

*Homework Solution "Faraday"*

**Problem:** If a rod has length  $2L$  and is rotating thru a magnetic field  $B$  with an angular velocity  $\omega$ , (a) what is the induced emf between the center of the rod and one end? (b) Between the two ends?

**Solution:**

Consider one half of the rod, from the midpoint to one end. This piece takes  $2\pi / \omega$  to sweep out a circular area  $\pi r^2 = \pi L^2$ .

The rate at which it will sweep across the area is  $A / t = \pi L^2 / (2\pi / \omega) = \frac{\omega L^2}{2}$ .

(a) The emf that is induced between the center of the rod and one end will be the magnetic field in this area times the rate at which the area is swept:

$$\text{emf} = \frac{B\omega L^2}{2}$$

(b) Both ends are at the same potential, so the potential difference across them is 0.