Sheet (3)

1. The maximum radiation intensity of a 90% efficiency antenna is 200 mW/ unit solid angle. Find the directivity and gain (dimensionless and in dB) when the
   (a) Input power is 125.66 mW
   (b) Radiated power is 125.66 mW

2. A lossless resonant half-wavelength dipole antenna, with input impedance of 73 ohms, is connected to a transmission line whose characteristic impedance is 50 ohms. Assuming that the pattern of the antenna is given approximately by $U=B_o\sin^3\theta$. Find the maximum gain and maximum absolute gain of this antenna.

3. A uniform plane wave, of is traveling in the positive z-direction. Find the polarization (linear, circular, or elliptical), sense of rotation (CW or CCW), when
   (a) Ex =Ey, $\Delta\varphi=\varphi y-\varphi x=0$ (b) Ex ≠Ey, $\Delta\varphi=\varphi y-\varphi x=0$
   (c) Ex =Ey, $\Delta\varphi=\varphi y-\varphi x=\pi/2$ (d) Ex =Ey, $\Delta\varphi=\varphi y-\varphi x=-\pi/2$
   (e) Ex =Ey, $\Delta\varphi=\varphi y-\varphi x=\pi/4$ (f) Ex =Ey, $\Delta\varphi=\varphi y-\varphi x=-\pi/4$
   (g) Ex =0.5Ey, $\Delta\varphi=\varphi y-\varphi x=\pi/2$ (h) Ex =0.5Ey, $\Delta\varphi=\varphi y-\varphi x=-\pi/2$

4. A wave traveling normally outward from the page (toward the reader) is the resultant of two elliptically polarized waves, one with components of E given by:

$$\mathscr{E}'_y = 3\cos\omega t$$

$$\mathscr{E}'_x = 7\cos\left(\omega t + \frac{\pi}{2}\right)$$

And the other with components given by:

$$\mathscr{E}''_y = 2\cos\omega t$$

$$\mathscr{E}''_x = 3\cos\left(\omega t - \frac{\pi}{2}\right)$$

   (a) What is the axial ratio of the resultant wave?
   (b) Does the resultant vector E rotate clockwise or counterclockwise?

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5. Design an antenna with omnidirectional amplitude pattern with a half-power beam width of 90°, Express its radiation intensity by $U=\text{Sin}^n\theta$. Determine the value of n and attempt to identify elements that exhibit such a pattern. Determine the directivity of the antenna.

6. The normalized far-zone field pattern of an antenna is given by

$$E = \begin{cases} (\sin\theta\cos^2\phi)^{1/2} & 0 \le \theta \le \pi \text{ and } 0 \le \phi \le \pi/2, 3\pi/2 \le \phi \le 2\pi \\ 0 & \text{elsewhere} \end{cases}$$

Find the directivity using
(a) The exact expression
(b) Kraus' approximate formula

REPORT

1. The normalized radiation intensity of an antenna is represented by

$$U(\theta) = \cos^2(\theta)\cos^2(3\theta), \quad (0 \le \theta \le 90^\circ, \quad 0^\circ \le \phi \le 360^\circ)$$

Find the exact and approximate directivity.

2. The radiation intensity is represented by

$$U = \begin{cases} U_0 \sin(\pi \sin\theta), & 0 \le \theta \le \pi/2 \text{ and } 0 \le \phi \le 2\pi \\ 0 & \text{elsewhere} \end{cases}$$

Find θ_{HP} and draw the radiation pattern.

Good Luck

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