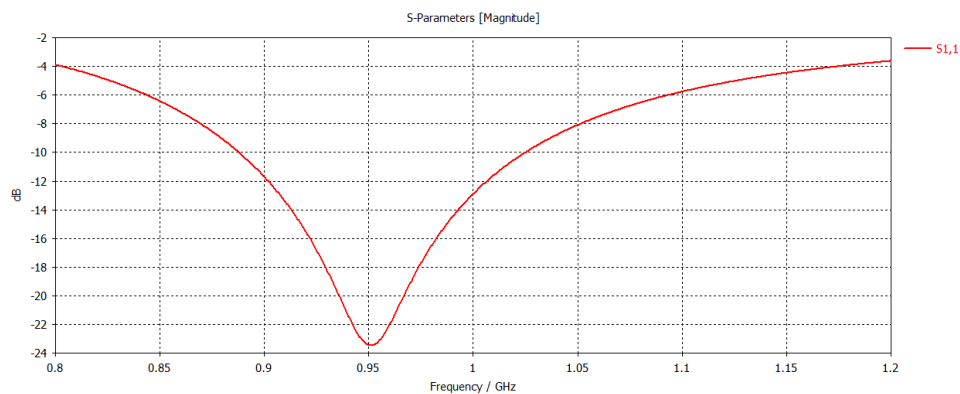

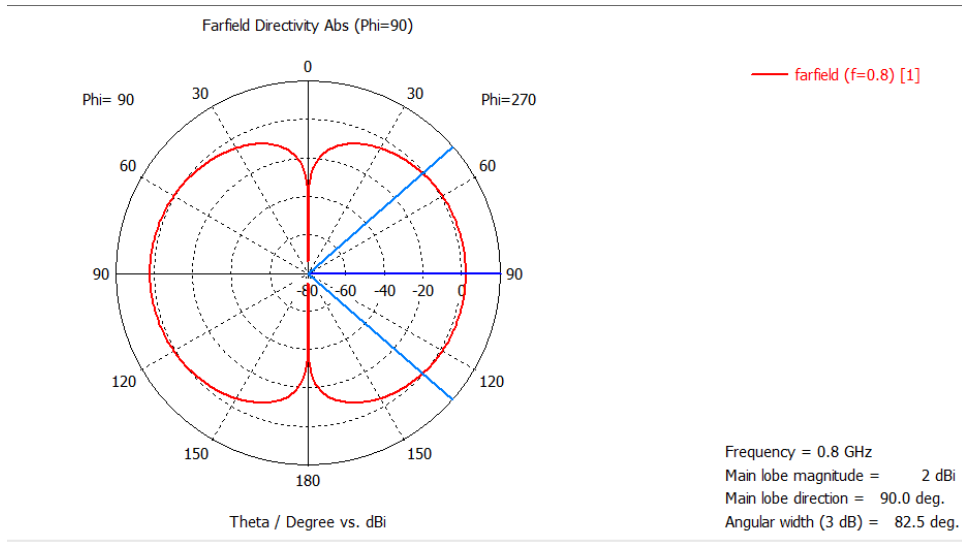*Figure 1 - S11 in dB for Integral Solver*

Farfield Directivity Abs (Phi=90)

Frequency = 0.8 GHz
Main lobe magnitude =   2 dBi
Main lobe direction =   90.0 deg.
Angular width (3 dB) =   82.5 deg.

Figure 2 - 0.8 GHz Integral Solver

Farfield Directivity Abs (Phi=90)

Frequency = 1 GHz
Main lobe magnitude =   2.14 dBi
Main lobe direction =   90.0 deg.
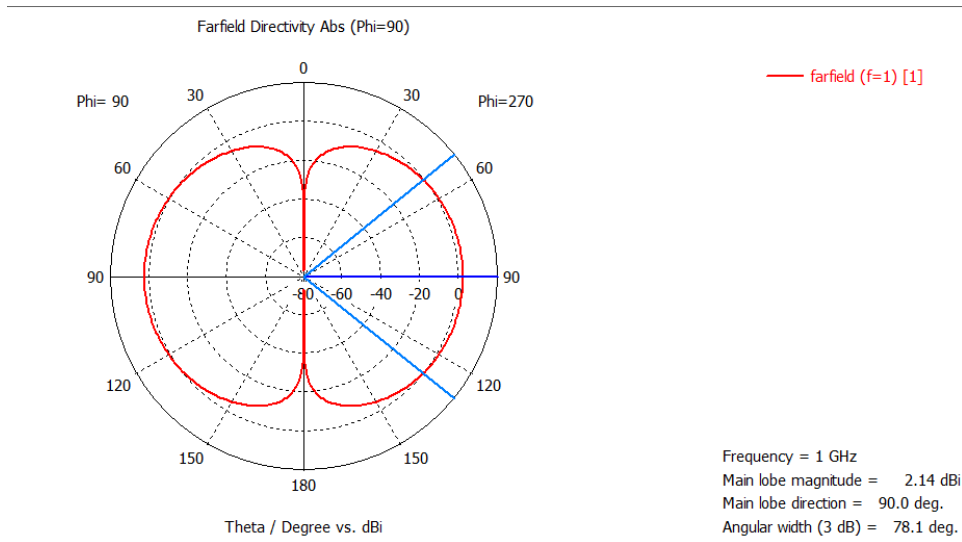Angular width (3 dB) =   78.1 deg.
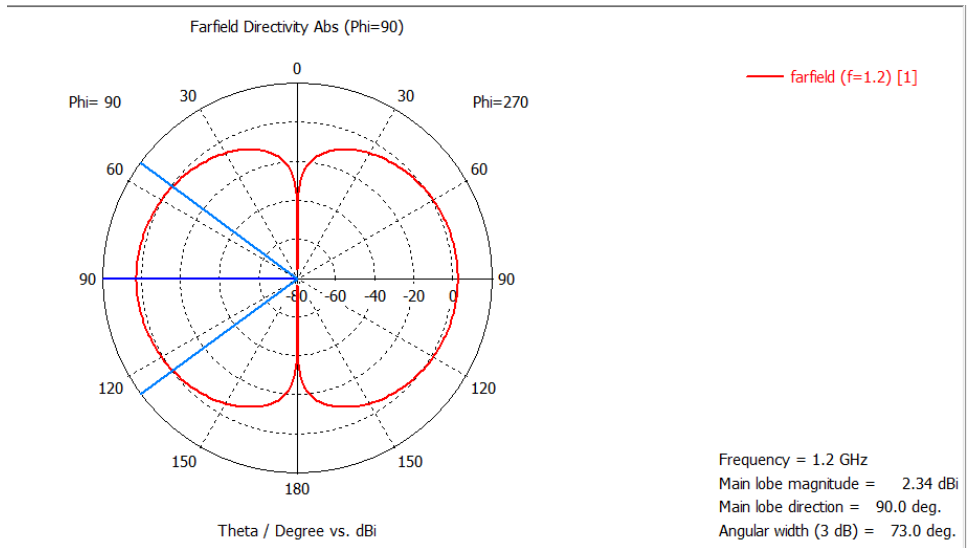
Figure 3 - 1 GHz Integral Solver

Figure 4 - 1.2 GHz Integral Solver

We then were asked to repeat the process and record the same data in the Frequency Domain Solver, which can be seen below in Figures 5 – 8.
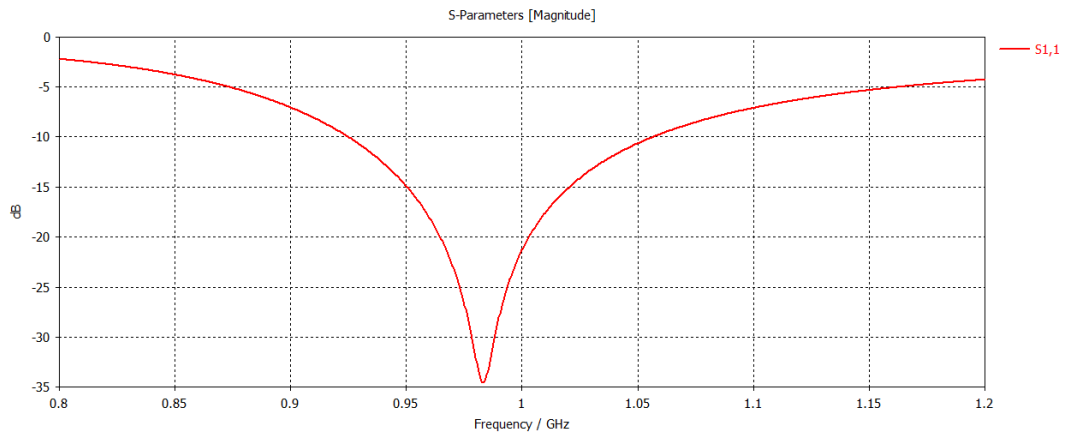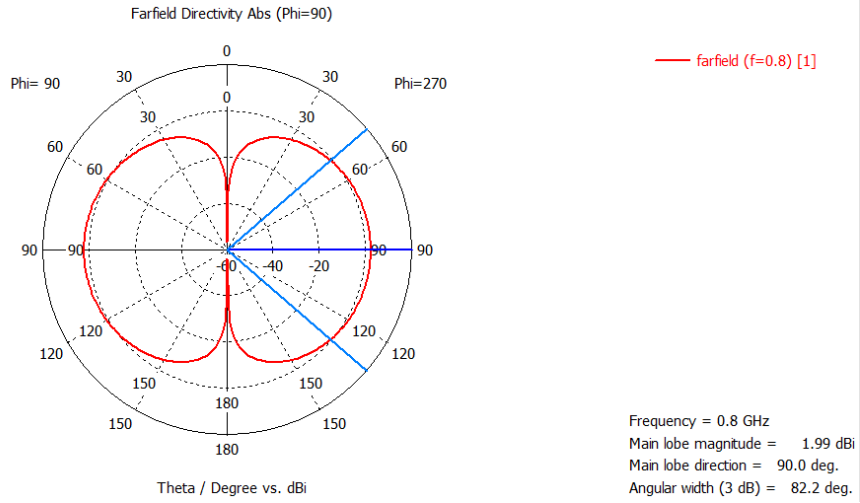

Figure 5 - S11 in dB Frequency Solver

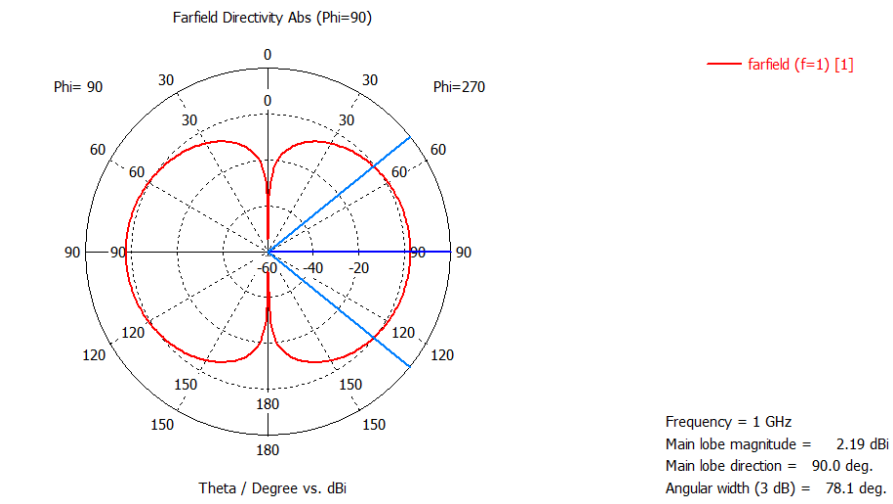*Figure 6 - 0.8 GHz Frequency Solver*

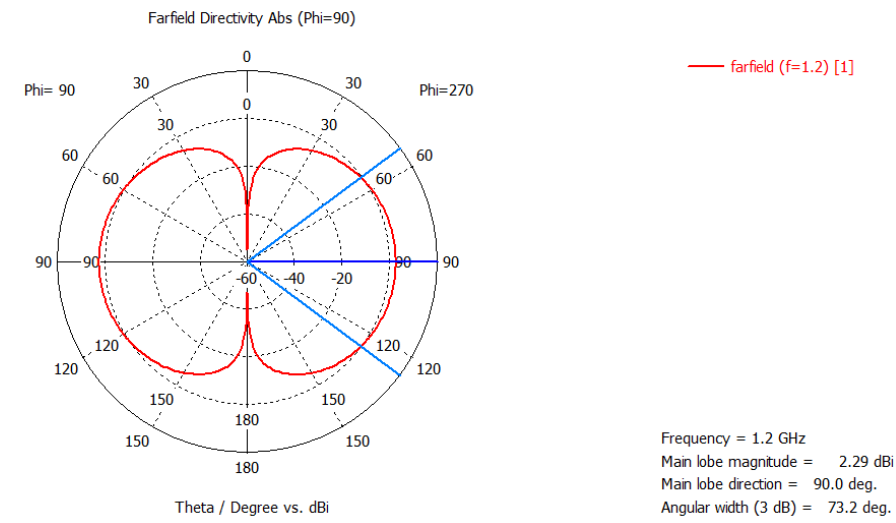*Figure 7 - 1 GHz Frequency Solver*

Figure 8 - 1.2 GHz Frequency Solver

Lastly, we were asked to repeat the process and record the same data in the Time Domain Solver, which can be seen below in Figures 9 – 12.
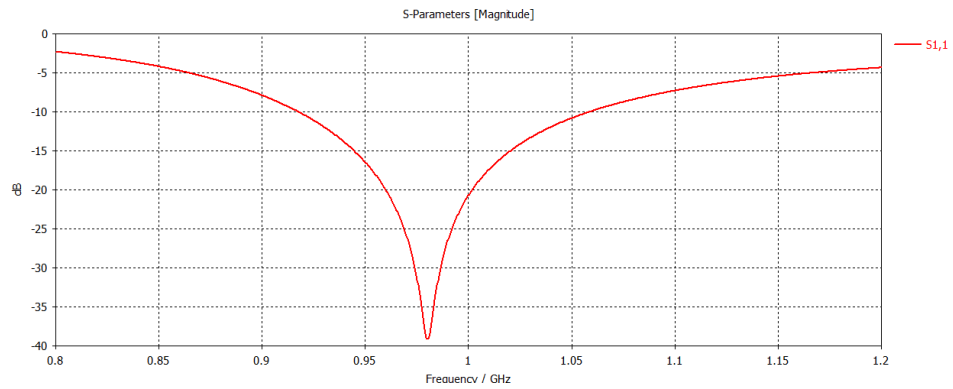
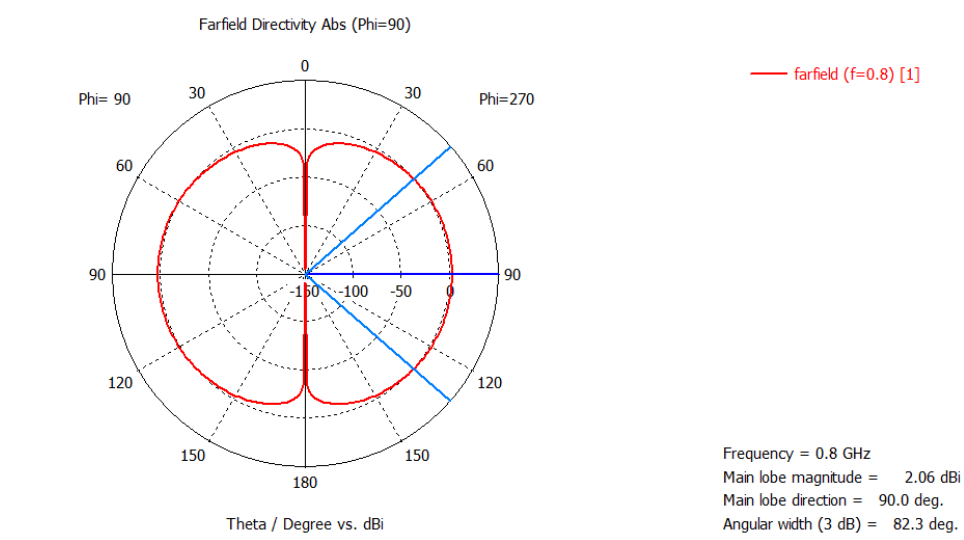

Figure 9 - S11 in dB Time Domain

Farfield Directivity Abs (Phi=90)

Phi= 90   Phi=270

Theta / Degree vs. dBi

farfield (f=0.8) [1]

Frequency = 0.8 GHz
Main lobe magnitude =   2.06 dBi
Main lobe direction =   90.0 deg.
Angular width (3 dB) =   82.3 deg.

Figure 10 - 0.8 GHz Time Solver

Farfield Directivity Abs (Phi=90)

Phi= 90   Phi=270

Theta / Degree vs. dBi

farfield (f=1) [1]

Frequency = 1 GHz
Main lobe magnitude =   2.19 dBi
Main lobe direction =   90.0 deg.
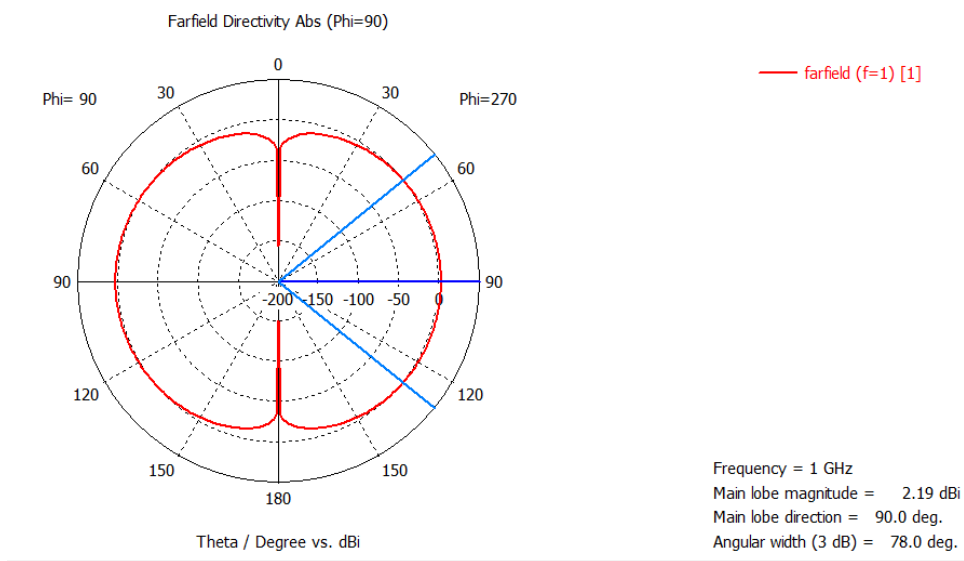Angular width (3 dB) =   78.0 deg.
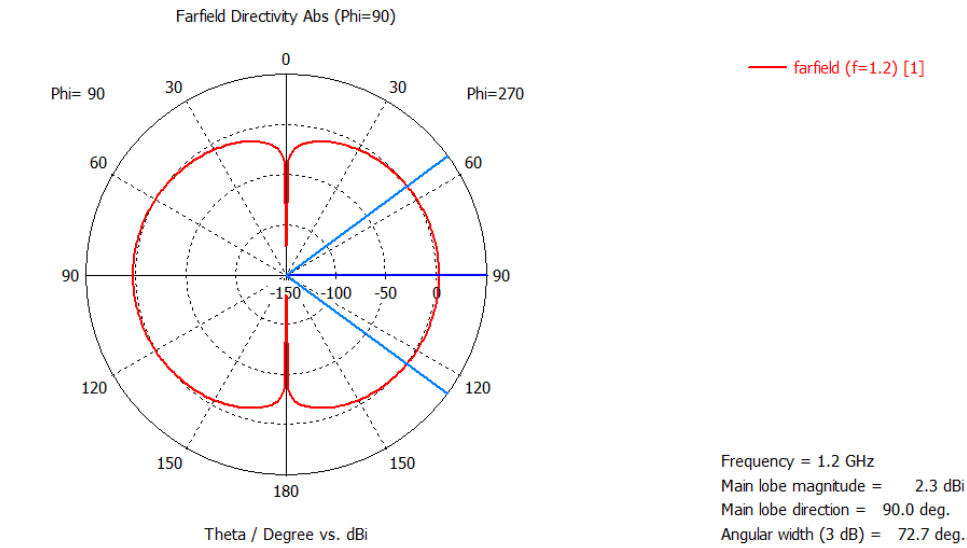
Figure 11 - 1 GHz Time Solver

Figure 12 - 1.2 GHz Time Solver

Analysis:

1) In your opinion, what are some advantages of performing simulations?
   a. Simulations save money and time on materials, testing, and general human power or capabilities. They allow for experimentation and room for mistakes without costing tons of money.

2) In your opinion, what are some disadvantages/pitfalls to using simulators like CST?
   a. The real world has a thousand interferences, materials can behave sporadically, and there are limitations to what programs like CST can do.

3) For each plot of S_{11} determine the frequency at which the antenna is best matched to the feed port.
   a. Integral - 0.95 GHz
   b. Frequency – 0.98 GHz
   c. Time – 0.97 GHz

4) What is the maximum theoretical directivity for a half -wave dipole given in dBi? Based on your simulations, which result agrees best with theory? Why do you think this might be?
   a. The directivity of half wave dipole is 2.15dBi. Based on my simulations, the Frequency Domain Solver has the best fit.

Conclusion:

This week's lab was another introductory dive into CST Studio and the importance of simulation in a field like electromagnetics. It allowed us to see how an electric and magnetic field reacts around a half-wave dipole and provided generally useful insights.