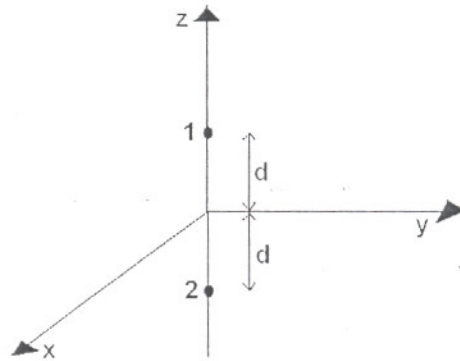


EEE 452/552 HW# 11



The figure shows two isotropic sources located symmetrically around the origin on the z-axis.

a) Derive and plot (polar and normalized) the magnitude of the array factor (AF) on the z-y plane, for following excitations:

- | | | | |
|------|--------------------------|-----|-----------------|
| i) | $E_1 = E_0, E_2 = E_0$ | and | $d = \lambda/2$ |
| ii) | $E_1 = E_0, E_2 = -E_0$ | and | $d = \lambda/2$ |
| iii) | $E_1 = E_0, E_2 = -jE_0$ | and | $d = \lambda/2$ |
| iv) | $E_1 = E_0, E_2 = -jE_0$ | and | $d = \lambda/4$ |
| v) | $E_1 = E_0, E_2 = E_0$ | and | $d = \lambda/4$ |

b) Consider the case (v) with the additional (third) source located at the origin with excitation $E_3 = 2E_0$. Derive and plot the magnitude of the AF. What happens if the excitation of the source at the origin is reversed, i.e. $E_3 = -2E_0$?

c) Show that the AF in (b) could be found by using the AF in (v) twice. Explain the idea behind this shortcut.

d) Multiply the AFs you have found in (i) and (ii). What is the source combination for this resulting AF? Explain idea behind this operation.

e) Let $E_1 = E_0, E_2 = E_0 \exp(-j\beta)$ and $d = \lambda/8$. Find the expression for β to obtain an AF having its only maximum occurring along $\theta = 0$. Find and plot (polar, normalized) the magnitude of the AF on the y-z plane.