Pongsak Mahachoklertwattana
Thammasat University

HOMEWORK SET #8

Note: Please show all the steps leading to the final answer.

1. A uniform plane wave traveling in the $+z$ direction, whose magnetic field is expressed as

$$\mathbf{H}^i = \hat{y} H_0 e^{-jkz} \quad z \leq 0 \tag{1}$$

impinges upon an aperture on an infinite, flat, perfect electric conductor whose cross section is indicated in figure 1.

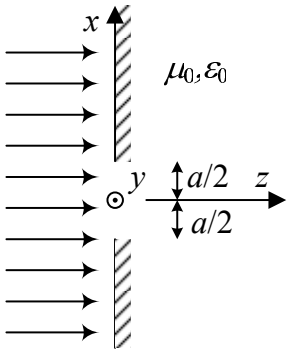

Figure 1: Geometry of the aperture in Problem 1

   (a) State the equivalent that must be used to determine the field radiated by the aperture to the right of the conductor $(z > 0)$.

   (b) Assuming the aperture distribution in the y direction is b, determine the far-zone fields for $z > 0$.

2. A narrow rectangular slot of size L by W is mounted on an infinite ground plane that covers the $x - y$ plane as shown in figure 2. The tangential field over the aperture is given by

$$\mathbf{E}_a = \hat{y} E_0 e^{-jkx'/\sqrt{2}}. \tag{2}$$

Using the equivelence principle and image theory, we can replace the aperture and infinite

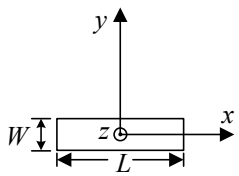

Figure 2: Geometry of the aperture in Problem 2

ground plane with an equivalent magnetic current radiating in free-space. Determine the

   (a) appropriate equivalent

Pongsak Mahachoklertwattana
Thammasat University

(b) far-zone spherical electric field components for $z > 0$

(c) direction (θ, ϕ) in which the radiation intensity is maximum.

3. A rectangular aperture, of dimensions a and b is mounted on an infinite ground plane, which is aligned with the $y - z$ plane. Assuming that the tangential field over the aperture is given by

$$\mathbf{E}_a = \hat{z} E_0 \cos\frac{\pi}{a} y', \quad -a/2 \leq y' \leq a/2, -b/2 \leq z' \leq b/2, \tag{3}$$

find the far-zone spherical electric and magnetic field components radiated by the aperture.