Homework 3: ECE 4370

Line Currents

1. A z-directed wire of length $n\lambda/2$ has a standing wave current of constant amplitude I_0, with the following mathematical description:

$$\tilde{I}(z') = \begin{cases} I_0 & \text{for } -\frac{n\lambda}{4} < z' < +\frac{n\lambda}{4} \\ 0 & \text{elsewhere} \end{cases}$$

where n is a positive integer number of stacked dipoles and u() is the unit step function.

a) Assuming ideal efficiency, make a dB-polar plot of the θ-pol elevation-cut gain pattern of a base station antenna for the cases of n = 1, 2, 3, 4 and 5. (**10 points**)

b) Calculate the radiation resistance, peak gain, and half-power beamwidth in θ for each case in (a). Report your values in a table. In the last column of the table, report the product of the linear value of the peak gain and the HPBW angle for each case. What do you notice? (**10 points**)

**it is OK to perform numerical integration where needed for this part*

c) Compare the case of n=1 to the half-wave dipole result that we calculated in class. How does this antenna compare to the HWDP in terms of peak gain, beamwidth, and radiation resistance (**5 points**)