

RL 電路的餘弦穩態響應

* 電路(Fig 10.3-1)中 $R = 5\Omega$, $L = 1H$, $v_s(t) = 5\cos 5t$,

求 $i(t)$, $v_R(t)$, $v_L(t)$ 穩態解。

$$\rightarrow \text{KVL } \frac{di(t)}{dt} + 5i(t) = 5\cos 5t,$$

\rightarrow 令 $i_f(t) = A\cos 5t + B\sin 5t$ 代入 O.D.E

$$\rightarrow (5A + 5B)\cos 5t + (-5A + 5B)\sin 5t = 5\cos 5t$$

$$\rightarrow \begin{cases} 5A + 5B = 5 \\ -5A + 5B = 0 \end{cases} \rightarrow A = \frac{1}{2}, \quad B = \frac{1}{2}$$

$$\rightarrow i_f(t) = \frac{1}{2}\cos 5t + \frac{1}{2}\sin 5t = \frac{\sqrt{2}}{2}\cos(5t - 45^\circ)$$

$$\rightarrow v_R(t) = 5i_f = \frac{5\sqrt{2}}{2}\cos(5t - 45^\circ)$$

$$\rightarrow v_L(t) = 1\frac{di_f}{dt} = -\frac{5\sqrt{2}}{2}\sin(5t - 45^\circ) = \frac{5\sqrt{2}}{2}\cos(5t + 45^\circ)$$

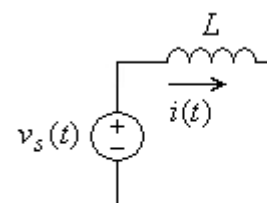


Fig 10.3-1

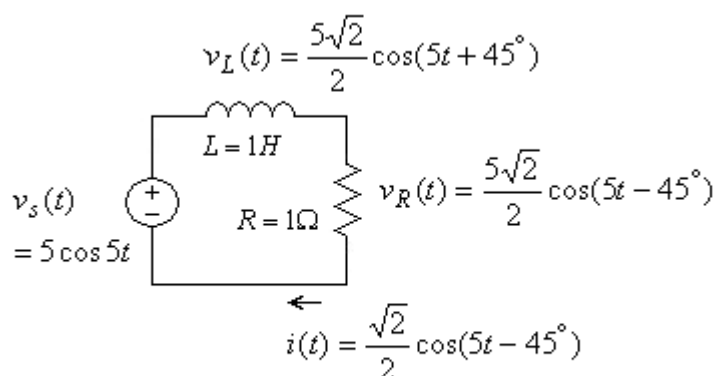


Fig 10.3-1b