Antennas &
Wave Propagation

Electronic Dep.
3rd Stage

Lecture Four

Power radiated by a current element and Radiation Resistance

Prepared By

2013

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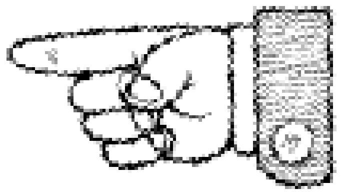
Power radiated by a current element

$$\mathcal{P}_{av} = \left[\frac{\omega^2 I_0^2\, dl^2 \sin^2\theta}{32\pi^2 \varepsilon r^2 c^3}\right] \text{W/m}^2$$



$$P = \int_{\text{surface}} (\mathcal{P}_{av}\, dA)$$

$$P = \int_0^{\pi} \left[\frac{(\omega^2 I_0^2\, dl^2 \sin^2\theta)}{32\pi^2 \varepsilon r^2 c^3}\right] 2\pi r^2 \sin\theta\, d\theta$$

$$P = 40\pi^2 I_0^2 \left(\frac{dl}{\lambda}\right)^2$$

The current I_0 is the maximum current and is equal to $I_{rms}\sqrt{2}$.

So,

$$P = 80\pi^2 I_{rms}^2 \left(\frac{dl}{\lambda}\right)^2$$

Radiation Resistance

is that fictitious resistance which when connected in series with the antenna will consume the same amount of power as when actually radiating

$$\mathcal{P}_{av} = \left[\frac{\omega^2 I_0^2 \, dl^2 \sin^2\theta}{32\pi^2 \varepsilon r^2 c^3}\right] \text{W/m}^2$$

$$R_r = \frac{P}{I_{\text{rms}}^2}$$

$$R_r = 80\pi^2 \left(\frac{dl}{\lambda}\right)^2$$

$$R_r = 789.5 \left(\frac{dl}{\lambda}\right)^2$$

Antenna Effective length

In practice current will be either linear or sinusoidal. This effect reduces the amount of power radiated from the **antenna** and **effectively** makes aerial **shorter** than the one with same current throughout.

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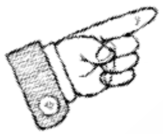
$$R_r = \frac{P}{I_{rms}^2}$$

$$R_r = 80\pi^2\left(\frac{dl}{\lambda}\right)^2$$



$$R_r = 789.5\left(\frac{dl}{\lambda}\right)^2$$

Thanks for Listening

Any Question
Please...