ANTENNA THEORY AND SIMULATION (YAGI)

SSP MINI PROJECT

BY-VINEET GALA

(COMM SUBSYSTEM)

Aim Of The Project

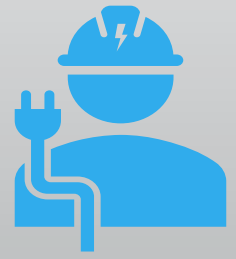
To simulate the Yagi antenna (ground station) for 145 Hz frequency and analyze results.

Study factors which antenna parameters depend on.

Approach

- Read about antenna parameters and theory associated.
- Referred a couple of tutorials on HFSS.
- Got used to HFSS by making simple antenna models and proceed step by step.
- Structured and planned simulations for different configurations of antenna.

About Antennas



How antennas work?

Antenna parameters-

Gain

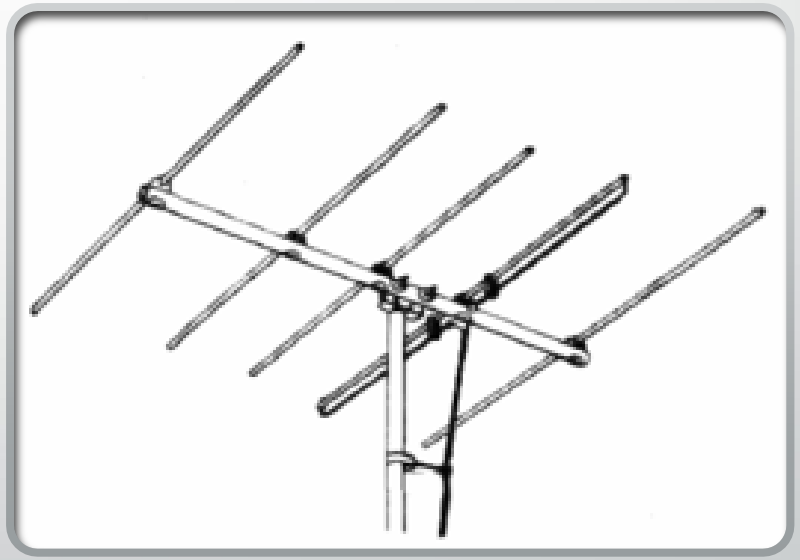
Radiation Pattern

Directivity

S11

More About Antennas

- Dipole antenna
- Yagi antenna
- Why use a Yagi antenna?



Achieving The First Milestone

By the end of week 1, I made a simple dipole antenna powered by source via a coaxial cable.

I learnt how to simulate and how to view and analyse results of the simulation such as S11 for different antenna lengths (optimetrics), gain etc.

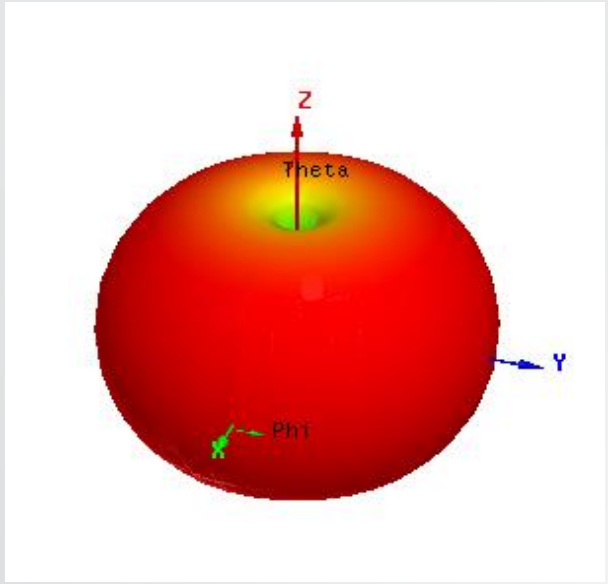
Achieving The Second Milestone

By the end of second week, I made a simple Yagi antenna model and started simulations

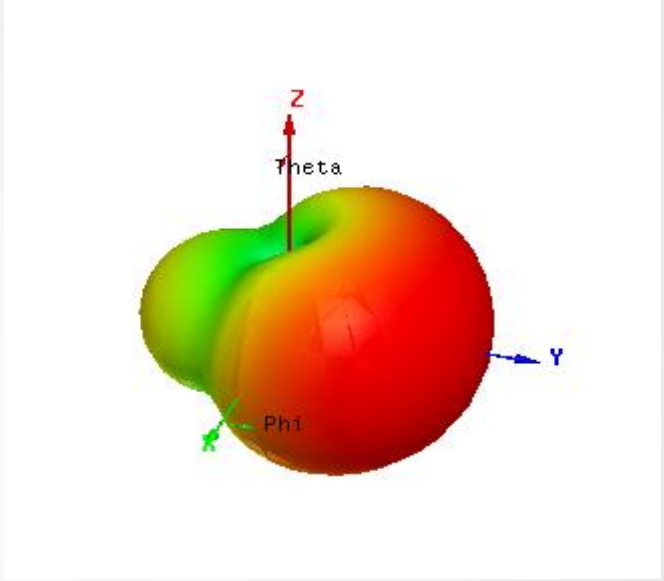
What difference does a reflector and 1, 2, 3 directors make?

Antenna	Maximum Gain (dB)
Dipole	2.3805
Yagi (1 reflector, 1 director)	7.1425
Yagi (1 reflector, 2 directors)	7.6902
Yagi (1 reflector, 3 directors)	8.0146

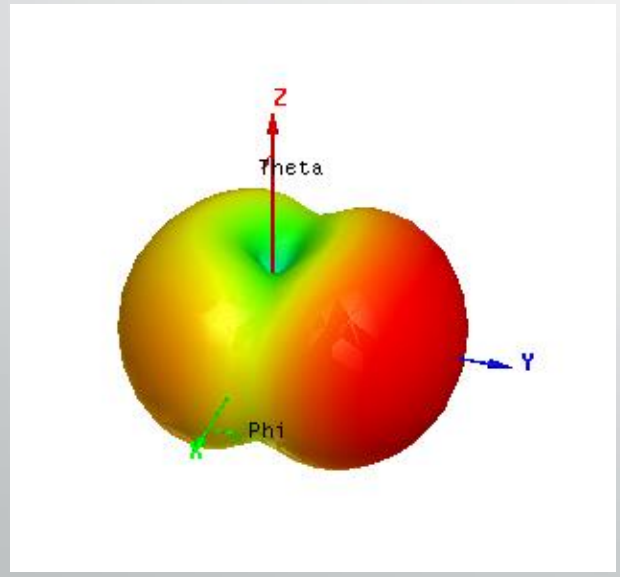
Radiation Patterns



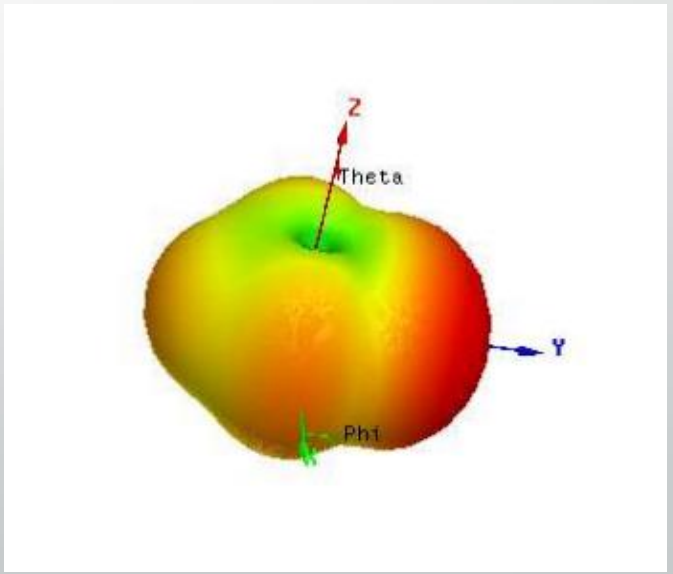
Dipole



Yagi – 1 ref, 1 dir

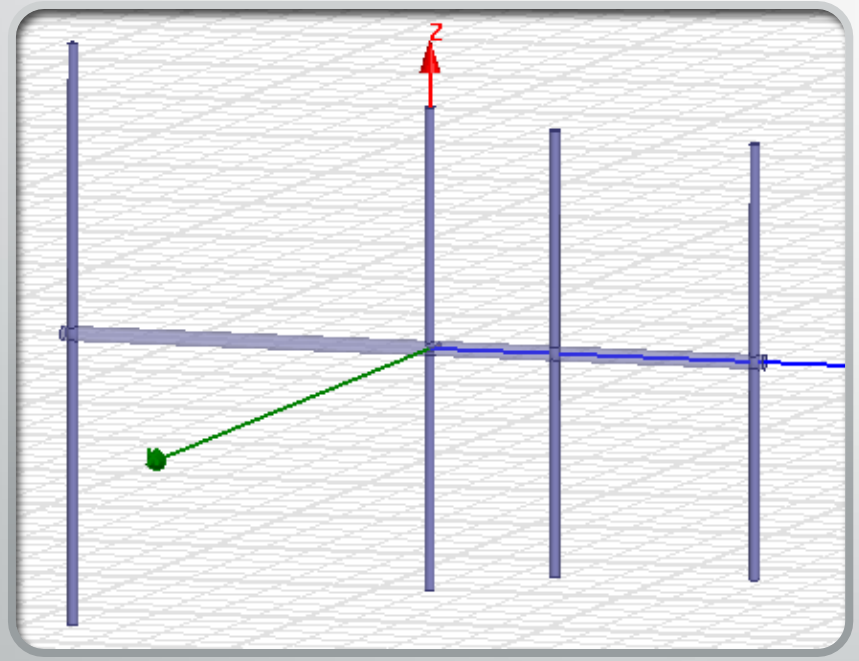


Yagi – 1 ref, 2 dir



Yagi – 1 ref, 3 dir

Achieving The Final Milestone



Added the boom to the setup but faced problems (for later).

Simulated the antenna for different distances of reflector, directors from feed pole.

Analysis

Reflector Distance (mm)	Maximum Gain (dB)
735	7.6799
740	7.6902
745	7.6485
750	7.6324

Dir 1 Distance (mm)	Dir 2 Distance (mm)	Maximum Gain (dB)
270	680	7.6687
250	680	7.6794
270	660	7.5824
250	660	7.5997
258.75	672.75	7.6120

Problems

- Unavailability of HFSS license initially.
- Unable to simulate the Aluminium Boom.
- Long time taken for simulating models with optimetrics – which failed because I could not see the results for the concerned variable.
- Garbage reports popping up due to some small mistakes.

Takeaway Lessons

Most of what I know about wireless communication.

Tracked satellites and received information.

Other subsystems' work.

Managing time, sleep and academics.

Working in a team and being answerable for my work – being consistent.

Feedback

The Mini Project and Recruitment Process:

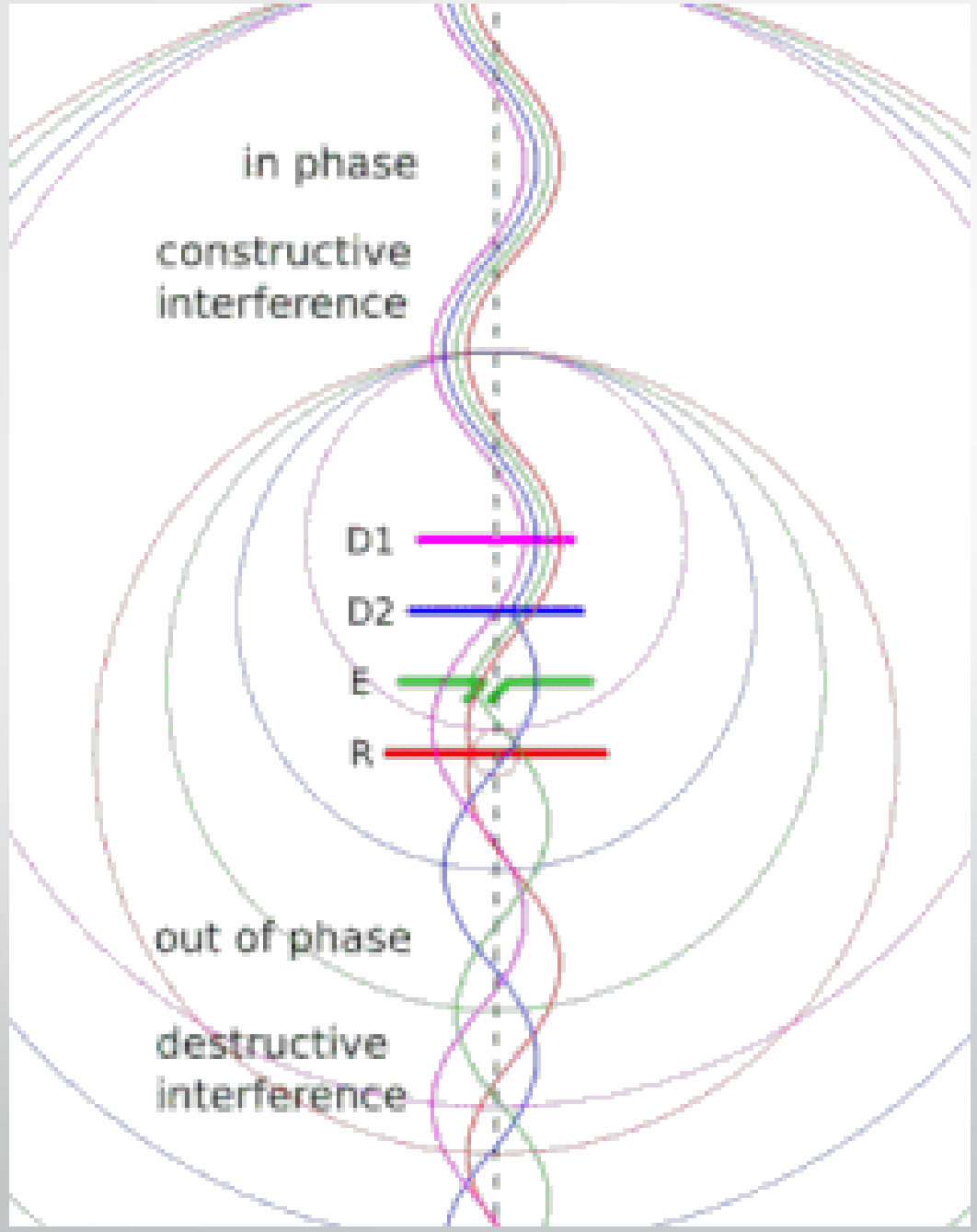
- Busiest and most productive 3 weeks so far.
- A very good idea to introduce a newcomer to the ways of the team.

Mentor: Atharv Savarkar

- Go-to Person for any problems related to my Mini Project at anytime.
- Understanding and helpful.

THANK YOU!

APPENDIX


in phase
constructive
interference
D1
D2
E
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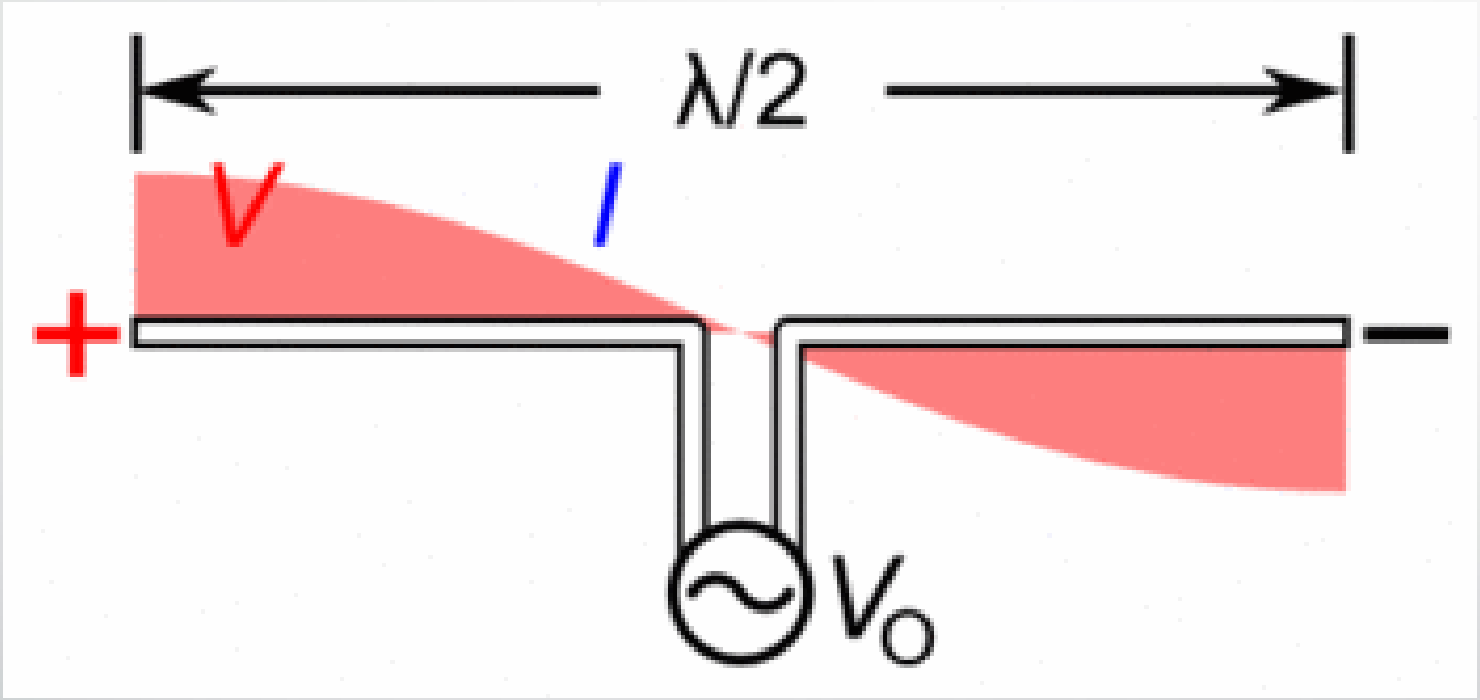
out of phase
destructive
interference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https://github.com/vineetgala/SSP_Mini_Project