Midterm Presentation

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Folded Dipole with Corner Reflector

Requirements:

- 433 MHz transmitting antenna
- Transmitter impedance matching with antenna impedance

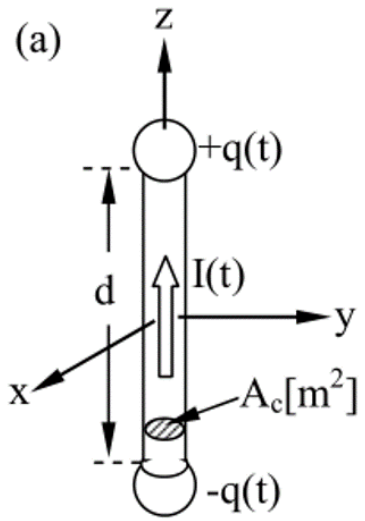
Objectives:

- High gain
- Design an antenna that works and can be understood

[1]

Hertzian Dipole

- Simplest infinitesimal radiating element
- Basis for further analysis of more complex antenna
- Two equal and opposite charge reservoirs separated by a distance d
- Far field:



[2]

$$B_\phi = -\frac{I\,\delta l}{4\pi j}\left(\frac{e^{-jkr_2}}{r_2}\right) k\sin(\theta)$$

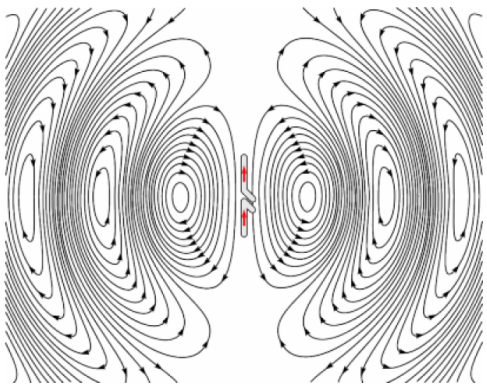
$$E_\theta = -\frac{I\,\delta l}{4\pi j}\left(\frac{e^{-jkr_2}}{r_2}\right)\sqrt{\frac{\mu_0}{\epsilon_0}}\, k\sin(\theta)$$

Folded Dipole

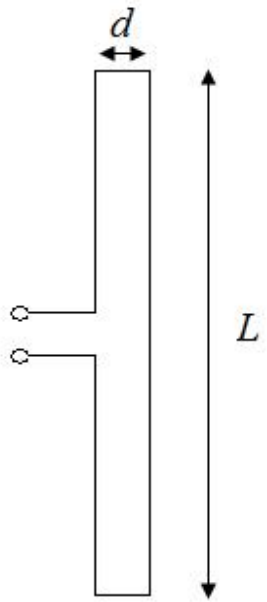
Folded Dipole

A basic dipole with the two ends folded to make a complete loop

- Length of rod are a half wavelength
- Direction propagating waves



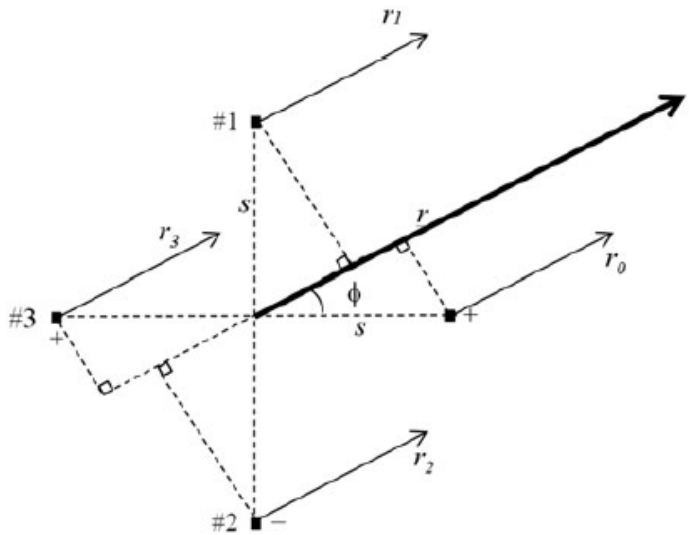
[3]



[4]

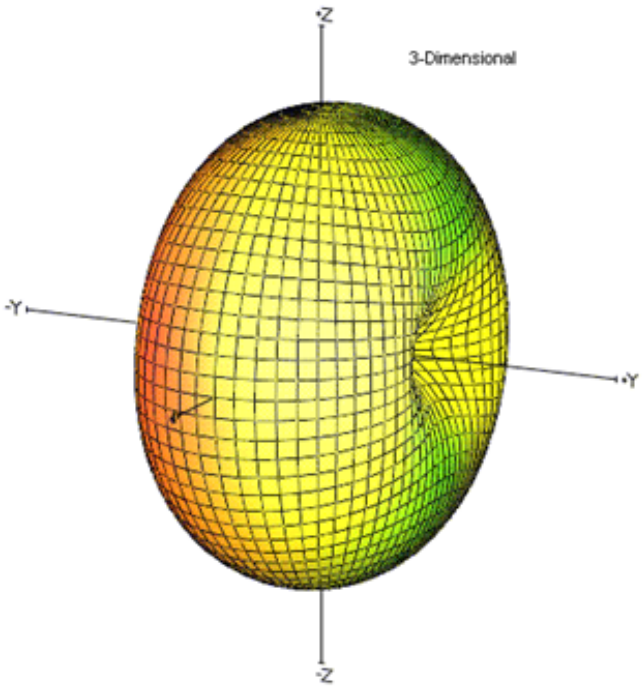
Corner Reflector

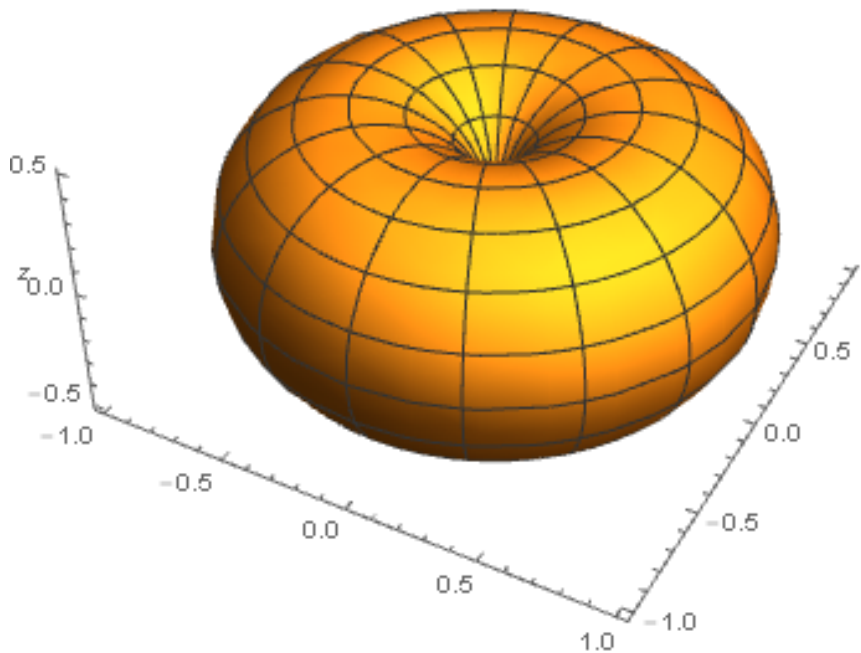
- Increases gain and directivity
- Assuming perfectly conducting intersecting planes
- Mirrors the dipole, 3 times the signal



[5]

Simulations vs Calculations





Issues to Tackle...

In theory everything works, but in practice...

Challenges:

- Phase
- Impedance Matching
- Building

Phase

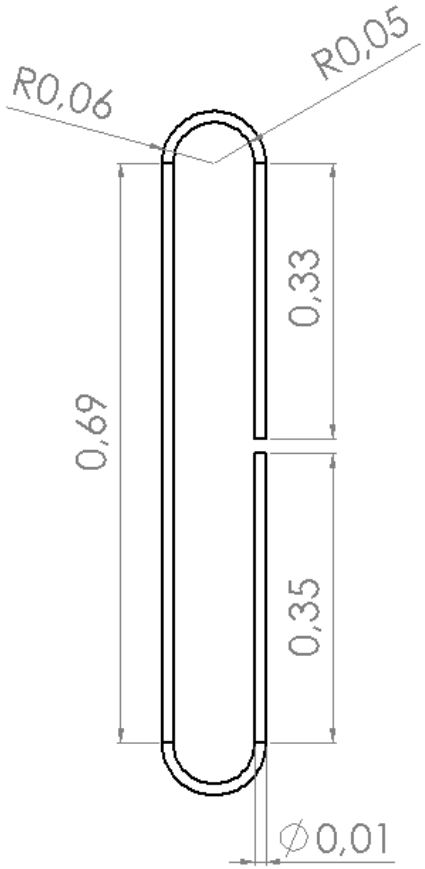
- Desired phase difference of π
- We may consider the full-wavelength antenna as composed of two half-wavelength antennas having identical radiating properties, one excited positively and the other negatively, or π out of phase.
- Phase difference can be regulated by shifting the gap in the dipole

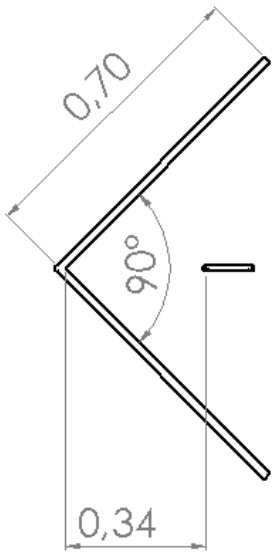
Impedance Matching

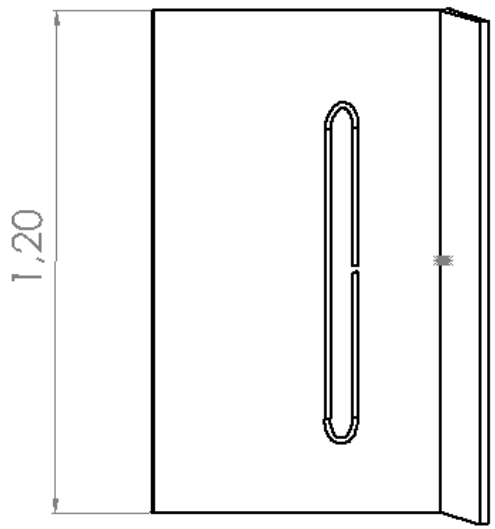
- Aim: $Z_{in} = Z_{out}$
- Minimize the transfer coefficient Γ
- ensures that the signal is not reflected back into the transmission line [6]
- Maximize the power delivered to the antenna

- Dependent on the separation between the two dipoles.
- Optimum separation smaller than 3 cm.

Technical Representation







Dimensions in meters

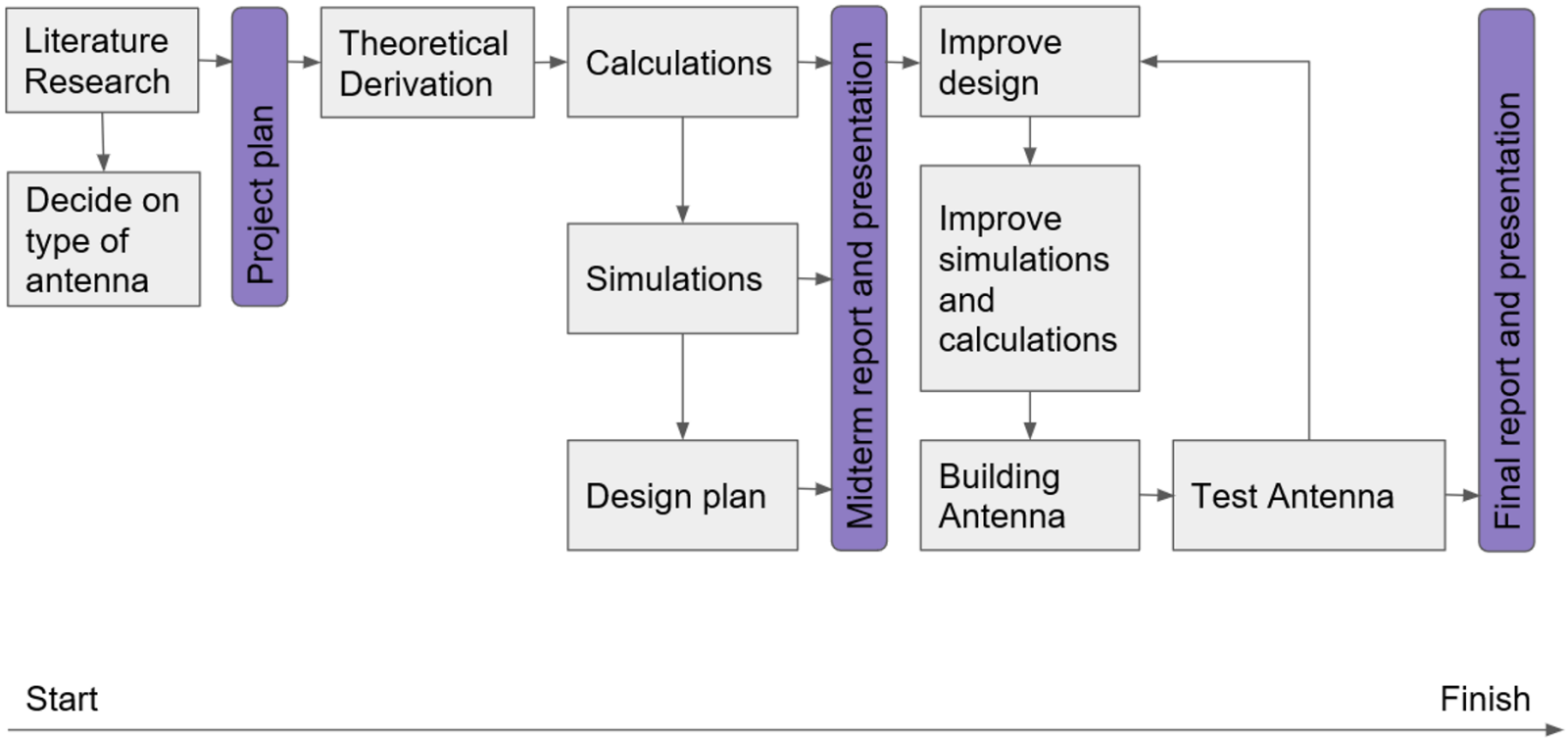
Construction

- Building Steps
  - Bending a hollow metal pipe to the folded dipole dimensions
  - Constructing the corner reflector out of wire mesh
  - Attaching the wires & balun to the folded dipole
- Materials
  - Copper
  - Wire mesh
  - Coax cable
  - Balun
- Budget - 25 euro

Conclusion

- Final calculations
- Minor adjustments to size of dipole
- Use simulations to verify theory
- Take into account that theory is not reality

Next Steps


Literature Research
Decide on type of antenna
Project plan
Theoretical Derivation
Calculations
Simulations
Design plan
Midterm report and presentation
Improve design
Improve simulations and calculations
Building Antenna
Test Antenna
Final report and presentation
Start
Finish

References I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