Chapter 6, Solution 45.

If the voltage waveform in Fig. 6.68 is applied to a 10-mH inductor, find the inductor current $i(t)$ for $0 < t < 2$ s. Assume $i(0) = 0$.
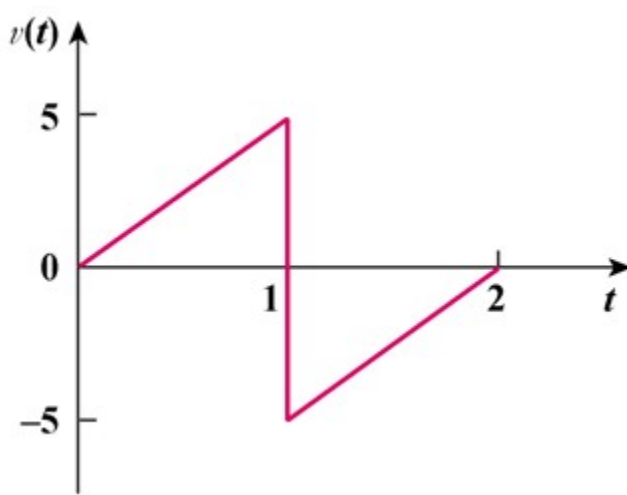

Figure 6.68
For Prob. 6.45.

Solution

$$i(t) = \frac{1}{L}\int_0^t v(t) + i(0)$$

For $0 < t < 1$, $v = 5t$

$$i = \frac{1}{10 \times 10^{-3}}\int_0^t 5t\ dt + 0$$

$$= 250t^2\ \text{A}$$

For $1 < t < 2$, $v = -10 + 5t$

$$i = \frac{1}{10 \times 10^{-3}}\int_1^t (-10 + 5t)dt + i(1)$$

$$= \int_1^t (0.5t - 1)dt + 0.25\text{kA}$$

$$= [1 - t + 0.25t^2\ ]\ \text{kA}$$

$$i(t) = \begin{cases} 250t^2 \, A, & 0 < t < 1s \\ [1 - t + 0.25t^2] \, kA, & 1 < t < 2s \end{cases}$$