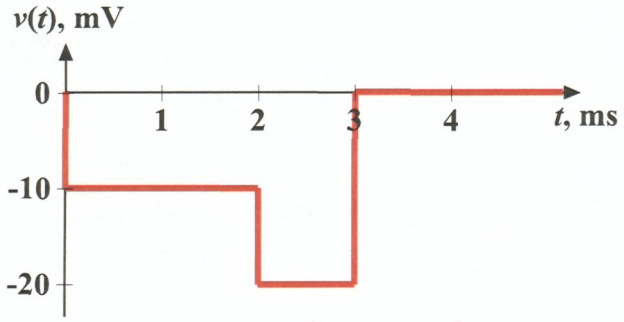
EE 2240

Problem #04

The waveform for the voltage across a 20 μH inductor is shown. Determine, and accurately sketch, the waveform for the inductor current if $v(t) = 0$ for $t < 0$.



$$i(t) = \frac{1}{L}\int_{-\infty}^{t} v(\tau)\,d\tau = \frac{1}{L}\int_{-\infty}^{0} v(\tau)\,d\tau + \frac{1}{L}\int_{0}^{t} v(\tau)\,d\tau = 5\times10^{4}\int_{0}^{t} v(\tau)\,d\tau$$

For $0 < t < 2\text{ms}$: $v(t) = -10\text{ mV}$

$$i(t) = 5\times10^{4}\int_{0}^{t}(-10\times10^{-3})\,d\tau = -500\,\tau\Big|_{0}^{t} = -500t\ \text{A}$$

For $2\text{ms} < t < 3\text{ms}$: $v(t) = -20\text{ mV}$

$$i(t) = -500(2\times10^{-3}) + 5\times10^{4}\int_{2\text{ms}}^{t}(-20\times10^{-3})\,d\tau$$

$$= -1 - 1000\,\tau\Big|_{2\text{ms}}^{t} = 1 - 1000t\ \text{A}$$

For $3\text{ms} < t$: $v(t) = 0$

$$i(t) = 1 - 1000(3\text{ms}) = 1 - 3 = -2\ \text{A}$$