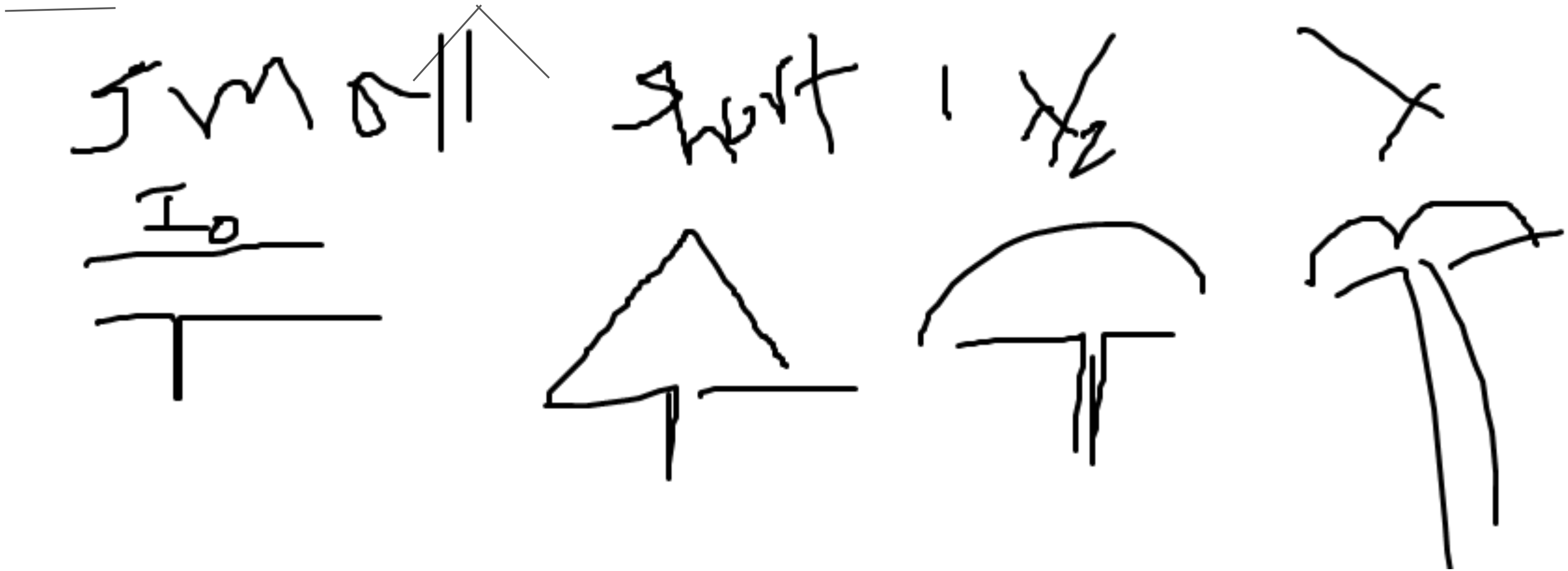
Question 1 Part A

Short | Small | Half | Whole



Question 1 Part B/C

READ the plot

(i believe in u)

Directivity And Radiation/Input Resistance

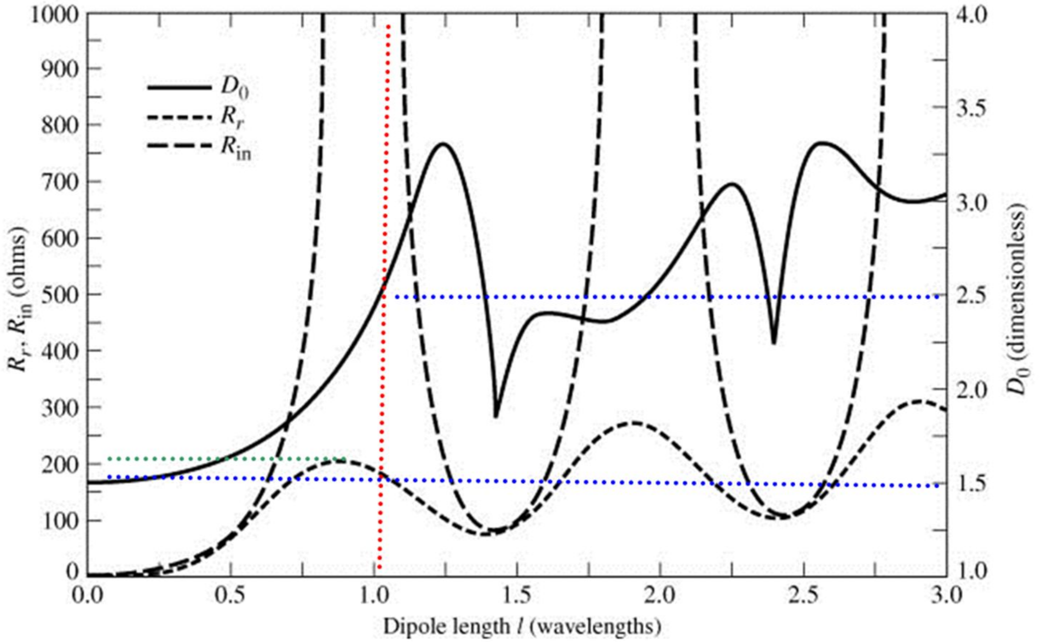


Fig. 4.9(a)

Chapter 4
Linear Wire Antennas

Question 1 Part D

Small BW

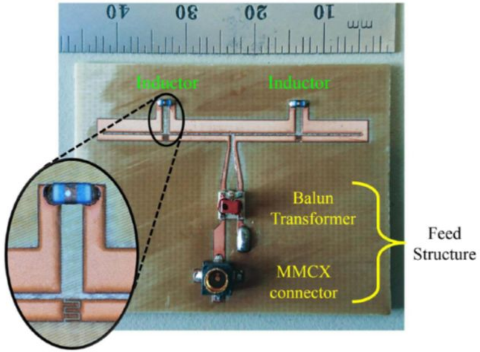


Fig. 10. Fabricated prototype of the loaded miniaturized FD antenna.

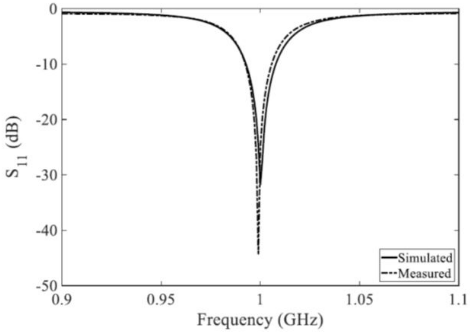


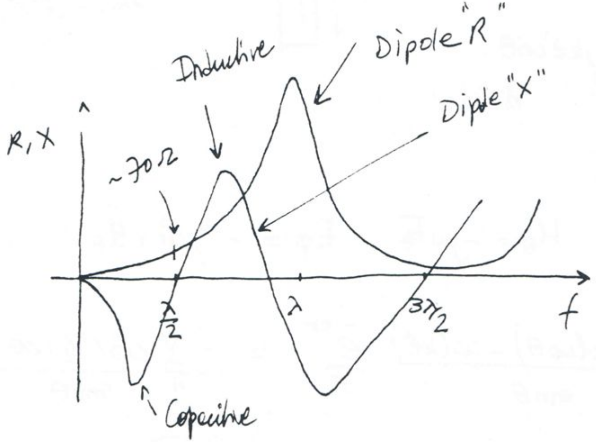
Fig. 11. Simulated versus measured S_{11}.

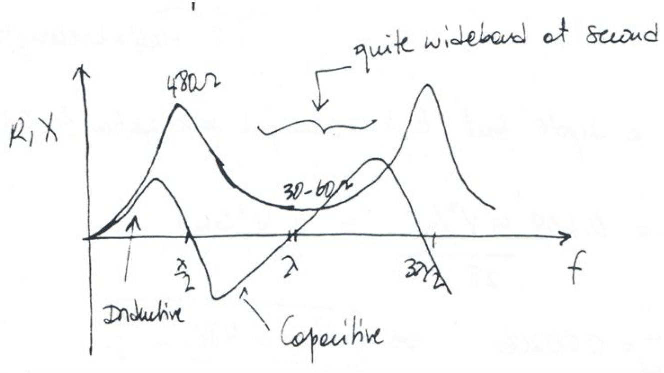
Question 2 Part A

We don't use the slot antenna because of the high input impedance at the first resonance which is around half lambda. We know that a dipole has resonance and about 10% BW at first resonance, however, due to the duality of the slot and bocker's relationship we can see that the bandwidth is much narrower and Rin is higher. Also at second resonance the BW is much greater than first.

(Left is dipole

Right is slot)



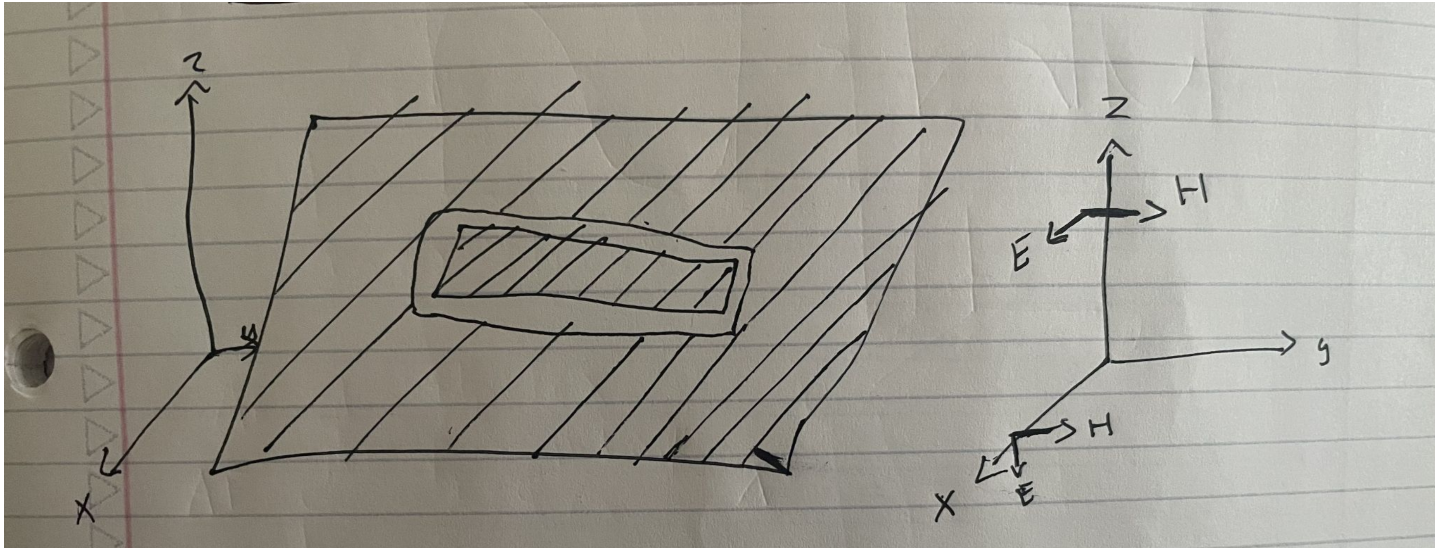


Question 2 Part B

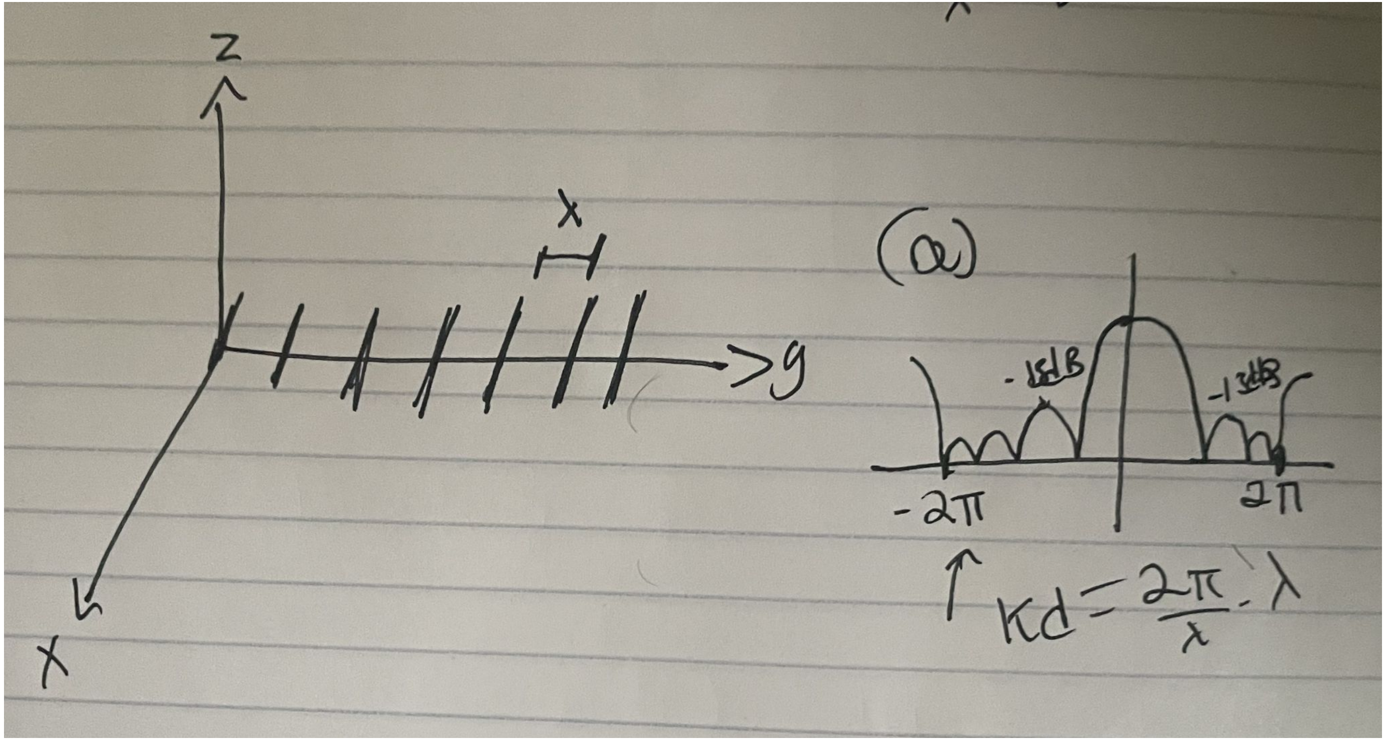
90 degree corner reflector or ground plane?

Question 2 part C

Draw the dual of the folded-dipole antenna and let us call it the folded slot antenna. Plot the field distribution on the folded-slot antenna. What is the input impedance of this antenna at resonance? Sketch its E- and H-plane far-field patterns.



Question 3 Part A



Question 3 Part B

b) (5 pts) Find the half-power beamwidth of the main beam in degrees.

.886/11 basically .886/10 = .085 rad -> approx 4.6 deg

50.6/11 = 4.6 deg

Half-power beamwidth (degrees) $l \gg \lambda$	$\frac{50.6}{(l/\lambda)}$
First-null beamwidth (degrees) $l \gg \lambda$	$\frac{114.6}{(l/\lambda)}$
First sidelobe max. (to main max.) (dB)	-13.2
Directivity factor (l large)	$2\left(\frac{l}{\lambda}\right)$

$$\text{HPBW} \approx 0.886\frac{\lambda}{L}, L \text{ is the length of array}$$

$$\text{FNBW} = \frac{2\lambda}{Nd} \approx \frac{2\lambda}{L}, L \text{ is the length of array}$$

Question 3 Part C

Psi = sinc(x) function since it is uniform

First SLL is -13 dB

Second SLL is -17 dB

These nums are from plots (but I also memorized them)

Just plot 10log(sinc(x)), you can do this in TI-84 calculator (make sure to properly set your window range)

Question 3 Part D

Estimate the directivity of the array.

2*11 = 22 -> 10log10(22) = 13.42 dBi

Half-power beamwidth (degrees) $l \gg \lambda$	$\frac{50.6}{(l/\lambda)}$
First-null beamwidth (degrees) $l \gg \lambda$	$\frac{114.6}{(l/\lambda)}$
First sidelobe max. (to main max.) (dB)	-13.2
Directivity factor (l large)	$2\left(\frac{l}{\lambda}\right)$

Question 3 Part E

The array is scanned to θ=30 degrees in the Y-Z plane. Calculate the phase for each element in the array.

1	5.441398	311.7691
2	4.599611	263.5383
3	3.757824	215.3074
4	2.916036	167.0766
5	2.074249	118.8457
6	1.232462	70.61487
7	0.390675	22.38402
8	5.832073	334.1532
9	4.990286	285.9223
10	4.148498	237.6915
11	3.306711	189.4606

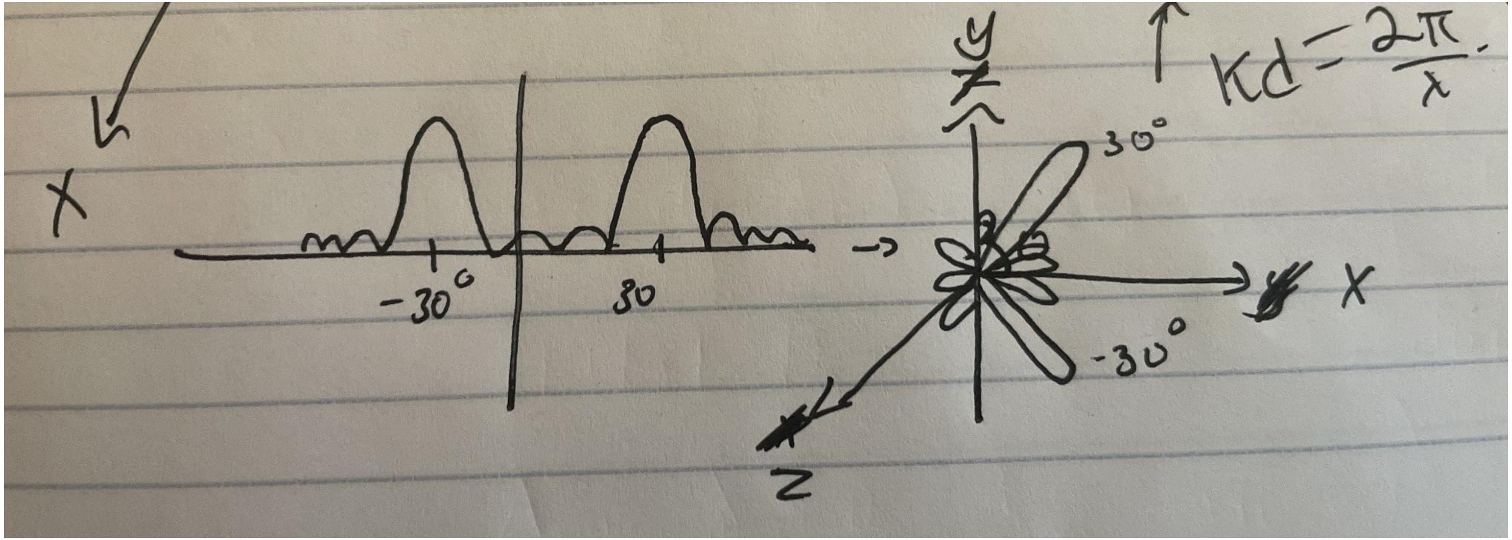
Scanning Array ($\theta = \theta_o$)

$$\psi\Big|_{\theta=\theta_o} = (kd\cos\theta + \beta)\Big|_{\theta=\theta_o} = kd\cos\theta_o + \beta = 0$$

$$\boxed{\beta = -kd\cos\theta_o} \qquad (6\text{-}21)$$

Question 3 Part F

Sketch the radiation pattern.



Question 3 Part G

Find the half-power beamwidth of the main beam in degrees.