

**6.5** A rectangular conducting loop  $5\text{ cm} \times 10\text{ cm}$  with a small air gap in one of its sides is spinning at 7200 revolutions per minute. If the field  $\mathbf{B}$  is normal to the loop axis and its magnitude is  $3 \times 10^{-6}\text{ T}$ , what is the peak voltage induced across the air gap?

**Solution:**

$$\omega = \frac{2\pi \text{ rad/cycle} \times 7200 \text{ cycles/min}}{60 \text{ s/min}} = 240\pi \text{ rad/s},$$

$$A = 5\text{ cm} \times 10\text{ cm} / (100 \text{ cm/m})^2 = 5.0 \times 10^{-3} \text{ m}^2.$$

From Eqs. (6.36) or (6.38),  $V_{\text{emf}} = A\omega B_0 \sin \omega t$ ; it can be seen that the peak voltage is

$$V_{\text{emf}}^{\text{peak}} = A\omega B_0 = 5.0 \times 10^{-3} \times 240\pi \times 3 \times 10^{-6} = 11.31 \quad (\mu\text{V}).$$

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