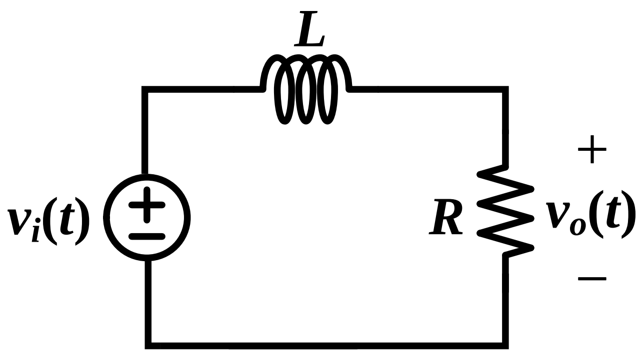
電路學(10510EE221002)第八次隨堂考

2016年11月30日
時間：10 分鐘
Close Book

學號：________________________________

姓名：________________________________

Find the sinusoidal steady state $v_o(t)$ for the following circuit by
(a) find the transfer function $\mathbf{H}(j\omega)$.
(b) find the numerical complex value of the $\mathbf{H}(j\omega)$ for ω =4 rad/s and ω = 4000 rad/s.
(c) find $v_o(t)$ for ω = 4 rad/s and $v_o(t)$ ω = 4000 rad/s.
(d) find $v_o(t)$.
(Assuming R = 4Ω, L = 1H, and $v_i(t)$ = 10cos(4t) + 10cos(4000t) V.)



Solution:

(a)

$$\mathbf{H}(j\omega) = \frac{\mathbf{V_o}}{\mathbf{V_i}}(j\omega) = \frac{R}{R + j\omega L} = \frac{1}{1 + j\omega\frac{L}{R}}$$

(b)

$$\mathbf{H}(j\omega) = |\mathbf{H}|\angle\phi$$

$$|\mathbf{H}(j\omega)| = \frac{1}{\sqrt{1^2 + (\frac{\omega}{4})^2}} \quad \text{and} \quad \phi = \angle\mathbf{H}(j\omega) = -\tan^{-1}(\frac{\omega}{4})$$

$$|\mathbf{H}(j\omega)|_{\omega=4} = \frac{1}{\sqrt{1^2 + (\frac{4}{4})^2}} = \frac{1}{\sqrt{2}} \approx 0.707$$

$$|\mathbf{H}(j\omega)|_{\omega=4000} = \frac{1}{\sqrt{1^2 + (\frac{4000}{4})^2}} = \frac{1}{\sqrt{1000001}} \approx 0.001$$

$$\angle \mathbf{H}(j\omega)_{\omega=4} = -\tan^{-1}(\frac{4}{4}) = -45^\circ$$

$$\angle \mathbf{H}(j\omega)_{\omega=4000} = -\tan^{-1}(\frac{4000}{4}) = -89.94^\circ \approx -90^\circ$$

(c)

$$v_o(t)\Big|_{\omega=4} = 5\sqrt{2}\cos(4t - 45^\circ)\text{V}$$

$$v_o(t)\Big|_{\omega=4000} = 0.01\cos(4000t - 90^\circ)\text{V}$$

(d)

$$v_o(t) = v_o(t)\Big|_{\omega=4} + v_o(t)\Big|_{\omega=4000}$$
$$= 5\sqrt{2}\cos(4t - 45^\circ) + 0.01\cos(4000t - 90^\circ)\text{V}$$

(a) $\mathbf{H}(j\omega) =$ ____________________,

(b) $\mathbf{H}(j\omega) = |\mathbf{H}|\angle\phi$

where $|\mathbf{H}|$ (at ω = 4 rad/s) = ____________________,

$|\mathbf{H}|$ (at ω = 4000 rad/s) = ____________________,

and ϕ (at ω = 4 rad/s) = ____________________,

ϕ (at ω = 4000 rad/s) = ____________________,

(c) $v_o(t)$ (for ω = 4 rad/s) = ____________________,

$v_o(t)$ (for ω = 4000 rad/s) = ____________________,

(d) $v_o(t)$ = ____________________.