Antenna Theory (EE-729) Projects

Project #1- Linear Antenna

Use MATLAB or C to calculate and plot the polar radiation pattern vs. theta for a thin linear dipole antenna of total length given by the following.
(a) $0.25 \lambda$   (b) $0.5 \lambda$   (c) $0.75 \lambda$   (d) $1.0 \lambda$   (e) $1.25 \lambda$   (f) $2 \lambda$

Project #2 – Uniform Array

Write a computer program to calculate the radiation pattern of an N-element Uniform Linear Array. Include the capability of plotting 2-d rectangular and polar patterns.

Using this program, perform the following calculations and plot patterns in, both, rectangular and polar forms.
a. Plot the radiation pattern for N=10 elements, spaced $d = \lambda/4$ apart, for three different values of phase difference: $\beta = 0$, $\beta = -\pi/4$, $\beta = -\pi/2$ and $\beta = \pi/2$. Comment on the result.
b. With $\beta$ corresponding to the Hansen-Woodyard condition, calculate the radiation pattern and compare with the ordinary endfire array. Use the same array as in part #a.
c. Investigate the 3-d characteristics of the array by placing it on each of the three axes, namely the x-, y-, and z-axes. Plot the pattern in each case and discuss.
d. Investigate the occurrence of grating lobes as spacing varies and hence establish the condition to avoid these. Perform this analysis for each type of array, namely the broadside, the endfire and the phased array.

Project –3 student presentations

1. Search the literature / web and select an interesting practical antenna.
2. Submit title and reference by 10/2/07
3. Develop a 5-minute presentation in power point to illustrate the following
   • description of antenna and its application
   • design and construction
   • radiation pattern, and directivity
   • input characteristics, frequency range, impedance matching scheme
**Project #4 – Antenna Synthesis**

(a) Write a computer programs for Antenna Synthesis by the following methods. Verify that your program is working by using the corresponding examples in the text. Using your program obtain results for the problems indicated for each.

1. Schelkunoff’s Polynomial Method – Example 7.1 and Problem 7.2 *(Both Ed)*
2. Fourier Transform
   - Line Source – Example 7.2 and Problem 7.12 *(7.6, 2nd Ed)*
   - Linear Array – Example 7.3 and Problem 7.14 *(7.7, 2nd Ed)*
3. Woodward Lawson Method
   - Line Source – Example 7.4 and Problem 7.21 *(7.12, 2nd Ed)*
   - Linear Array – Example 7.5 and Problem 7.22 *(7.13, 2nd Ed)*

(b) In the case of point source linear arrays, investigate the effect of spacing, \(d\), and the phase difference, \(\beta\), on the antenna pattern.

**Project #5 Microstrip Antenna Design using Designer**

a. Using Ensemble, design a rectangular microstrip patch antenna to have an input impedance of 100 \(\Omega\) and a resonant frequency of 10 GHz.

b. Using the antenna in part #a, design an 8-element linear array with a microstrip transmission line feed system from a 50 \(\Omega\) source. Calculate and plot the radiation pattern and gain.