Patch Antenna Simulations

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Patch Antenna

- Description: small patch, feed, and ground plane
- Very popular, widely used, cheap, and easy to make
- Simple geometry
- Multiple applications
Background

- Transverse ElectroMagnetic (TEM) Waves
- Transmission Line Theory
  - Coaxial Wires
  - Parallel Plates
  - Other configurations Etc.
- Circuit Analysis

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Project Motivation

- Various types of patch antennas used in modern day
- Variation in measured and simulation data
  - Feed measurements and dimensions
  - Accurate simulation
  - Materials
  - Modifications
  - Other factors
- Calculate reflection coefficient ($S_{11}$) and impedance at load (antenna)
Project Overview

- Measure antenna’s frequency
- Measured antenna’s dimensions
- Modify/Create antenna on HFSS
- Run Simulation
- Collect Data/Plot Graphs
- Consider future work if necessary
HFSS

- Use HFSS to conduct simulations
- High level matrix mathematics
- Ease of use
- Design electronics with radiation patterns
- Useful as a future tool

3D Electric field pattern on left

Picture taken from: http://www.ansoft.com/images/hfssv11e.gif
Data

Measured and Simulations

Frequency (GHz)

dB

MEASURED
MODEL 1
ACTUAL DIMENSIONS 1
ACTUAL DIMENSIONS 2
MODEL 2
MODEL 3

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Conclusion

- What I learned:
  - Impedances
  - Transmission line
  - More experience with Network Analyzers
    - Smith Chart
  - HFSS
    - Plotting and analyzing data
    - Really useful tool
- Like to thank Jake and PURE
- Questions???