Problem 6.4 A stationary conducting loop with an internal resistance of 0.5 Ω is placed in a time-varying magnetic field. When the loop is closed, a current of 5 A flows through it. What will the current be if the loop is opened to create a small gap and a 2-Ω resistor is connected across its open ends?

Solution: V_{emf} is independent of the resistance which is in the loop. Therefore, when the loop is intact and the internal resistance is only 0.5 Ω,

$$V_{\text{emf}} = 5\ \text{A} \times 0.5\ \Omega = 2.5\ \text{V}.$$

When the small gap is created, the total resistance in the loop is infinite and the current flow is zero. With a 2-Ω resistor in the gap,

$$I = V_{\text{emf}}/(2\ \Omega + 0.5\ \Omega) = 2.5\ \text{V}/2.5\ \Omega = 1 \quad \text{(A)}.$$