

- 2.95 A lossless ( $e_{cd} = 1$ ) antenna is operating at 100 MHz and its maximum effective aperture is  $0.7162 \text{ m}^2$  at this frequency. The input impedance of this antenna is 75 ohms, and it is attached to a 50-ohm transmission line. Find the directivity (dimensionless) of this antenna if it is polarization-matched.

$$(2-112) A_{em} = e_{cd} (1 - |\Gamma|^2) \left( \frac{\lambda^2}{4\pi} \right) D_0 |\hat{p}_w \cdot \hat{p}_a|^2$$

$$A_{em} = 0.7162 \text{ m}^2$$

$$e_{cd} = 1$$

$$\Gamma = \frac{Z_{ant} - Z_0}{Z_{ant} + Z_0} = \frac{75 - 50}{75 + 50} = 0.2$$

→  $|\Gamma| = 0.2$

$$\lambda = \frac{c}{f} = \frac{2.998 \times 10^8}{100 \times 10^6} = 2.998 \text{ m}$$

$$|\hat{p}_w \cdot \hat{p}_a|^2 = 1 = \text{PLF}$$

$$D_0 = \frac{A_{em} (4\pi)}{e_{cd} (\lambda^2) (1 - |\Gamma|^2) |\hat{p}_w \cdot \hat{p}_a|^2}$$

$$= \frac{0.7162 (4\pi)}{1 (2.998)^2 (1 - 0.2^2) (1)}$$

$$\underline{\underline{D_0 = 1.043 = 0.183 \text{ dB}_i}}$$