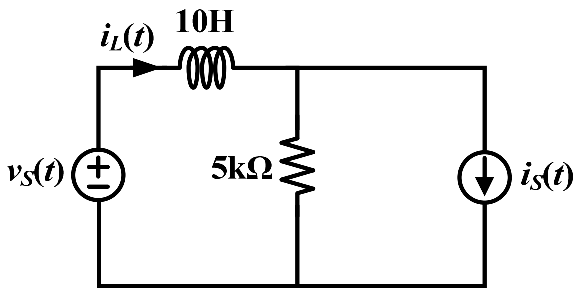
電路學(EE2210)第七次隨堂考

2015年5月6日
時間：10 分鐘
Close Book

學號：________________

姓名：________________

Using superposition, determine the current $i_L(t)$ for the following circuit. Assume $v_S(t) = 10u(t)$ V and $i_S(t) = 2u(t)$ mA, find $i_L(0^+)$, $i_L(\infty)$, the time constant (τ), and the response $i_L(t)$. Sketch the response $i_L(t)$ for $t \geq 0$. (Label the key values in your sketch.)



Solutions:
The inductor first acts as an open circuit and eventually becomes a wire:
When $t \geq 0$,

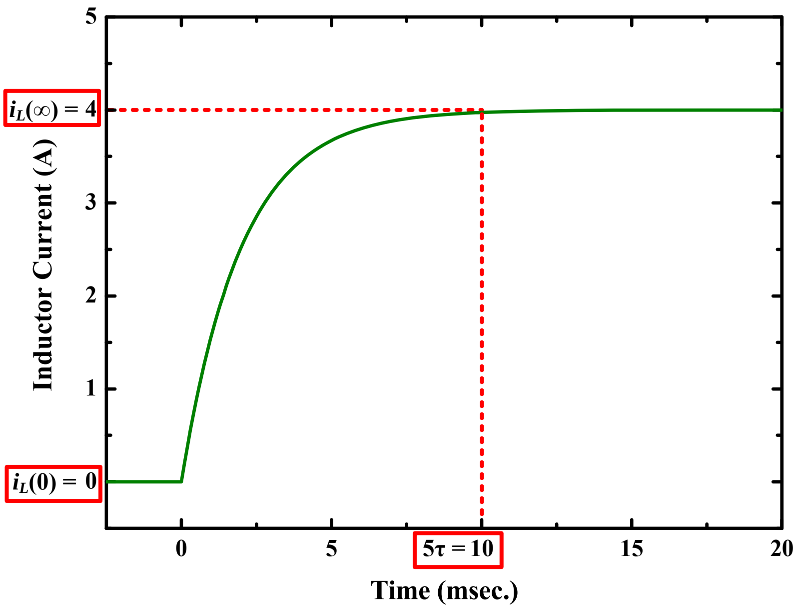
Initial: $i_L(0^+) = i_L(0^-) = 0$

Final: $i_L(\infty) = \dfrac{v_S(\infty)}{5\text{k}\Omega} + i_S(\infty) = \dfrac{10\text{V}}{5\text{k}\Omega} + 2\text{mA} = 4\text{mA}$

Time constant: $\tau = \dfrac{L}{R} = \dfrac{10}{5\text{k}} = 2\text{msec.}$

Then $i_L(t)$ can be written by intuitive method,

$$i_L(t) = Initial\ value\left(e^{-t/\tau}\right) + Final\ value\left(1 - e^{-t/\tau}\right)$$
$$= 4(1 - e^{-t/\tau})\text{mA where } \tau = 2\text{msec.}$$



$i_L(0^+)$ = ______0A______, $i_L(\infty)$ = ______4mA______, Time constant (τ) = ______2msec.______,

$i_L(t) = 4(1 - e^{-t/\tau})$mA where $\tau = 2$msec,

Sketch the response $i_L(t)$ for $t > 0$: