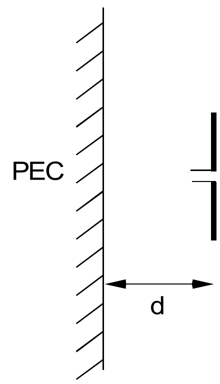
Reading: Balanis Chapters 7 & 8, plus Handouts

Homework #3 **Due: Wednesday, 30 April 2003**

1) Using the induced EMF theory for slender dipoles and image theory, plot the real and imaginary parts of the input impedance of a half-wave dipole ($L = \lambda_0/2$) as a function of distance in front of a conducting plane using the dipole orientation shown below. Assume a radius to length ratio of a/L=0.001. This example illustrates how mutual coupling can significantly affect the input impedance of antennas in close proximity.



2) This problem involves a numerical solution of Hallén's integral equation using the method of moments. We derived this equation in class for a center-fed dipole as

$$\int_{-l/2}^{l/2} \frac{e^{-jk_0R}}{R} I(z')\,dz' = -j\frac{2\pi}{\eta_0} V_g \sin k_0|z| + 4\pi C \cos k_0 z$$

where $R = [a^2 + (z - z')^2]^{1/2}$, V_g is the applied voltage at the gap, a is the dipole radius, l is the dipole length, and $I(z)$ is the unknown current distribution. The constant C is unknown, but is uniquely determined by the boundary condition on the current at the end of the wire.

a) Following the Method of Moments procedure, determine the unknown current distribution and input impedance of both a half-wave and full-wave dipole of radius $a/L = 0.01$. Use either pulse or triangular sub-domain basis functions and point-matching, and use as many basis functions as possible. Note that there are certain symmetries in the problem which can be exploited to speed the calculation. Make a plot of the resulting current distribution on the wire, and compare with a sinusoidal distribution.

b) Plot the far-field radiation pattern using the rigorous current distribution and compare with that predicted by the sinusoidal model.