

PROBLEM A4

PLOT THE RADIATION PATTERN OF AN ARRAY OF 3 ISOTROPIC RADIATORS FED IN PHASE;
THE DISTANCE BETWEEN TWO RADIATORS IS 12.5 cm AND THE WORKING FREQUENCY
IS 2.5 GHz

SOLUTION

$$f = 2.5\text{ GHz} \quad \lambda = \frac{c}{f} = 12.5\text{ cm}$$

SINCE THE RADIATORS ARE ISOTROPIC SOURCES, THE TOTAL RADIATION PATTERN IS
GIVEN BY THE ARRAY FACTOR

$$\psi = \frac{2\pi}{\lambda} d \cos \theta + \alpha = \frac{2\pi}{0.125} 0.125 \cos \theta + 0 = 2\pi \cos \theta$$

- MAXIMA $\psi = 0, \pm 2\pi, \pm 4\pi, \dots$

$$\psi = 0 \quad \psi = 2\pi \cos \theta = 0 \quad \cos \theta = 0$$

$$\theta = \pm 90^\circ$$

$$\psi = \pm 2\pi \quad \psi = 2\pi \cos \theta = \pm 2\pi \quad \cos \theta = \pm 1$$

$$\cos \theta = 1 \quad \theta = 0^\circ$$

$$\cos \theta = -1 \quad \theta = 180^\circ$$

$$\psi = \pm 4\pi \quad \psi = 2\pi \cos \theta = \pm 4\pi \quad \cos \theta = \pm 2 \quad \text{there is no solution}$$

THE MAXIMUM DIRECTIONS ARE $\theta = 0^\circ, \pm 90^\circ, 180^\circ$

- NOW DIRECTIONS FOR $\varphi = \pm \frac{2h\pi}{N}$ $h \neq N$ $h \neq 2N$, $h \neq 3N, \dots$

$$h=1 \quad \varphi = \pm \frac{2\pi}{3} \quad 2\pi \cos \theta = \pm \frac{2\pi}{3} \quad \cos \theta = \pm \frac{1}{3}$$

$$\cos \theta = \frac{1}{3} \quad \theta = \pm 70.5^\circ$$

$$\cos \theta = -\frac{1}{3} \quad \theta = \pm 109.5^\circ$$

$$h=2 \quad \varphi = \pm \frac{4\pi}{3} \quad 2\pi \cos \theta = \pm \frac{4\pi}{3} \quad \cos \theta = \pm \frac{2}{3}$$

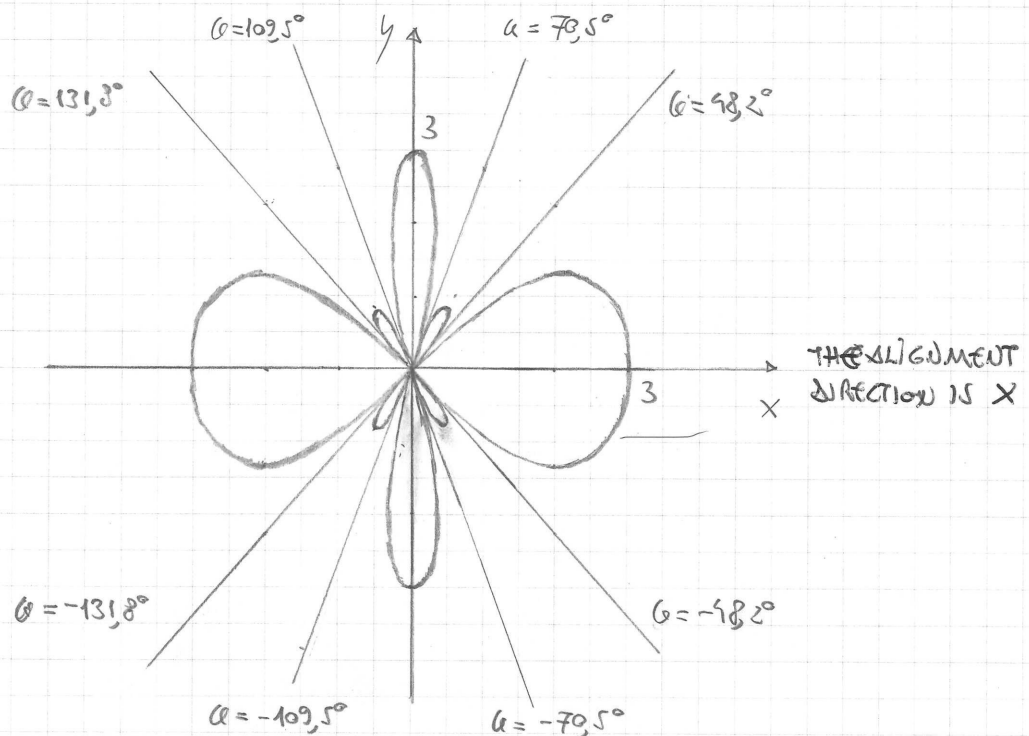
$$\cos \theta = \frac{2}{3} \quad \theta = \pm 48.2^\circ$$

$$\cos \theta = -\frac{2}{3} \quad \theta = \pm 131.8^\circ$$

$$h=3 \quad \varphi = \pm \frac{6\pi}{3} \quad 2\pi \cos \theta = \pm \frac{6\pi}{3} \quad \cos \theta = \pm 1 \quad \text{NO SOLUTION}$$

THE NOW DIRECTIONS ARE $\theta = \pm 48.2^\circ, \pm 70.5^\circ, \pm 109.5^\circ, \pm 131.8^\circ$

$N|F(\theta, \varphi)|$



THERE ARE 9 MAIN LOBES

AND 9 SECONDARY LOBES