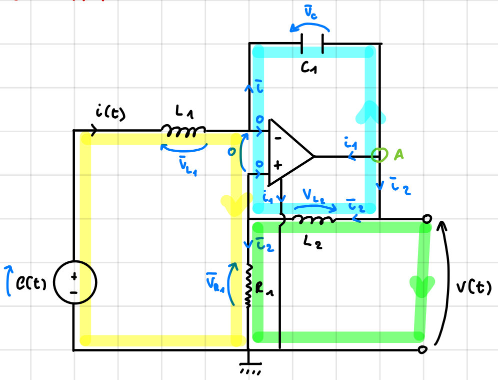
ESERCITAZIONE

ESERCIZIO 14.1



$L_1 = 1H \quad R_1 = 2\,\Omega \qquad v(t) = ? \quad i(t) = ? \quad p_a^{op}(o) = ?$

$L_2 = 2H \quad C_1 = 1\,F$

$e(t) = \sin(wt)\ V$

$z_{L_1} = jwL_1 = j\ \Omega \qquad e(t) = \cos(wt - \frac{\pi}{2}) \rightarrow \bar{e} = e^{-j\frac{\pi}{2}} = -j\ V$

$z_{L_2} = jwL_2 = 2j\ \Omega$

$z_{C_1} = 1/jwC_1 = -j\ \Omega \qquad \bar{V}_{L_1} = j\bar{i}, \quad \bar{V}_c = -j\bar{i}$

$z_{R_1} = R_1 = 2\ \Omega \qquad \bar{V}_{L_2} = 2j\bar{i}_2, \quad \bar{V}_{R_1} = 2\bar{i}_2$

$\bar{V}_c = -\bar{V}_{L_2} = +j\bar{i} \quad \rightarrow \quad 2j\bar{i}_2 = j\bar{i} \rightarrow \bar{i}_2 = \frac{\bar{i}}{2}$

$\bar{e} - \bar{V}_{L_1} = \bar{V}_R \quad \rightarrow \quad \bar{i} = \frac{-j-1}{2} = \dots = \frac{\sqrt{2}}{2}e^{j\frac{5}{4}\pi} \implies i(t) = \frac{\sqrt{2}}{2}\cos(wt + \frac{5}{4}\pi)\ A$

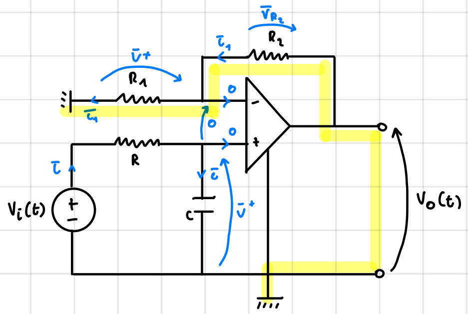
$\bar{V} = \bar{V}_{R_1} + \bar{V}_{L_2} \quad \rightarrow \quad \bar{V} = (1+j)\bar{i} = \dots = e^{-j\frac{\pi}{2}} \implies v(t) = \cos\pi t(wt - \frac{\pi}{2}) = \sin(wt)\ V$

$\bar{i}_1 = \frac{\bar{i}}{2} = \frac{1+j}{4}$

$\hat{A} = \frac{1}{2}(-j)\left(\frac{1-j}{4}\right) = \frac{1}{8} + j\frac{1}{8} \quad \rightarrow \quad P = \frac{1}{8} \implies p_a(t) = P + |\hat{A}|\cos(2wt + \angle\bar{v} + \angle\bar{i})$

$|\hat{A}| = \dots = \frac{\sqrt{2}}{8} \qquad = \frac{1}{8} + \frac{\sqrt{2}}{8}\cos(2wt + \frac{3}{4}\pi)$

ESERCIZIO 2



$R_1 = 1K\Omega \qquad C = 100\,\mu F \qquad V_o(t) = ? \ \Big|\ \begin{matrix} w_1 = 100\ rad/s \\ w_2 = 100\ Krad/s \\ w_3 = 100\ Mrad/s \end{matrix}$

$R_2 = 10\ K\Omega \qquad V_i(t) = 5\cos(wt + \frac{\pi}{3})\ V$

$R = 100\ \Omega$

Che filtro è?

$\bar{V}_i = 5e^{j\frac{\pi}{3}} \qquad z_R = R, \quad z_{R_1} = R_1, \quad z_{R_2} = R_2$

$z_C = -j\frac{1}{wC}$

$\bar{V}^+ = \bar{V}_i \frac{z_C}{z_R + z_C} \quad \rightarrow \quad \bar{i}_1 = \frac{\bar{V}^+}{z_{R_1}}$

$\bar{V}_o = \bar{V}_{R_2} + \bar{V}^+ = z_{R_2}\bar{i}_1 + \bar{V}^+ = V^+\left(1 + \frac{z_{R_2}}{z_{R_1}}\right) = \bar{V}_i\left(\frac{z_C}{z_R + z_C}\right)\left(1 + \frac{z_{R_2}}{z_{R_1}}\right) = \left(1 + \frac{R_2}{R_1}\right)\frac{1}{1 + jwRC}\bar{V}_i$

$\Downarrow$

$H(jw) = \frac{\bar{V}_o(jw)}{\bar{V}_i(jw)} = \left(1 + \frac{R_2}{R_1}\right)\frac{1}{1 + jwRC} = \left(1 + \frac{R_2}{R_1}\right)\frac{1}{1 + j\frac{w}{w_1}}$

$|H(jw)| = \left|1 + \frac{R_2}{R_1}\right| \cdot |1| \div \left|1 + j\frac{w}{w_T}\right| = \left(1 + \frac{R_2}{R_1}\right)\cdot\frac{1}{\sqrt{1 + \frac{w^2}{w_T^2}}}$

$\arg(H(jw)) = \angle 1 + \frac{R_1}{R_2} + \angle 1 - \angle 1 + j\frac{w}{w_T} = -\arctan\left(\frac{w}{w_1}\right)$

$\Big\}\ |H(jw)| = \prod |P|$

$\arg(H(jw)) = \sum \angle P$

$\Downarrow$

$w \to 0 \ : \ |H(jw)| = 1 + \frac{R_2}{R_1} \ ; \quad \arg(H(jw)) = 0$

$w \to \infty \ : \ |H(jw)| = 0 \ ; \quad \arg(H(jw)) = -\frac{\pi}{2}$

$w \to w_T \ : \ |H(jw)| = \frac{\sqrt{2}}{2} \qquad \arg(H(jw)) = -\frac{\pi}{4}$

$\implies$

$\Downarrow$

filtro passa-basso

$V_o(jw) = \bar{H}(jw)\cdot\bar{V}_i(jw) = |H||V_i|e^{j(\angle H + \angle V_i)} \implies v_o(t) = \dots = \underline{5\cdot\frac{11}{\sqrt{1 + (w/w_T)^2}}\cdot\cos\left(wt + \frac{\pi}{3} - \arctan\left(\frac{w}{w_c}\right)\right)}$

$V_o(t)\Big|_{\substack{w_1 \\ w_2 \\ w_3}} = \dots$