Benha University	Antennas &Wave Propagation	Electrical Eng. Dept.
Faculty of Engineering		4^{th} year communication
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Sheet (2)

1. Estimate the directivity of an antenna with $\Theta_{HP} = 2^o$ and $\Phi_{HP}=1^o$.

2. Find the number of square degrees in the solid angle Ω on a spherical surface that is between ($\theta=20^o$ and $\theta=40^o$), and ($\varphi=30^o$ and $\varphi=70^o$).

3. The normalized field pattern of an antenna is given by $E(\theta)=\sin\theta\sin\varphi$. E_n has a value only for $0\leq \theta \leq \Pi$ & $0\leq \varphi \leq \Pi$, and zero elsewhere , Find

a. The exact directivity.
b. The approximate directivity.
c. The decibel difference.

4. Calculate the $D_{approx.}$ from the HPBW of a unidirectional antenna if the power pattern is given by :

$$E(\theta,\phi) = 30 \cos^2\theta \sin^{3/2}\Phi$$

$0\leq\theta\leq\Pi \qquad 0\leq\Phi\leq \Pi$ and zero otherwise.

Then repeat by calculating D_{exact} for the previous pattern. Finally calculate the db difference between the exact and approximate records.

5. The far-zone electric-field intensity (array factor) of an end-fire two-element array antenna, placed along the z-axis and radiating into free-space, is given by

$$E = \cos\left[\frac{\pi}{4}(\cos\theta - 1)\right]\frac{e^{-jkr}}{r}, \qquad 0 \leq \theta \leq \pi$$

Find the directivity using Kraus' approximate formula

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

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

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

7. Estimate the directivity for a source with relative field pattern

a. E = Cos2θCosθ. Assume a unidirectional pattern.
b. $E = \sin(\frac{\Pi}{2}\cos\theta)$. Assume $0\leq \theta \leq \Pi$ & $0\leq \varphi \leq 2\Pi$.

Good Luck

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