Homework set 8 (David K. Cheng, Fundamentals of Engineering Electromagnetics)

P. 6-4 In Fig. 6-10 assume a constant current $i_1 = I_0$, but that the rectangular loop moves away with a constant velocity $\mathbf{u} = \mathbf{a}_y u_0$. Determine i_2 when the loop is at a position as shown.

P. 6-6 A conducting sliding bar oscillates over two parallel conducting rails in a sinusoidally varying magnetic field

$$\mathbf{B} = \mathbf{a}_z 5\cos\omega t \quad \text{(mT)},$$

as shown in Fig.6-12. The position of the sliding bar is given by $x = 0.35(1-\cos\omega t)$ (m), and the rails are terminated in a resistance R=0.2 (Ω). Find i.

P. 6-7 Determine the frequency at which a time-harmonic electric field intensity causes a conduction current density and a displacement current density of equal magnitude in

a) seawater with $\varepsilon_r = 72$ and $\sigma = 4 \ (S/m)$, and

b) moist soil with $\varepsilon_r = 2.5$ and $\sigma = 4 \ (S/m)$.

P. 6-9 An infinite current sheet $\mathbf{J} = \mathbf{a}_x 5$ (A/m) coinciding with the xy-plane separates air (region1, z>0) from a medium with $\mu_{r2} = 2$ (region 2, z<0). Given that $\mathbf{H}_1 = \mathbf{a}_x 30 + \mathbf{a}_y 40 + \mathbf{a}_z 20$ (A/m), find

a) $\mathbf{H}_2$,

b) $\mathbf{B}_2$,

c) angle α_1 that $\mathbf{B}_1$ makes with the z-axis, and

d) angle α_1 that $\mathbf{B}_2$ makes with the z-axis.