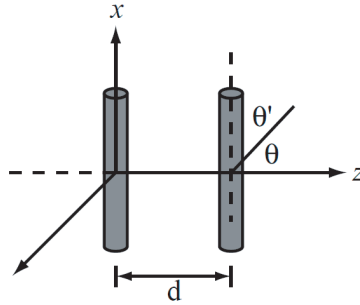


**9.43** If the antennas in part (a) of Problem 9.42 are parallel, vertical, Hertzian dipoles with axes along the  $x$ -direction, determine the normalized radiation intensity in the  $x$ - $z$  plane and plot it.

**Solution:** The power density radiated by a Hertzian dipole is given from Eq. (9.12) by  $S_e(\theta') = S_0 \sin^2 \theta'$ , where  $\theta'$  is the angle measured from the dipole axis, which in the present case is the  $x$  axis (Fig. P9.43(a)).

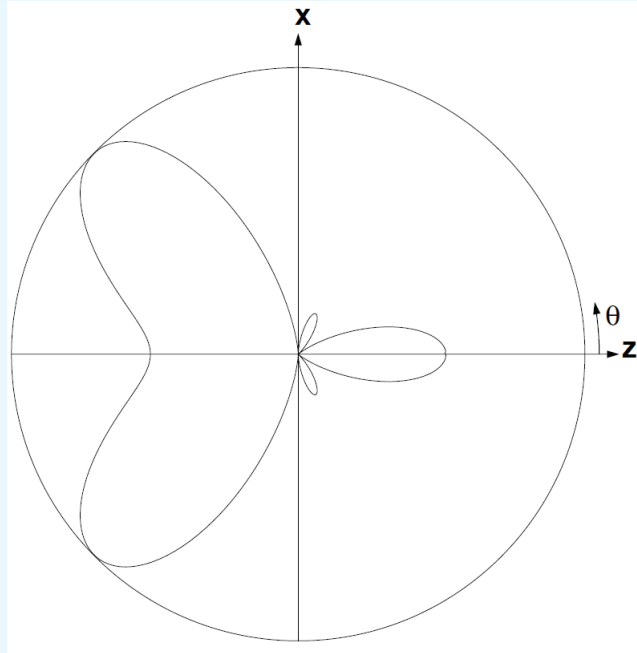


**Figure P9.43** (a) Two vertical dipoles of Problem 9.43.

Hence,  $\theta' = \pi/2 - \theta$  and  $S_e(\theta) = S_0 \sin^2(\frac{1}{2}\pi - \theta) = S_0 \cos^2 \theta$ . Then, from Eq. (9.108), the total power density is the product of the element pattern and the array factor. From part (a) of the previous problem:

$$S(\theta) = S_e(\theta) F_a(\theta) = 4S_0 \cos^2 \theta \cos^2 \left[ \frac{\pi}{8} (4 \cos \theta + 1) \right].$$

This function has a maximum value of  $3.52S_0$  and it occurs at  $\theta_{\max} = \pm 135.5^\circ$ . The maximum must be found by trial and error. A plot of the normalized array antenna pattern is shown in Fig. P9.43(b).



**Figure P9.43** (b) Pattern factor in the elevation plane of the array in Problem 9.43(a).