University of Tehran
School of Electrical and Computer Engineering
Antenna, Spring 2017
Instructor: Dr. L. Yousefi

Homework#3 Due Date: 19 Farvardin

Q1, 20 Marks

Using Matlab, plot the power radiation pattern of dipole antennas with the following lengths: $l = \lambda/4,\ \ \lambda/2,\ \lambda,\ 3\lambda/4$
Also calculate the HPBW for those antennas.

Q2, 20 Marks

Using boundary conditions, find the image of a Magnetic current perpendicular to a PEC plate. Repeat the problem for a magnetic current parallel to a PEC plane.

Q3, 20 Marks

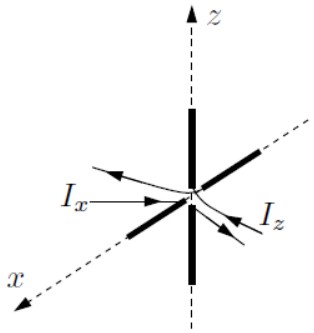
A thin dipole with length *l* is placed on the z -axis (with its center at the Origin) and has the following current distribution:

$$I(z) = I_0 \cos\left(\frac{\pi z}{l}\right) \qquad -l/2 \ \leq z \leq l/2$$

Calculate the far zone electromagnetic fields, and radiation intensity. Plot the radiation pattern for different values of $l = \lambda/4,\ \ \lambda/2,\ \lambda,\ 3\lambda/4$

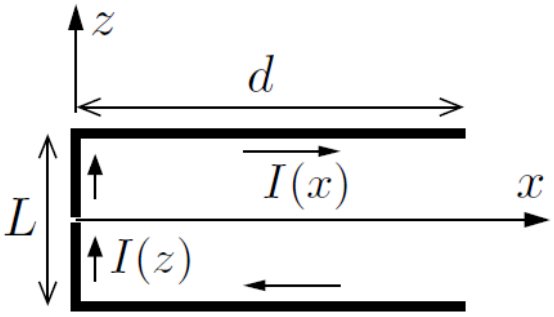
Q4, 30 Marks

Two identical half-wave dipoles are placed perpendicular to each other and make a cross in the x-z plane as shown below. The amplitudes of the currents on the two antennas are *Ix* and *Iz*. Calculate the far field of this antenna and find its polarization unit vector on the positive y-axis. Find the relationship between *Ix* and *Iz* to produce a LHCP wave on the positive y-axis.



Q5, 20 Marks

A transmission line loaded dipole antenna is shown below.



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Assume the current on the dipole is constant: $I(z) = I_0$ for $-L/2 \le z \le L/2$. The current on the open-ended transmission line is sinusoidal and equal to:

$$I(x) = I_0 \frac{\sin(k(d-x))}{\sin(kd)} \qquad 0 \le x \le d$$

Find the far-zone radiated fields of the antenna, and plot the radiation pattern in the principle E and H Planes.

Q6*, 20 Bonus Marks

Evaluate the following integral that we found in class for the radiated power of linear wire antennas. Here $l = L/2$ is the half of the length of the antenna.

$$Q = \int_0^{\pi} \frac{(\cos(kl\cos\theta) - \cos(kl))^2}{\sin\theta} d\theta$$

Q7*, 20 Bonus Marks

An inclined (bent) monopole antenna with length l makes an angle of θ_0 with a PEC ground plane. The current on the antenna can be modeled as $I(l') = I_m \sin(kl - kl')$ where l' is the distance from the feed point. Find the radiated field and plot the radiation pattern of this antenna in the E and H Planes.