

Problem 7.30 The amplitudes of an elliptically polarized plane wave traveling in a lossless, nonmagnetic medium with $\epsilon_r = 4$ are $H_{y0} = 3$ (mA/m) and $H_{z0} = 4$ (mA/m). Determine the average power flowing through an aperture in the y - z plane if its area is 20 m^2 .

Solution:

$$\eta = \frac{\eta_0}{\sqrt{\epsilon_r}} = \frac{120\pi}{\sqrt{4}} = 60\pi = 188.5 \text{ } \Omega,$$

$$\mathbf{S}_{\text{av}} = \hat{\mathbf{x}} \frac{\eta}{2} [H_{y0}^2 + H_{z0}^2] = \hat{\mathbf{x}} \frac{188.5}{2} [9 + 16] \times 10^{-6} = 2.36 \text{ (mW/m}^2\text{)},$$

$$P = S_{\text{av}} A = 2.36 \times 10^{-3} \times 20 = 47.13 \text{ (mW)}.$$
