

9.46 Find and plot the normalized array factor and determine the half-power beamwidth for a five-element linear array excited with equal phase and a uniform amplitude distribution. The interelement spacing is $3\lambda/4$.

Solution: Using Eq. (9.121),

$$F_{\text{an}}(\theta) = \frac{\sin^2[(N\pi d/\lambda)\cos\theta]}{N^2\sin^2[(\pi d/\lambda)\cos\theta]} = \frac{\sin^2[(15\pi/4)\cos\theta]}{25\sin^2[(3\pi/4)\cos\theta]}$$

and this pattern is shown in Fig. P9.46. The peak values of the pattern occur at $\theta = \pm 90^\circ$. From numerical values of the pattern, the angles at which $F_{\text{an}}(\theta) = 0.5$ are approximately 6.75° on either side of the peaks. Hence, $\beta \approx 13.5^\circ$.

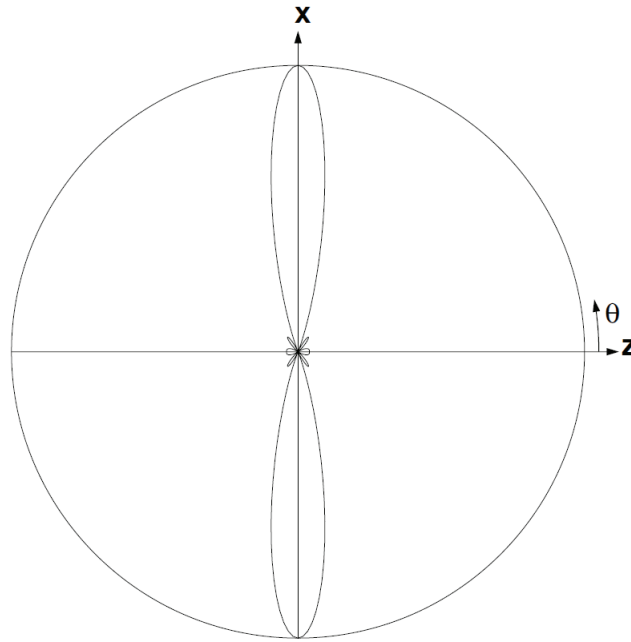


Figure P9.46 Normalized array pattern of a 5-element array with uniform amplitude distribution in Problem 9.46.