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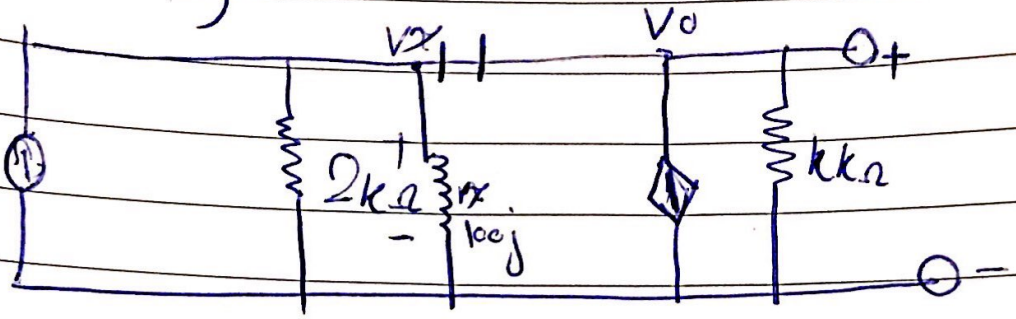
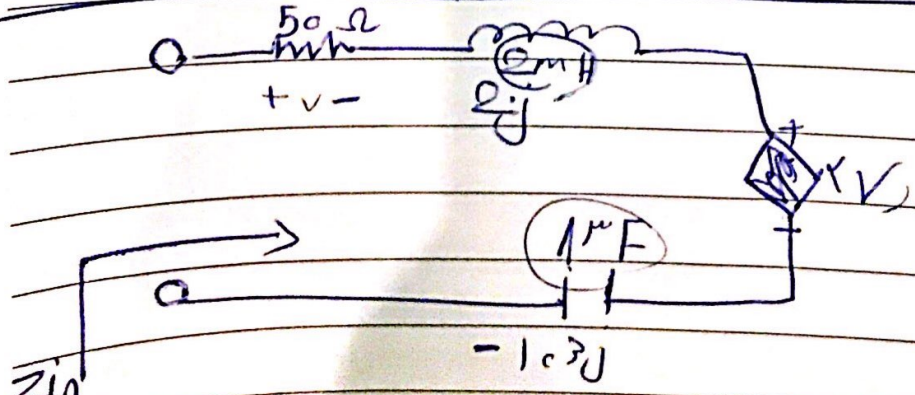
$\omega = 2k$ Rad/s



KCL: $-10 + \frac{V_x}{2\times10^3} + \frac{V_x}{100j} + \frac{V_x - V_o}{-250j} = 0 \rightarrow V_x = \frac{2\times10^5 - 4V_o}{j+4}$

$\frac{V_o - V_x}{-200j} + 0.1V_x + \frac{V_o}{4\times10^3} = 0 \rightarrow V_x = \frac{10V_o - 400}{4j}$

$V_o = \frac{32\times10^5 + 800 - 800j}{300 + 150j} = 1.53.2078 \sin(2\times10^3 t - 0.4780)$



$V = -5\times10^3 ij + 2(50i) + 2ji + 0.5i$

$Z = \frac{V}{I} = -10^3 j + 100 + 2j + 50 = 0.78j + 180$

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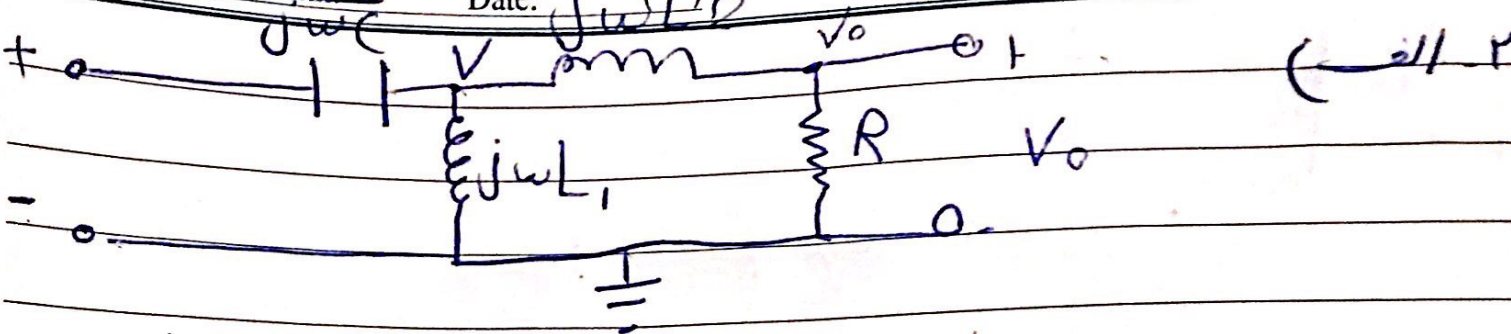

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KCL: $(V-V_i)j\omega C + \frac{V}{j\omega L_1} + \frac{V-V_o}{j\omega L_2} = 0$

$\Rightarrow -(V-V_i)\omega^2 L_1 L_2 C + V + V - V_o = 0$

KCL: $\frac{V_o - V}{j\omega L_2} + \frac{V_o}{R} = 0 \Rightarrow V = \left(1 + \frac{j\omega L_2}{R}\right) V_o$

$\left(2 - \omega^2 L_1 L_2 C\right)\left(1 + \frac{j\omega L_2}{R}\right) V_o - V_o + \omega^2 L_1 L_2 C V_i = 0$

$1 - \omega^2 L_1 L_2 C + j\left(\frac{2\omega L_2 - \omega^2 L_1 L_2^2 C}{R}\right) V_o = -\omega^2 L_1 L_2 C V_{o1}$

$\Rightarrow \frac{V_o}{V_i} = \frac{-\omega^2 L_1 L_2 C}{1 - \omega^2 L_1 L_2 C + j\left(\frac{2\omega L_2 - \omega^2 L_1 L_2^2 C}{R}\right)}$ تابع انتقال

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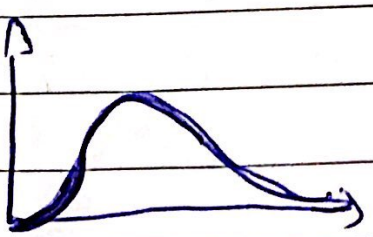
ب)

$$\left|\frac{V_o}{V_i}\right| = \frac{\omega^2 L_1 L_2 C}{\sqrt{(1-\omega^2 L_1 L_2 C)^2 + \left(\frac{\omega L_2 - \omega^2 L_1 L_2^2 C}{R}\right)^2}}$$

فیلتر میان گذر



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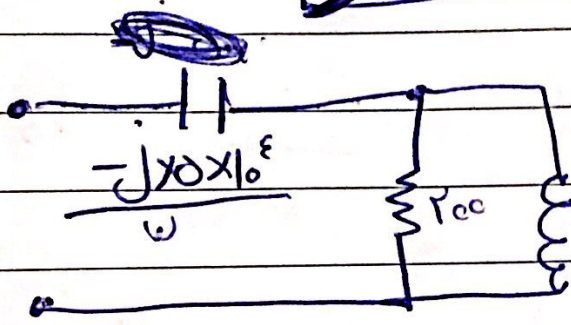

$$Z_{eq} = \frac{-j\times5\times10^4}{\omega} + \frac{80\,j\omega}{200 + 0.4j\omega} = \frac{-j\times5\times10^4}{\omega} + \frac{80\,j\omega(200-0.4j\omega)}{\omega^2 0.16 + 4\times10^4}$$

$$= \frac{-j2\times10^5 - j\omega^2 8\times10^3 + j\omega^2 16\times10^3 + 32\omega^3}{\omega(\omega^2 0.16 + 4\times10^4)}$$

$$\Rightarrow 8\times10^3\omega^2 - 2\times10^5 = 0 \Rightarrow \omega^2 = \frac{1}{4}\times10^6 \Rightarrow \omega = 500 \Rightarrow f = \frac{250}{\pi}$$

ب)

$$Z_{max}: \frac{32\times500^3}{(4\times10^4 + 0.16\times500^2)\times500} = 100$$