5.1) a) $Z_R = R$ $\quad V_L = Z_L \cdot I_L = V_0$

$Z_L = j\omega L$ $\quad I_L = I_S \cdot \frac{R}{j\omega L + R}$ $\quad \Rightarrow V_0 = I_S \cdot \frac{j\omega L R}{j\omega L + R}$

b) $\left| \frac{V_0}{I_S} \right| = \left| \frac{j\omega L R}{j\omega L + R} \right| = \frac{\omega L R}{\sqrt{R^2 + \omega^2 L^2}}$

$\frac{\omega L R}{\sqrt{R^2 + \omega^2 L^2}} = 0{,}707$ com $R = 1\text{k}\Omega$, $L = 1\text{mH}$ Logo $\omega = 707$ e $f = \frac{\omega}{2\pi} = 112.5\text{ Hz}$

5.2) a) $V_{AB} = R_2 \cdot I_{AB}$

Temos um divisor de corrente logo:

$I_{AB} = I_S \cdot \frac{R_1}{R_1 + R_2 + \frac{1}{j\omega C_2}} = I_S \cdot \frac{C_2 j\omega R_1}{C_2 j\omega (R_1 + R_2) + 1}$

Logo $V_{AB} = I_S \cdot \frac{C_2 j\omega R_1 R_2}{C_2 j\omega (R_1 + R_2) + 1}$

$Z_{AB} = (Z_{C_2} + Z_{R_1}) // Z_{R_2} = \left(\frac{1}{C_2 j\omega} + R_1\right) // R_2 =$

$= \left(\frac{C_2 j\omega}{1 + R_1 C_2 j\omega} + \frac{1}{R_2}\right)^{-1} = \frac{R_2 (1 + R_1 C_2 j\omega)}{1 + R_1 C_2 j\omega + R_2 C_2 j\omega}$

$Z_{AB} = \frac{R_2 + R_1 R_2 C_2 j\omega}{1 + (R_1 + R_2) j\omega C_2}$

5.3) a)

$Z_t = (Z_{C_2} + Z_{L_2}) // Z_{L_1} + Z_{C_1} = \left(L_2 j\omega + \frac{1}{C_2 j\omega}\right) // L_1 j\omega + \frac{1}{C_1 j\omega} = \left(\frac{C_2 j\omega}{1 - L_2 C_2 \omega} + \frac{1}{L_1 j\omega}\right)^{-1} + \frac{1}{C_1 j\omega} =$

$= j\left(\frac{\omega L_1 (1 - \omega^2 L_2 C_2)}{1 - \omega^2 C_2 (L_1 + L_2)} - \frac{1}{\omega C_1}\right)$

b) $Z_t = (Z_{C_2} + Z_{L_2}) // Z_{C_1} + Z_{L_1} = \left(L_2 j\omega + \frac{1}{C_2 j\omega}\right) // \frac{1}{C_1 j\omega} + L_1 j\omega = \left(\frac{C_2 \omega j}{1 - L_2 C_2 \omega} + C_1 j\omega\right)^{-1} + L_1 j\omega =$

$= j\left(\omega L_1 - \frac{1 - L_2 C_2 \omega^2}{1 + \frac{C_2}{C_1} - \omega^2 C_2 L_2} \cdot \frac{1}{\omega C_1}\right)$

5.4) a) $I_S = 5 e^{j\frac{\pi}{4}}\text{ A}$

b) $V_C(j\omega) = \frac{1}{C\omega j} \cdot \frac{j\omega L \cdot i_G}{j\omega L + R + \frac{1}{j\omega C}}$ → Divisor de corrente!

$F(j\omega) = \frac{j\omega L}{C\omega j \left(j\omega L + R + \frac{1}{j\omega C}\right)} = \frac{j\omega L}{1 - \omega^2 CL + j\omega CR}\ \Omega$

c) $V_C(j\omega) = \frac{j\omega L}{1 - \omega^2 CL + j\omega CR} \cdot i_G = \frac{1}{2} \cdot i_G \quad \Rightarrow V_C(t) = 2.5 \cos\left(1000t + \frac{\pi}{4}\right)$

$\bar{V}_C = 2.5 e^{j\frac{\pi}{4}}$

$R = 200\,\Omega$
$C = 100\,\mu\text{F}$ Calculadora
$L = 10\,\text{mH}$
$\omega = 1000$

5.5) $i(t) = 0.8 \sin(20t) = 0.8 \cos(20t - \frac{\pi}{2}) = 0.8\, e^{-\frac{\pi}{2} j}$

$V_s(t) = 50 \cos(20t - 53^\circ \cdot \frac{\pi}{180^\circ}) = 50\, e^{-53^\circ j}$

Pela malha:

$$Ri + j\omega L i + V_s - V_{im} = 0 \iff 100 \cdot 0{,}8\, e^{-\frac{\pi}{2} j} + j \cdot 20 \cdot 10 \cdot e^{-\frac{\pi}{2} j} + 50 e^{-53^\circ j} = V_{im}$$

calculadora:

$$V_{im} = 244.76\, e^{-0.562844\, j} = 244.76 \cos(20t - \underbrace{0.562844}_{\downarrow\ 32.2^\circ \cdot \frac{\pi}{180^\circ}})$$

5.6) a)

$R_1 = 4\,\Omega$

$R_2 = 10\,\Omega$

$C_1 = 1\,mF$

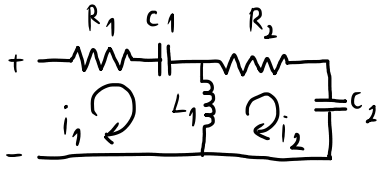
$C_2 = 0.25\,mF$

$L_1 = 12\,mH$

$$\left(R_2 + \frac{1}{j\omega C_2}\right) // \; j\omega L_1 + R_1 + \frac{1}{j\omega C_1} \Rightarrow \text{calculadora} \Rightarrow 8.81\, e^{0.561375 j}$$

$$\overline{Z_t} = 8.81\, e^{32.2^\circ \cdot \frac{\pi}{180^\circ} j}\ \Omega$$

b) Equações das malhas:



Nota: $i_2 = i_c$

$$\begin{cases} R_1 i_1 + \frac{1}{j\omega C_1} i_1 + j\omega L_1 (i_1 - i_2) - V = 0 \\ j\omega L_1 (i_1 - i_2) + R_2 i_2 + \frac{1}{j\omega C_2} i_2 = 0 \end{cases} \quad \text{com} \quad i_2 = 2\, e^{j\frac{\pi}{6}}$$

↳ calculadora $\rightarrow V = 29.96\, e^{-34.1^\circ \cdot \frac{\pi}{180^\circ} \cdot j}$

$$v(t) = 29.96 \cos(500t - \frac{34.1^\circ}{180^\circ}\pi)$$