Chapter 7, Solution 84.

The resistance of a 160-mH coil is 8Ω. Find the time required for the current to build up to 60% of its final value when voltage is applied to the coil.

Solution

Let I_o be the final value of the current. Then

$$i(t) = I_o(1 - e^{-t/\tau}), \qquad \tau = R/L = 0.16/8 = 1/50$$

$$\mathbf{0.6}I_o = I_o(1 - e^{-50t}) \longrightarrow t = \frac{1}{50}\ln\frac{1}{0.4} = \underline{\mathbf{18.33\ ms}}.$$