Elen4001 High Frequency Techniques Home Page

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SuperNEC Study Guide

Now that the SuperNEC Study Guide is out-of-print, (I prefer the term "Sold-Out" :-), Poynting Antennas has kindly allowed its dissemination in the interests of the "Public Good".

In the interests of forests, please do not print it, but use your favorite pdf reader. SuperNEC Study Guide, version 1. Watch this space for updates.

Errors in the SuperNEC Study Guide may be mailed to `AlanRobertClark@gmail.com`; please put SuperNEC Study Guide in the Subject line.

The additional "m-files" required by the Study Guide are obtainable here.

SuperNEC itself is obtainable from www.SuperNEC.com. Follow the intructions for a license. Naturally SuperNEC is installed in the D-Lab.

Additional Material

There are quite a few papers dealing with RF stuff at `http://www.plextek.com/technicalpapers.htm` that describe the basics of Oscillator design, Mixer design, Synthesiser design, more on Synthesisers, Digital Modulation Schemes, the use of PCB materials at RF, RF Basics (Link Budget, Gain cascade, compression points, filtering etc), and the design of a Gilbert Cell mixer at mm wave frequencies.

An example of a mixer lab from University of California, Santa Barbara and an intro to a PLL (Phase Locked Loop, an introdultion to receiver design, a synthesiser design using a PLL from the same University.

A paper on antenna factor varying as a function of height.

A simple receiver design.

Noise is always one of those "Dark Forces" that kill the unsuspecting designer: it is often ***Hopelessly Misunderstood***™. Two excellent lectures on Noise from Stanford ee252 and Toronto ece422 Local copies are Stanford and Toronto (Sadly, not LaTeX 2_ε: Mathus Horribilus). Naturally we have the Nyquist paper that started it all!.

Professor Google

Some cute antennas/antenna arrays can be seen via maps.google.com (different zoom levels (19z) is closest :-):

Our own Catherine Paverd, when in third year(2013), assisted in the installation of the digital radar for the SuperDARN HF Radar array(15z), at SANAE IV, the South African Antarctic base (Long dark thin thing at left :-).

World War 2 aircraft detection radar array, replicated elsewhere after the War, an example is the Wullenwever Array at Gander, Newfoundland, Canada(17z). Note the $\lambda/4$ circular "curtain" vertical "ground", as well as the $\lambda/4$ horizontal ground in front of the curtain.

The beginnings of the Square Kilometre Array can be seen at the site of KAT-7(18z), the Karoo Array Telescope, which has been built. Soon to come, just up the drag, is MeerKAT(16z).

Both together.(15z)

Our local Radio Astronomical Observatory is at Hartebeeshoek, hence known as HartRAO(19z). It is a 26m dish, constructed by NASA for the Apollo missions to the moon, recently re-clad for even higher frequency Radio Astronomy work, the subject of a certain M.Sc.

South Africa's Shortwave broadcasting arrays are to be found at Meyerton, south of Boksburg-by-the-Lake(16z)

The Antenna Farm at O.R.Tambo International Airport, on the R24 just before Simba Chips here(17z) Street View very useful.

Arecibo, a stationary 305m Dish (1000 feet!) is in Puerto Rico(17z) Sadly, the 900 ton Instrument platform plummeted into the Dish on 1 December 2020, destroying the Telescope. As of 1 April 2021, Google still shows what it was like before the crash.... As always, Scott Manley has the analysis.

The Very Large Array is on tracks to optimise the baseline for the viewing conditions required, yes, it *IS* called VLA(15z) in New Mexico, USA.

Then there's the Atacama Large Millimeter Array ALMA(16z) for short. Its in the Atacama desert, Chile, altitude 5 058m (Oxygen optional :-).

Yes, I KNOW its optical, but it's still ours :-) The South African Large Telescope, SALT(17z), for short. Astronomers are highly lexically challenged. . . . . .

Canberra, Australia Deep Space Network station with a 70m antenna, a 34m and the rest are "merely" 26m. Visible here(16z)

Very interesting page at Deep Space Network, live tracking... Click on the antenna, then "more detail" to see transmit power, received dBm and bits per second in real time.

A current "Hot Topic" is the "Internet of Things", or IoT, which utilises RF for Machine-to-Machine (M2M) communication: Smart Grid, Automatic Metering (AMI). The two MAJOR implementations as of February 2017 are SigFox and LoRa. We will wait-and-see who wins, similar to the BetaMax vs VHS War. An interesting overview is found here. It is from `https://www.link-labs.com/blog/what-is-lora`. A more detailed look at the protocols is found in LPWAN Technology Explained.

Don't Do this at home. . . . . .

How a Microwave, well, ummmm

eTexts

A very recent publication (1873) is A Treatise on Electricity and Magnetism by James Clerk Maxwell. (Why can't these blokes spell Clark correctly, anyhow?).

2021 Covidly-appropriate first modules :-)

Since we could not "Automate" access to the full 4thyr class before Elective Choices were finalised, here then the first few topics :-) Introduction, Chapter 1, Topic 1: The Electromagnetic Spectrum

Presentation Chapter 1, Topic 1: The Electromagnetic Spectrum Video

Tuts, project example feedback

Tut1, tut2, tut3, and tut4.

Example exam paper.

Wireless Technology Overview The first chapter is the modulation stuff I did at the beginning. (Note that this is copyrighted, please do not dissemminate.)