Homework 7

VE230 - Electromagnetics I, Summer 2020

∗ **Due: July 30, 11:59 PM**

P7-1 Express the transformer emf induced in a stationary loop in terms of time-varying vector potential **A**.

P7-2 The circuit in Fig.1 is situated in a magnetic field

$$\mathbf{B} = \mathbf{a_z}\mathbf{3}\cos\left(5\pi 10^7 t - \frac{2}{3}\pi x\right) \quad (\mu\mathrm{T})$$

Assume $R = 15(\Omega)$, find the current i.

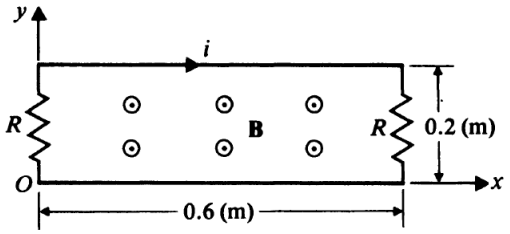

Figure 1: A circuit in a time-varying magnetic field.

P7-7 A conducting sliding bar oscillates over two parallel conducting rails in a sinusoidally varying magnetic field

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

as shown in Fig. 7-13. 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 $R = 0.2(\Omega)$. Find i.

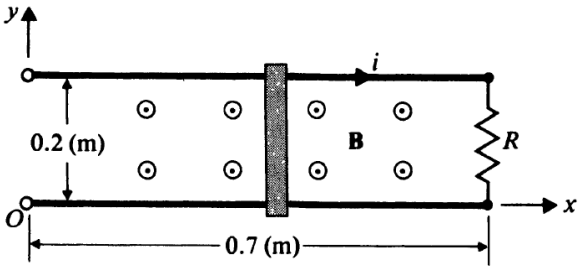

FIGURE 7–13
A conducting bar sliding over parallel rails in a time-varying magnetic field (Problem P.7–7).

P7-11 Derive the two divergence equations, Eqs. (7-53c) and (7-53d) from the two curl equations, (7-53a) and (7-53b), and the equation of continuity, Eq. (7-48).

P7-12 Prove that the Lorentz condition for potentials as expressed in Eq. (7-62) is consistent with the equation of continuity.