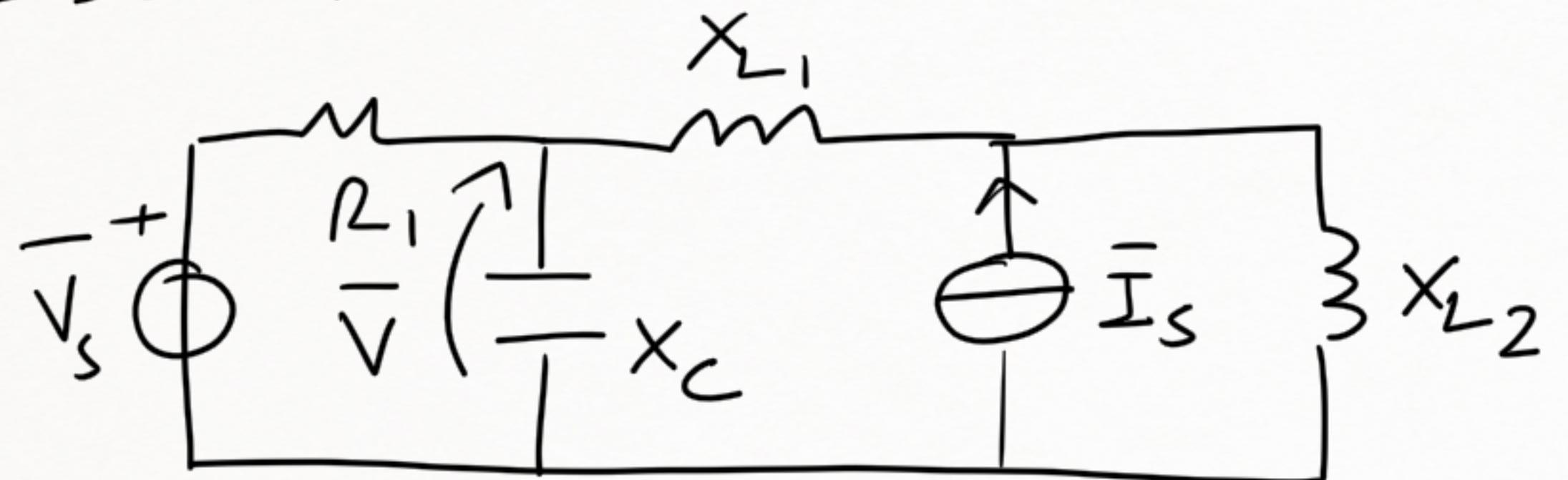
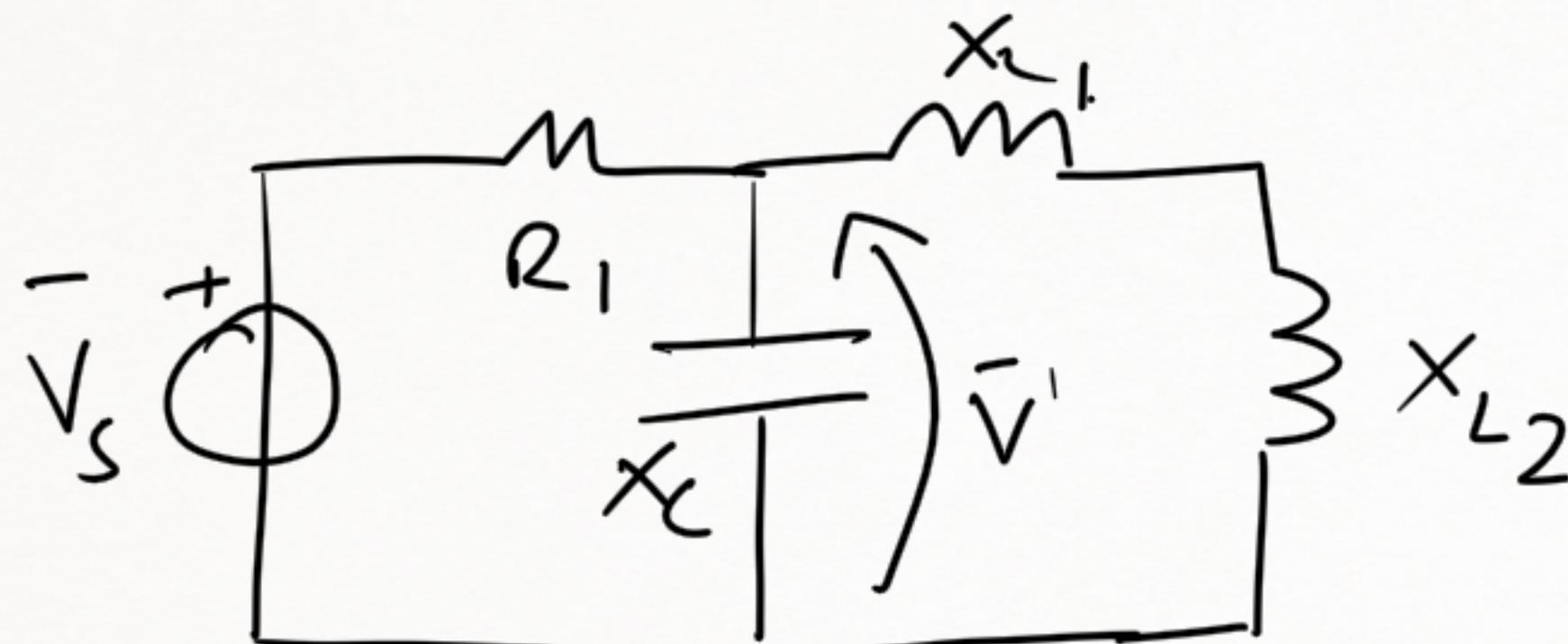


ESE 37



PSE

CASO 1: \bar{V}_s ON \bar{I}_s OFF



$$= (8 - j4) \text{ V}$$

$$\bar{V}_s = 10 \text{ V}$$

$$\bar{I}_s = 10 \text{ A}$$

$$R_1 = 2 \Omega$$

$$X_C = -2 \Omega$$

$$X_{L1} = 1 \Omega$$

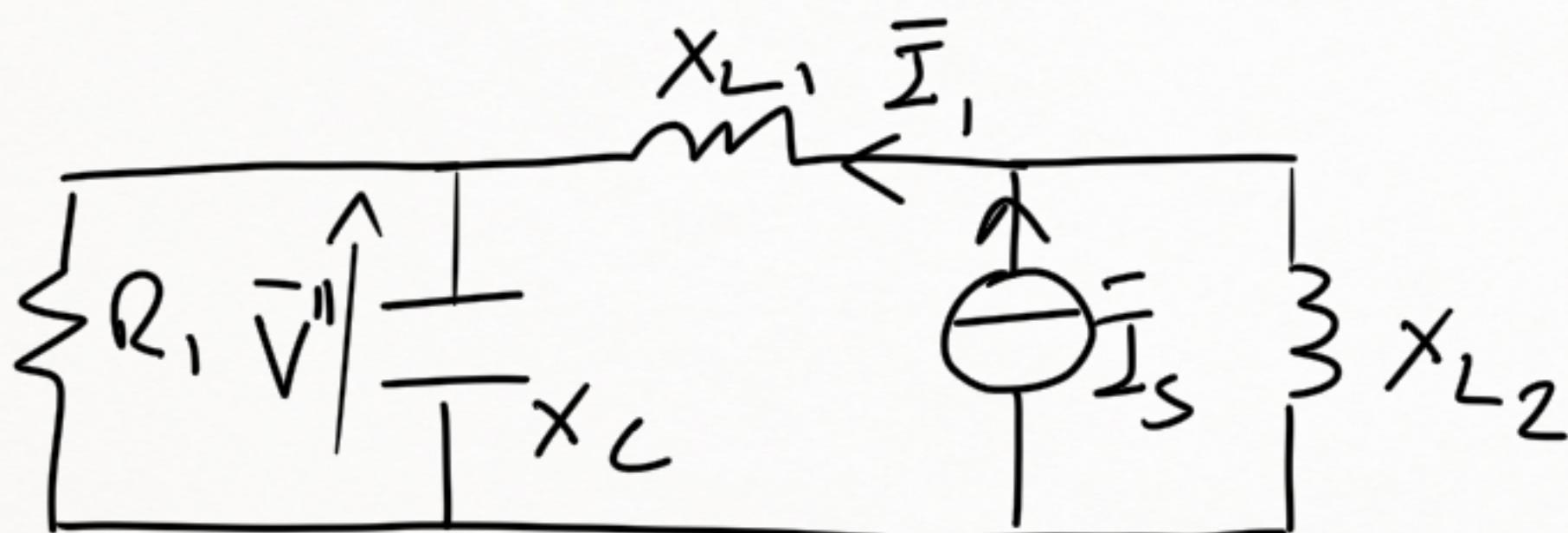
$$X_{L2} = 3 \Omega$$

$$\bar{V} = ?$$

$$\bar{V}' = \bar{V}_s \cdot \frac{jX_C / (jX_{L1} + jX_{L2})}{R_1 + jX_C / (jX_{L1} + jX_{L2})} =$$

$$jX_C // (jX_{L_1} + jX_{L_2}) = -j4\Omega$$

CASO 2: \bar{V}_S OFF \bar{I}_S ON



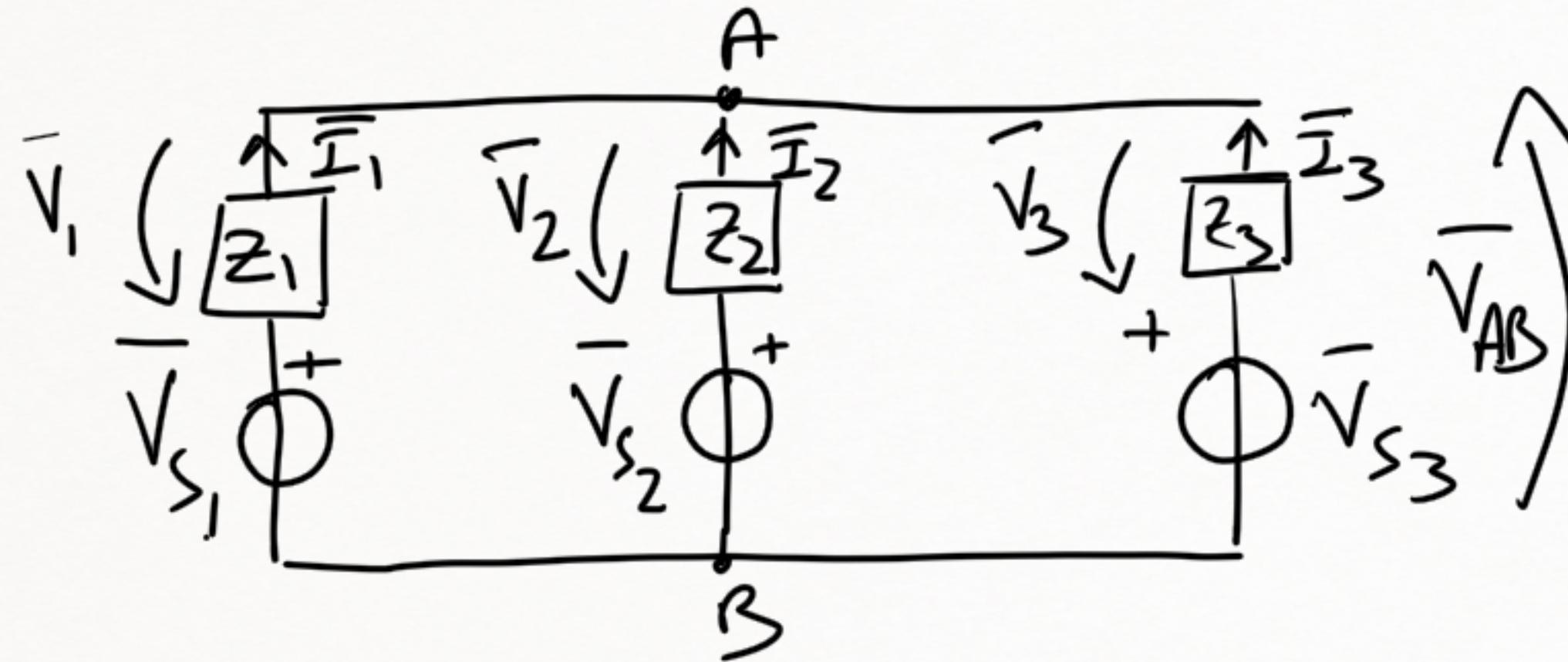
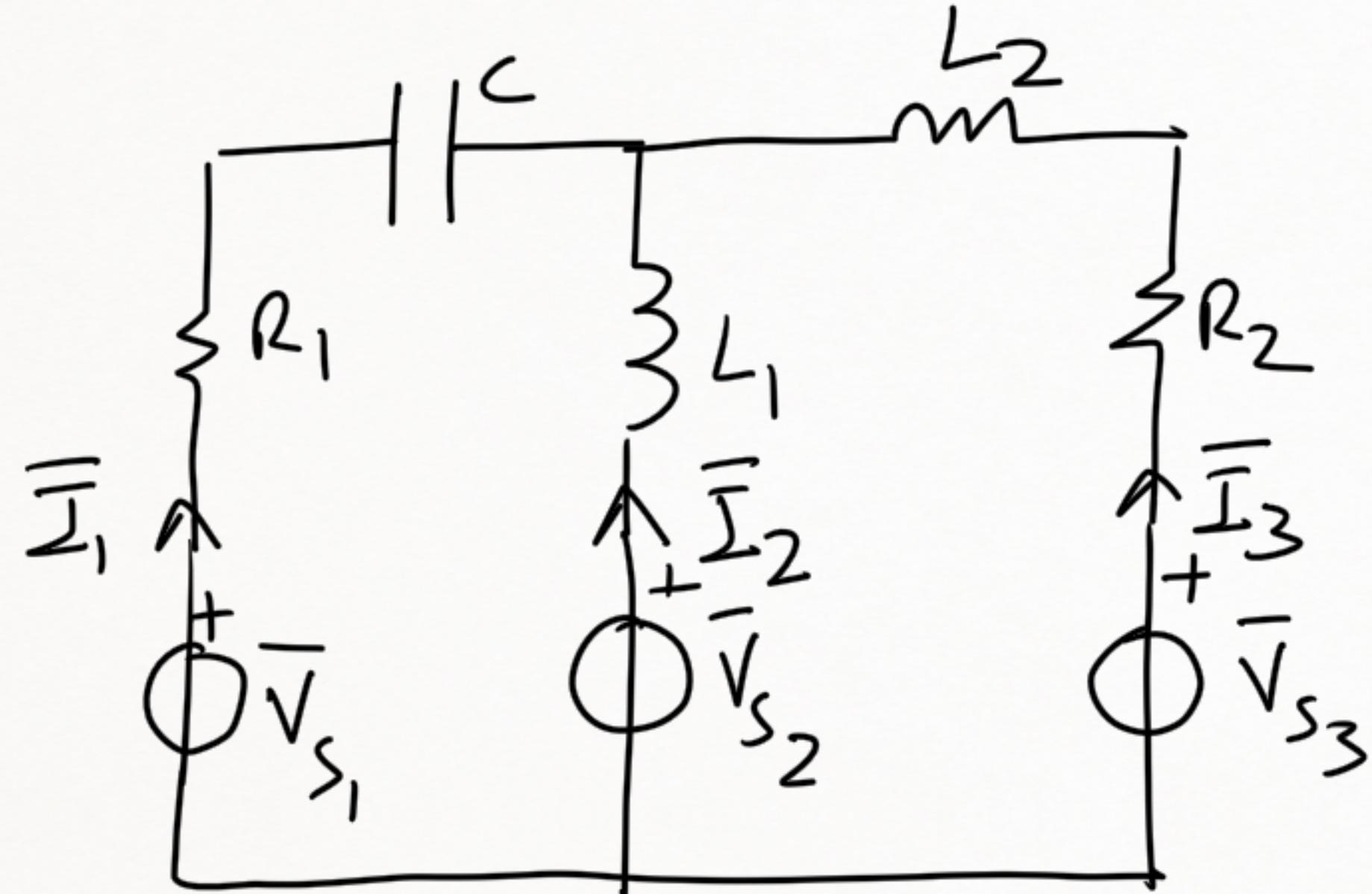
$$R_1 // jX_C = (1-j) \Omega$$

$$\bar{I}_1 = \bar{I}_S \frac{jX_{L_2}}{jX_{L_2} + jX_{L_1} + jX_C // R_1} = (5 + j3) A$$

$$\bar{V}'' = \bar{I}_1 (R_1 // jX_C) = (12 - j6) V$$

$$\bar{V} = \bar{V}' + \bar{V}'' = (20 - j10) V$$

ESE 38



$$\bar{V}_{S_1} = 2\text{ V}$$

$$\bar{V}_{S_2} = (1 - j)\text{ V}$$

$$\bar{V}_{S_3} = j2\text{ V}$$

$$R_1 = R_2 = 1\Omega$$

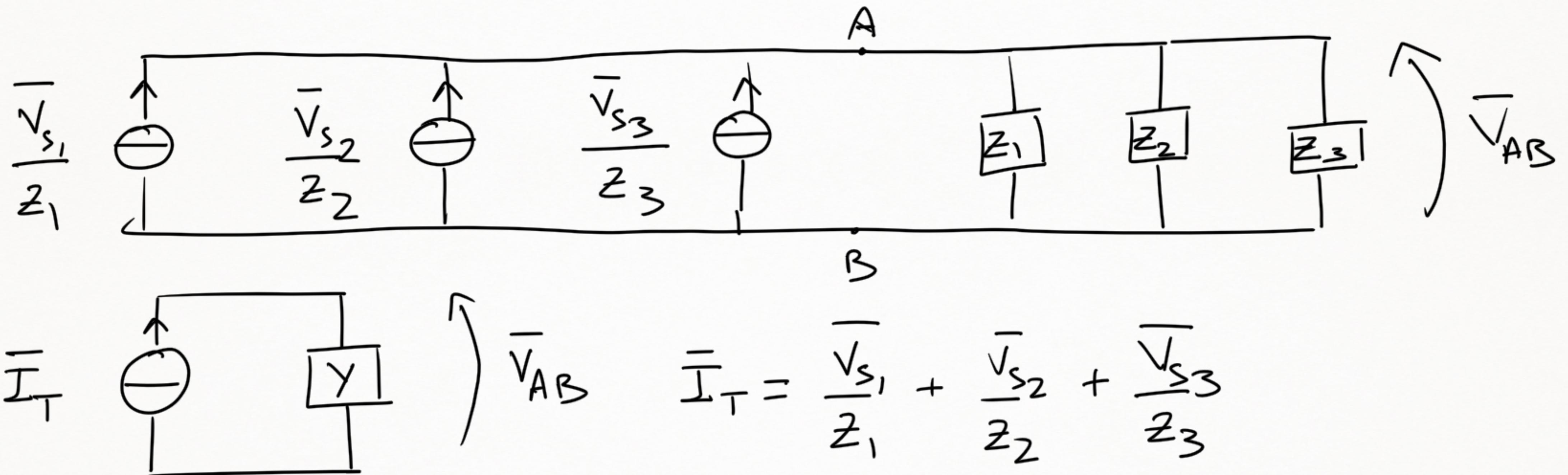
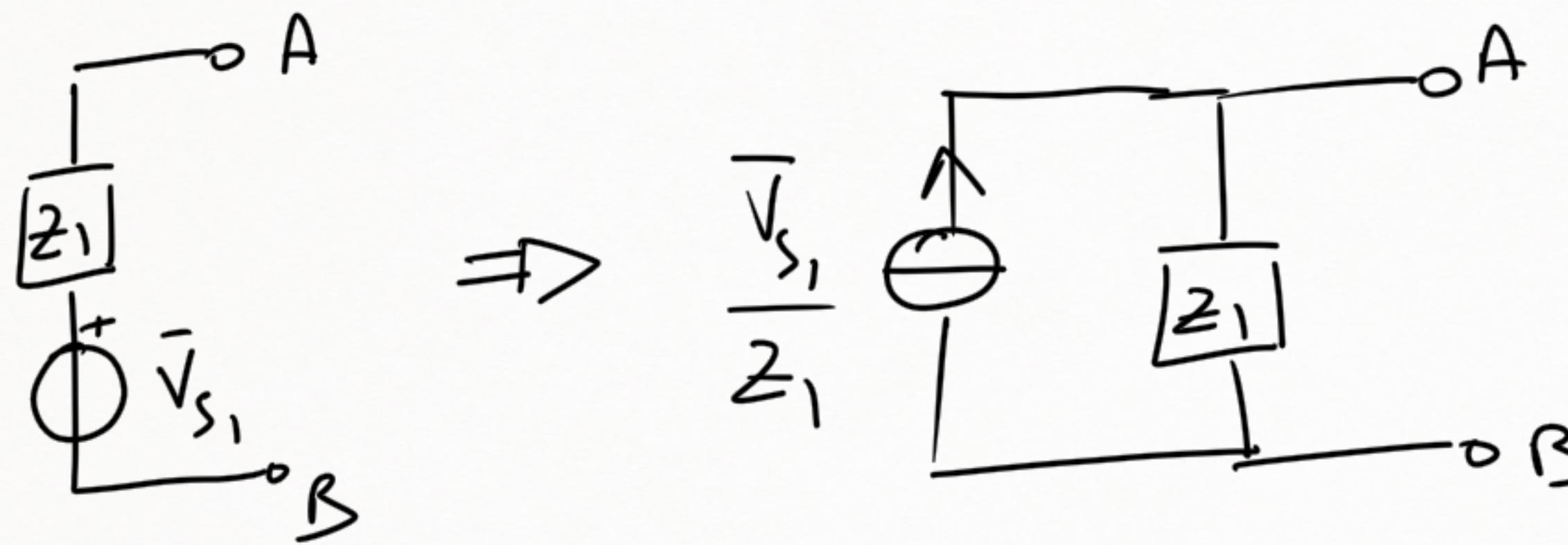
$$X_{L_1} = X_{L_2} = 1\Omega$$

$$X_C = -1\Omega$$

$$S_{\bar{V}_{S_1}} = ?$$

$$S_{\bar{V}_{S_2}} = ?$$

$$S_{\bar{V}_{S_3}} = ?$$



$$Y = Y_1 + Y_2 + Y_3$$

$$Y_1 = \frac{1}{Z_1} = \frac{1}{R_1 + jX_C} = \left(\frac{1}{2} + j\frac{1}{2}\right) s$$

$$Y_2 = \frac{1}{Z_2} = \frac{1}{jX_{L_1}} = -j s$$

$$Y_3 = \frac{1}{Z_3} = \frac{1}{R_2 + jX_L} = \left(\frac{1}{2} - j\frac{1}{2}\right) s$$

$$\bar{V}_{AB} = \frac{\bar{I}_T}{Y} = j V$$

$$\bar{V}_{S_1} = \bar{V}_1 + \bar{V}_{AB} \Rightarrow \bar{V}_1 = \bar{V}_{S_1} - \bar{V}_{AB} = (2-j) V$$

$$\bar{V}_{S_2} = \bar{V}_2 + \bar{V}_{AB} \Rightarrow \bar{V}_2 = \bar{V}_{S_2} - \bar{V}_{AB} = (1-j^2) V$$

$$\bar{V}_{S_3} = \bar{V}_3 + \bar{V}_{AB} \Rightarrow \bar{V}_3 = \bar{V}_{S_3} - \bar{V}_{AB} = j V$$

$$\bar{I}_1 = \frac{\bar{V}_1}{Z_1} = \bar{V}_1 \quad Y_1 = \left(\frac{3}{2} + j \frac{1}{2} \right) A$$

$$\bar{I}_2 = \frac{\bar{V}_2}{Z_2} = \bar{V}_2 \quad Y_2 = (-2-j) A$$

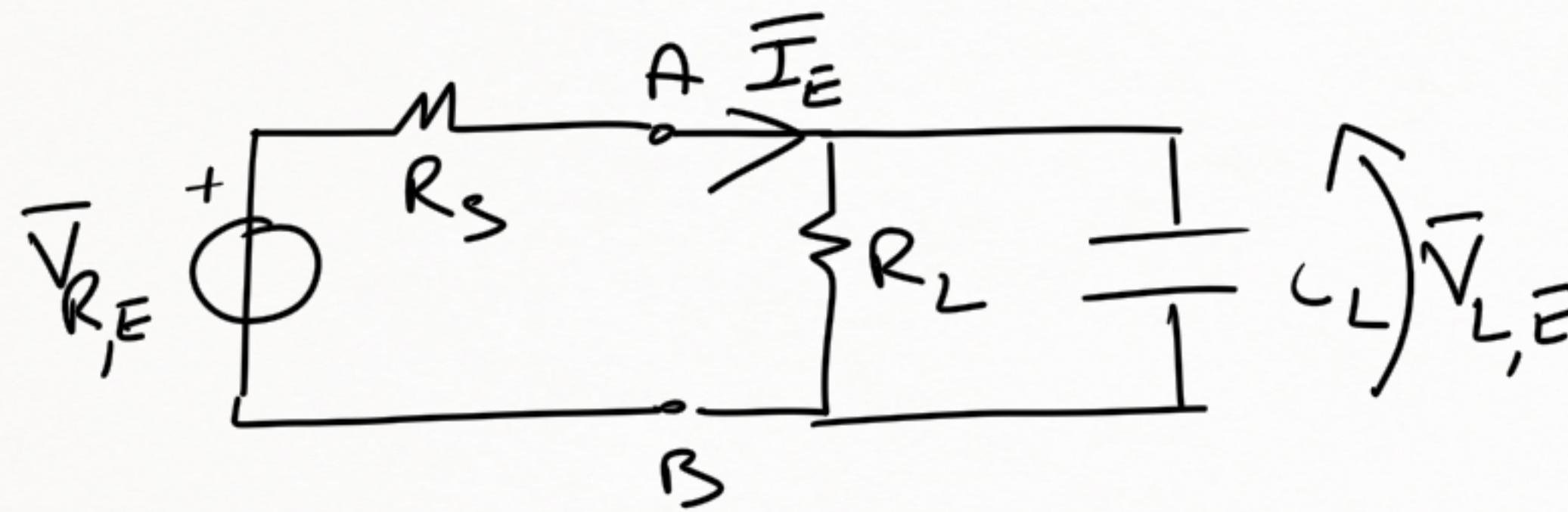
$$\bar{I}_3 = \frac{\bar{V}_3}{Z_3} = \bar{V}_3 \quad Y_3 = \left(\frac{1}{2} + j \frac{1}{2} \right) A$$

$$S_{\bar{V}_{S_1}} = \frac{1}{2} \bar{V}_{S_1} \bar{I}_1^* = \left(\frac{3}{2} - j \frac{1}{2} \right) \text{VA}$$

$$S_{\bar{V}_{S_2}} = \frac{1}{2} \bar{V}_{S_2} \bar{I}_2^* = \left(-\frac{1}{2} + j \frac{3}{2} \right) \text{VA}$$

$$S_{\bar{V}_{S_3}} = \frac{1}{2} \bar{V}_{S_3} \bar{I}_3^* = \left(\frac{1}{2} + j \frac{1}{2} \right) \text{VA}$$

ESE 35



$$\bar{V}_{R,E} = 220 \text{ V}$$

$$R_s = 2 \Omega$$

$$R_L = 16 \Omega$$

$$C_L = 100 \mu\text{F}$$

$$f_R = 50 \text{ Hz}$$

$$P_A \text{ SUL CARICO } R_L // jX_C = ?$$

$$2\pi f_R = \omega_R \approx 314 \frac{\text{rad}}{\text{s}}$$

$$Z_L = R_L // jX_C = (12,77 - j6,42) \Omega$$

$$X_C = - \frac{1}{\omega_R C} = - 31,85 \Omega$$

$$\bar{I}_E = \frac{\bar{V}_{R,E}}{R_s + R_L // jX_C} = (12,52 + j5,44) \text{ A}$$

$$P_A = \operatorname{Re} \left\{ Z_L |\bar{I}_E|^2 \right\} \simeq 2,383 \text{ kW}$$

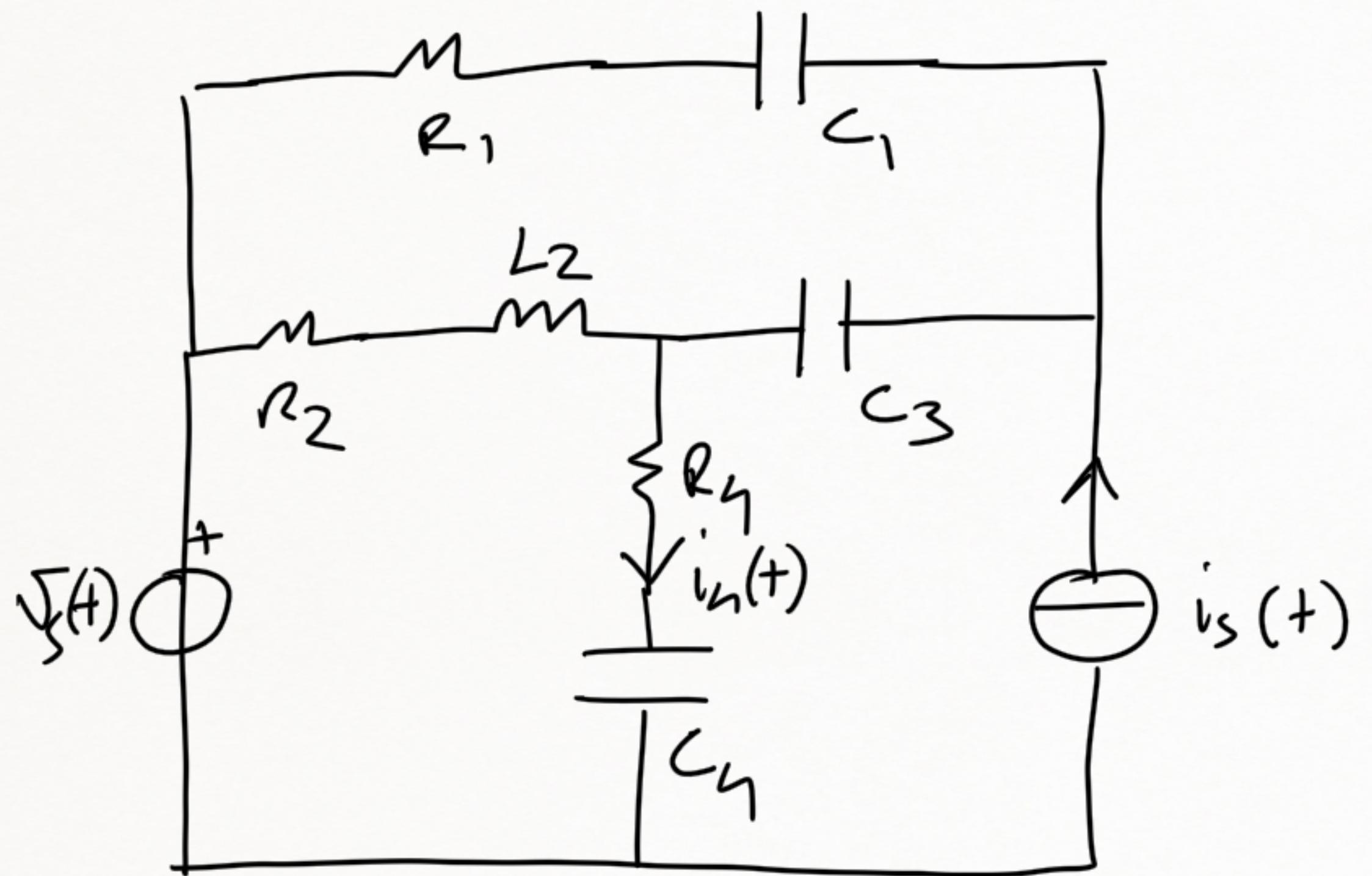
$$\bar{V}_{L,E} = \bar{V}_{R,E} \frac{Z_L}{R_S + Z_L} = (154,4 - j19,88) \text{ V}$$

$$P_A = \operatorname{Re} \left\{ \frac{|\bar{V}_{L,E}|^2}{Z^*} \right\} \simeq 2,383 \text{ kW}$$

$$P_A = \operatorname{Re} \left\{ \bar{I}_E^* \cdot \bar{V}_{L,E} \right\} = |\bar{I}_E| |\bar{V}_{L,E}| \cos(\varphi_V - \varphi_I) \simeq 2,383 \text{ kW}$$

$$\varphi_V = -0,053 \text{ rad} \quad ; \quad \varphi_I = 0,41 \text{ rad}$$

ESE 40



$$R_1 = R_2 = R_L = 1 \Omega$$

$$L_2 = 1 \text{ H}$$

$$C_1 = C_3 = C_L = 1 \text{ F}$$

$$V_s(t) = 4\sqrt{2} \cos(\omega_1 t + \frac{\pi}{4}) \text{ V}$$

$$i_s(t) = 5 \cos(\omega_2 t + \frac{\pi}{2}) \text{ A}$$

$$\omega_1 = 1 \frac{\text{rad}}{\text{s}}$$

$$\omega_2 = 2 \frac{\text{rad}}{\text{s}}$$

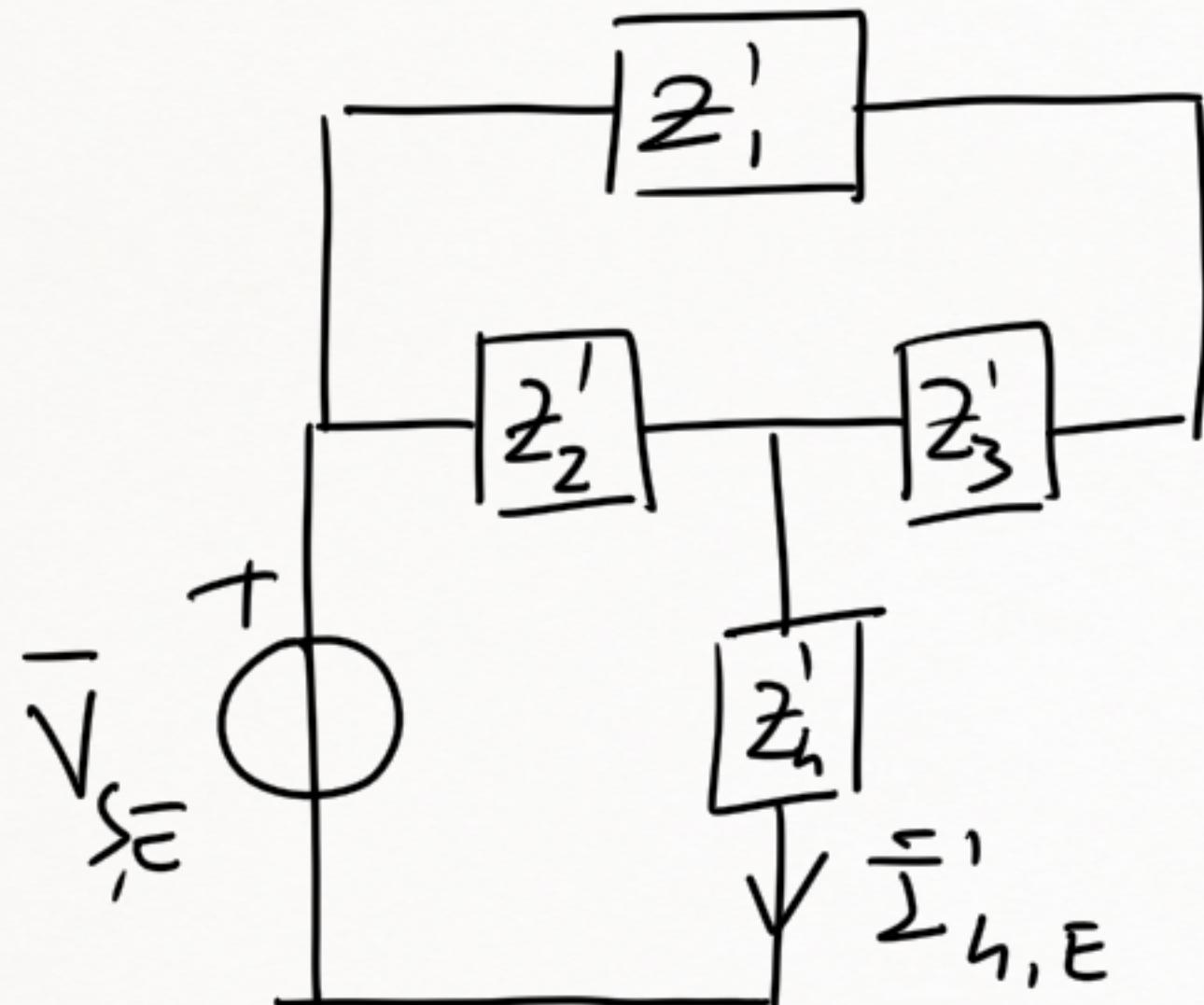
$$i_m(t) = ?$$

$$P_{R_L} = ?$$

ω_1 ;

$$\bar{V}_S = \sqrt{2} e^{j\frac{\pi}{4}} = \sqrt{2} \left(\frac{\sqrt{2}}{2} + j \frac{\sqrt{2}}{2} \right) = (1+j) V$$

$$\bar{V}_{S,E} = \frac{\bar{V}_S}{\sqrt{2}} = (1+j) V$$

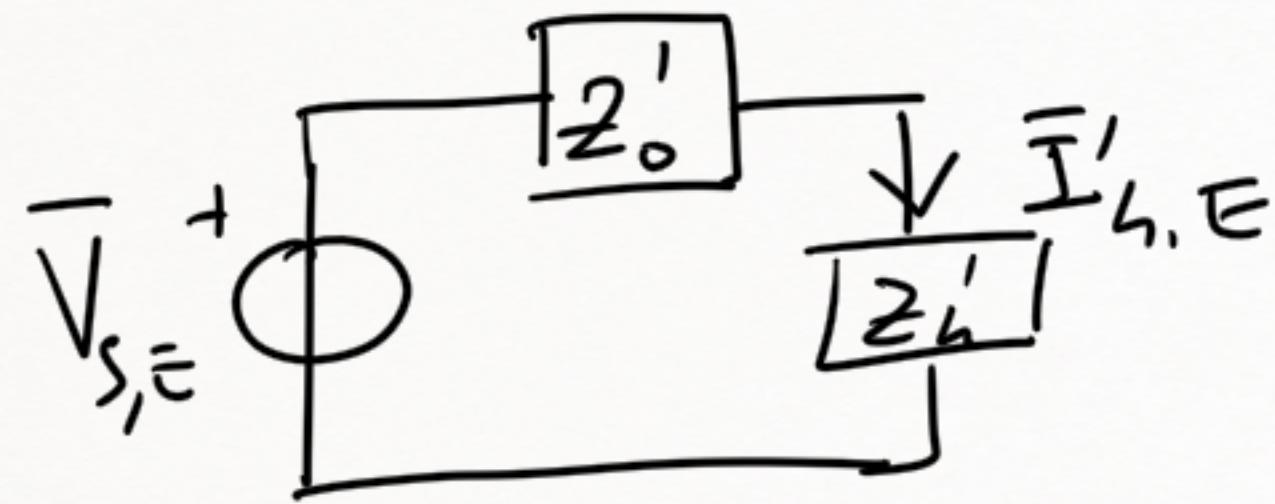


$$z'_1 = R_1 + j \left(-\frac{1}{\omega_1 C_1} \right) = (1-j) \Omega$$

$$z'_2 = R_2 + j \omega_1 L_2 = (1+j) \Omega$$

$$z'_3 = -j \frac{1}{\omega_1 C_3} = -j \Omega$$

$$z'_4 = R_4 - j \frac{1}{\omega_1 C_4} = (1-j) \Omega$$



$$Z_0' = (Z_1' + Z_3') // Z_2' = \left(\frac{7}{5} + j \frac{1}{5} \right) \Omega$$

$$\bar{I}_{L,E}' = \frac{\bar{V}_{S,E}}{Z_0' + Z_L'} = \left(\frac{1}{\sqrt{2}} + j \frac{2}{\sqrt{2}} \right) A$$

$$P_{R_L} = R_L |\bar{I}_{L,E}'|^2 = \frac{5}{2} W$$

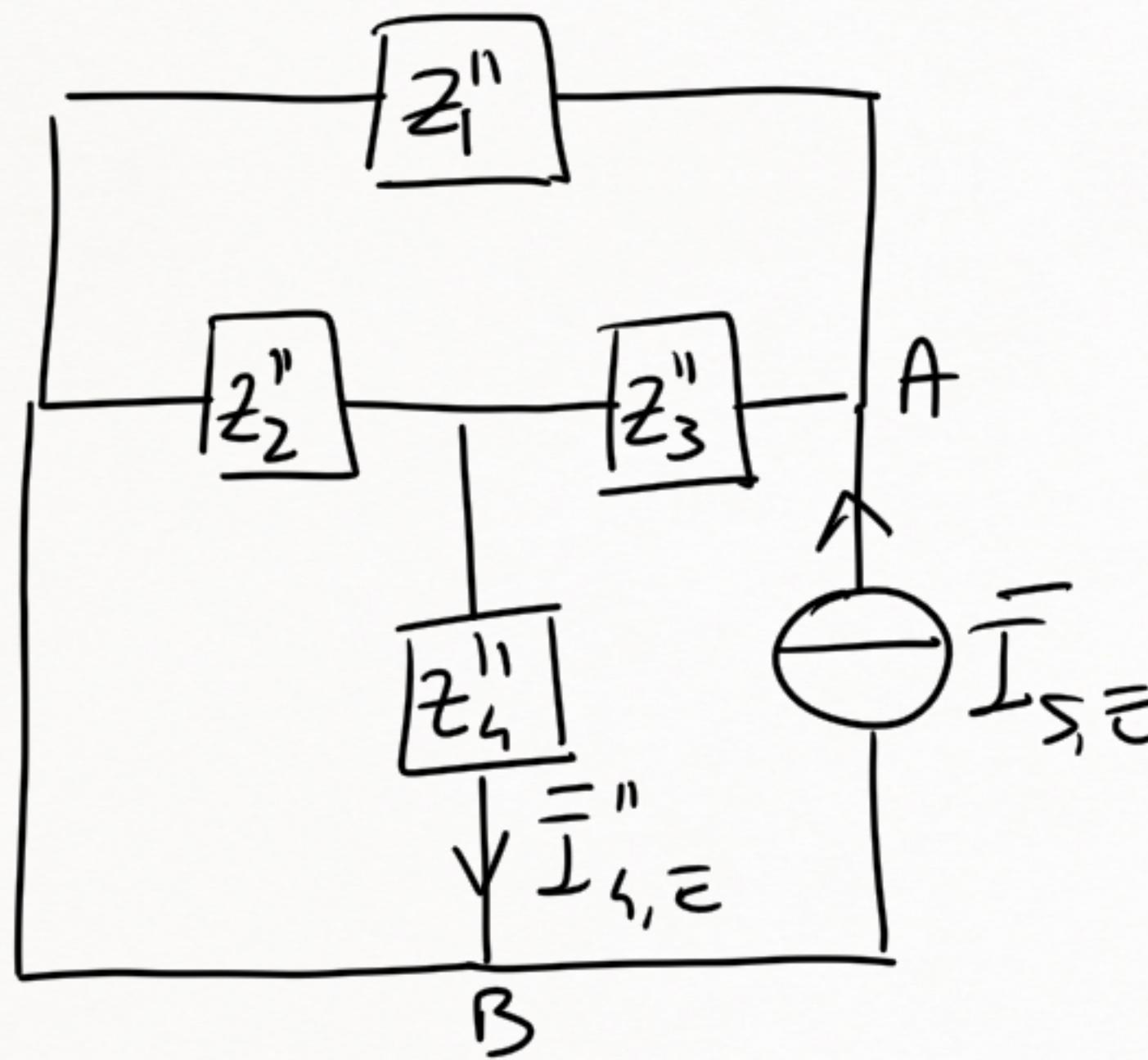
$$\varphi_I = \arctan 2 \left(\frac{2}{\sqrt{2}}, \frac{1}{\sqrt{2}} \right) = 1,11 \text{ rad}$$

$$i_L'(t) = \operatorname{Re} \left\{ \sqrt{2} \bar{I}_{L,E}' e^{j\omega t} \right\} = \sqrt{5} \cos(\omega t + 1,11) A$$

$\omega_2 :$

$$\bar{I}_S = 5 e^{j\frac{\pi}{2}} = j5 \text{ A}$$

$$\bar{I}_{S,\Xi} = \frac{\bar{I}_S}{\sqrt{2}} = j \frac{5}{\sqrt{2}} \text{ A}$$

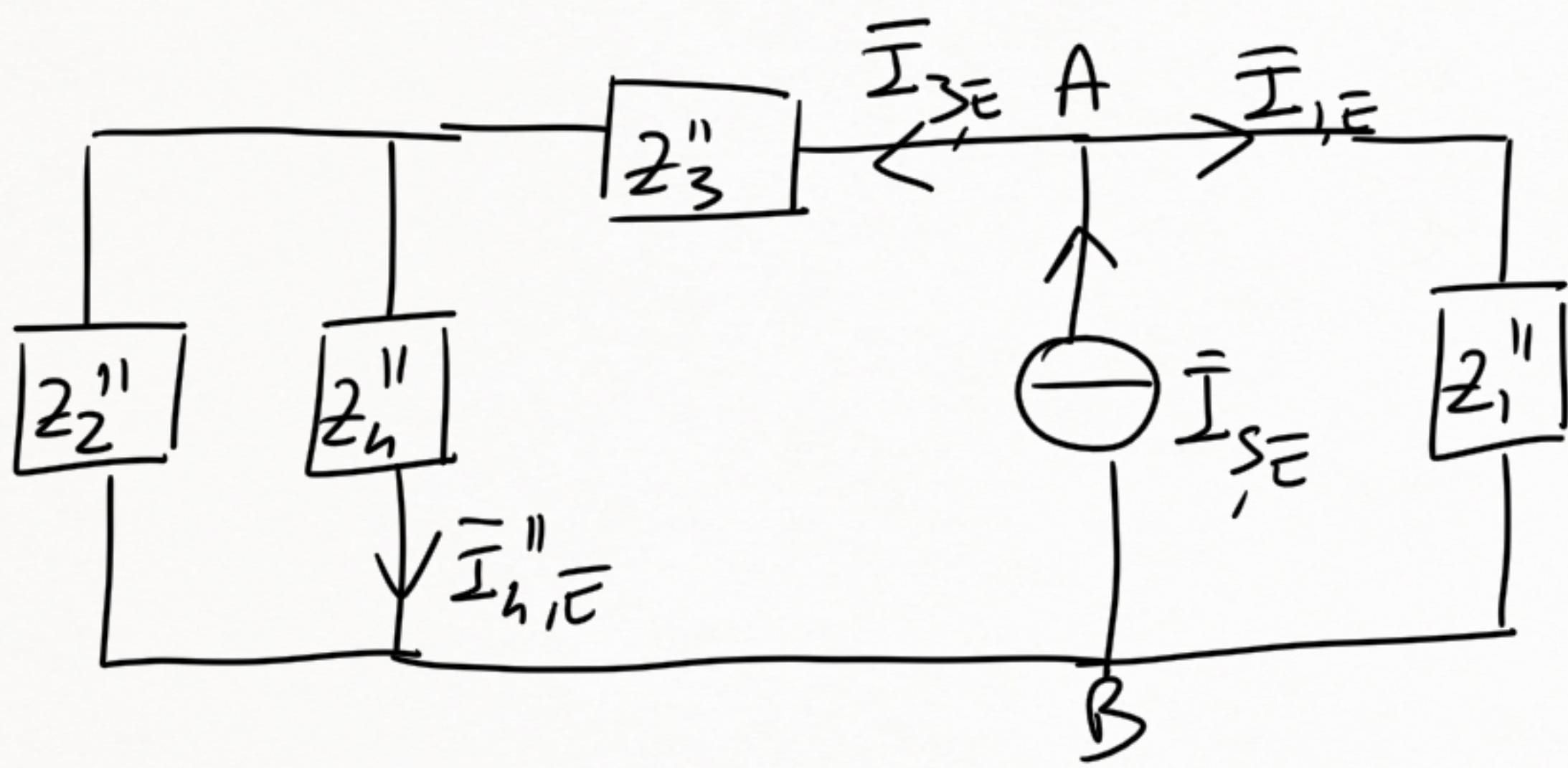


$$Z_1'' = R_1 - j \frac{1}{\omega_2 C_1} = \left(1 - j \frac{1}{2}\right) \Omega$$

$$Z_2'' = R_2 + j \omega_2 L_2 = (1 + j 2) \Omega$$

$$Z_3'' = -j \frac{1}{\omega_2 C_3} = -j \frac{1}{2} \Omega$$

$$Z_4'' = R_3 - j \frac{1}{\omega_2 C_4} = \left(1 - j \frac{1}{2}\right) \Omega$$



$$\bar{I}_{3,E} = \bar{I}_{S,E} \cdot \frac{z_1''}{z_1'' + z_3'' + z_2'' // z_4''} = j \frac{5}{2\sqrt{2}} \text{ A}$$

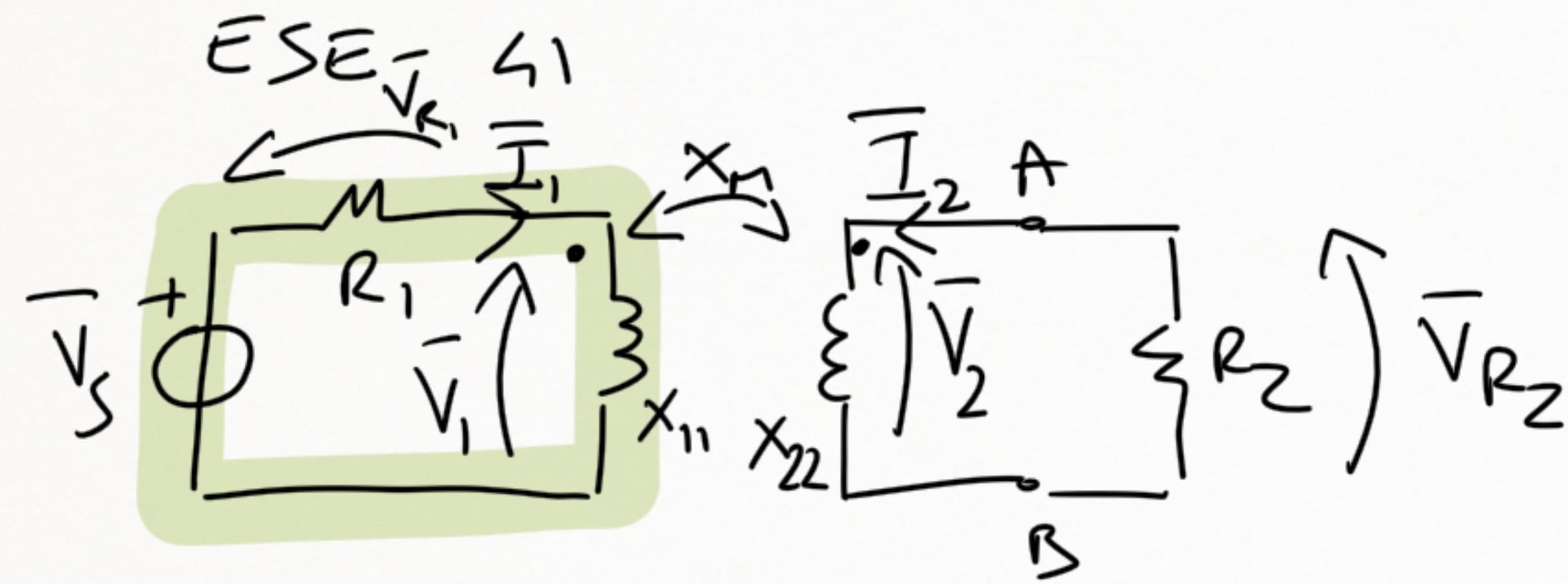
$$\bar{I}_{h,E} = \bar{I}_{3,E} \cdot \frac{z_2''}{z_2'' + z_4''} = \left(-\frac{1}{\sqrt{2}} + j \frac{2}{\sqrt{2}} \right) \text{ A}$$

$$P_{R_h}'' = R_h |\bar{I}_{h,E}''|^2 = \frac{5}{2} W$$

$$i_h''(+) = \operatorname{Re} \left\{ \sqrt{2} \bar{I}_{h,E}'' e^{j \omega_2 t} \right\} = \sqrt{5} \cos(\omega_2 t + 2, 03) A$$

$$P_{R_h} = P_{R_h}' + P_{R_h}'' = 5W$$

$$i_h(t) = i_h'(+) + i_h''(+)$$



$$\bar{V}_s = \left(\frac{5}{2} + j \frac{5}{2} \right) V$$

$$X_{11} = 6 \Omega$$

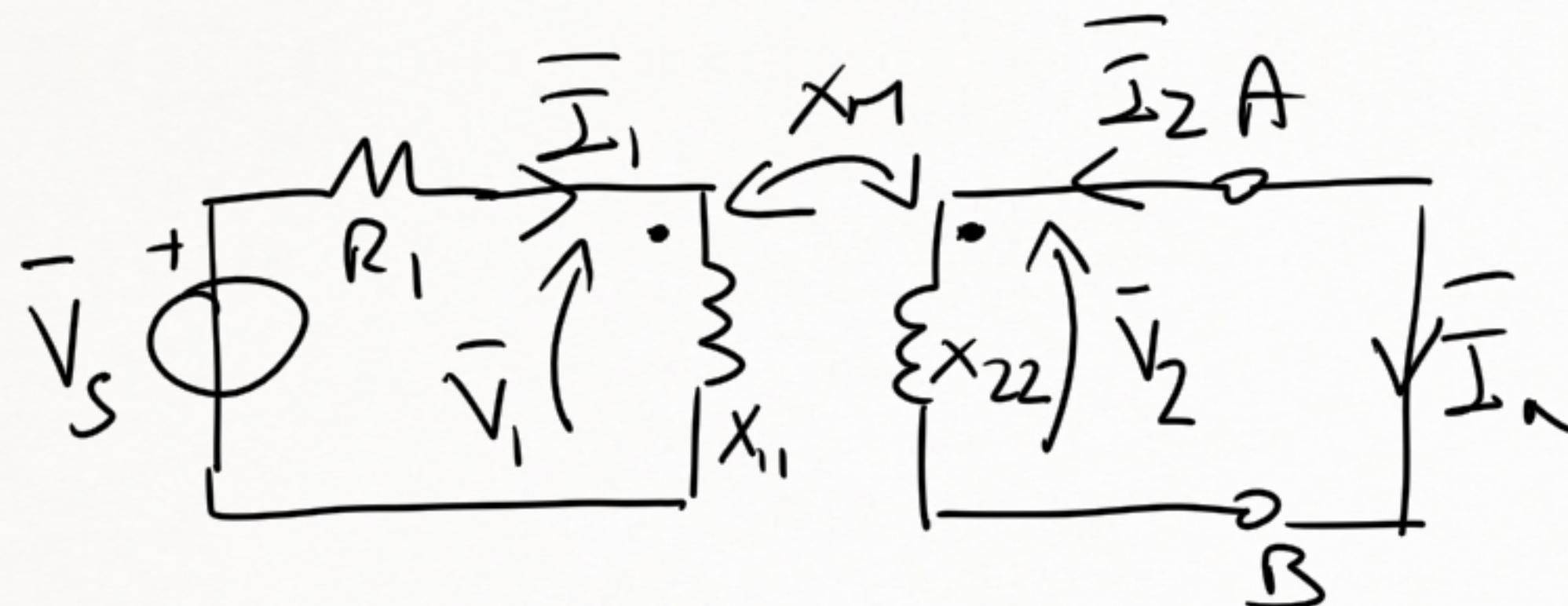
$$X_{22} = 12 \Omega$$

$$X_m = 8 \Omega$$

$$R_1 = 8 \Omega$$

$$R_2 = 12 \Omega$$

$$\bar{V}_{R_2} = ?$$



$$\bar{V}_1 = jX_{11}\bar{I}_1 + jX_m\bar{I}_2$$

$$\bar{V}_2 = jX_m\bar{I}_1 + jX_{22}\bar{I}_2$$

$$\bar{I}_2 = -\bar{I}_N ; \bar{V}_2 = 0V$$

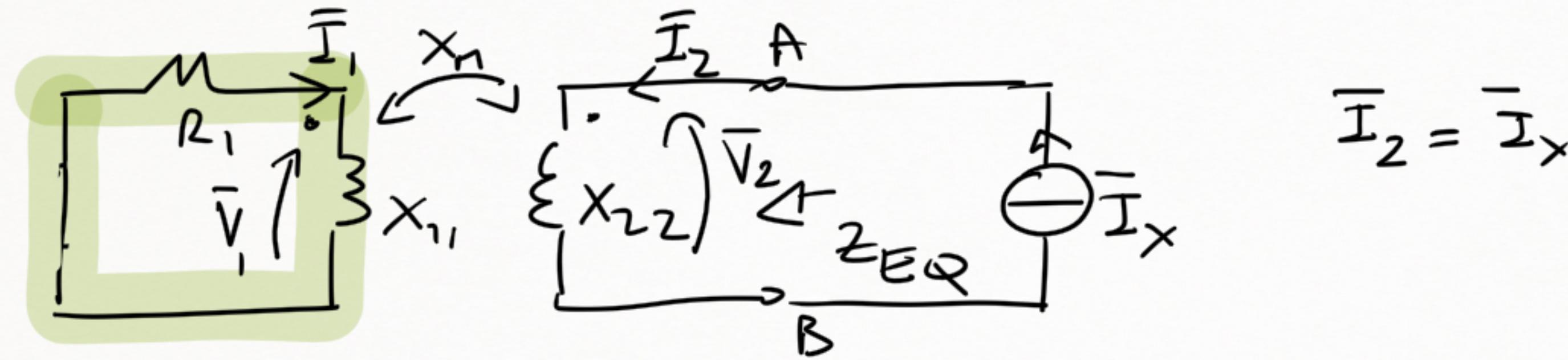
$$\textcircled{1} \quad \bar{V}_1 = jX_{11}\bar{I}_1 - jX_m\bar{I}_N$$

$$\textcircled{2} \quad 0 = jX_m\bar{I}_1 - jX_{22}\bar{I}_N \Rightarrow \bar{I}_1 = \frac{jX_{22}}{jX_m} \bar{I}_N$$

$$\textcircled{1} \quad \bar{V}_1 = \bar{V}_S - \bar{V}_{R_1} = \bar{V}_S - \bar{I}_1 R_1 = jX_{11}\bar{I}_1 - jX_m\bar{I}_N$$

$$\bar{V}_S = \frac{jX_{22}}{jX_m} \bar{I}_N R_1 + jX_{11} \frac{jX_{22}}{jX_m} \bar{I}_N - jX_m \bar{I}_N$$

$$\bar{I}_N = \frac{\bar{V}_S}{\frac{jX_{22}}{jX_m} R_1 + jX_{11} \frac{jX_{22}}{jX_m} - jX_m}$$



$$\bar{I}_2 = \bar{I}_x$$

$$Z_{EQ} = \frac{\bar{V}_2}{\bar{I}_x}$$

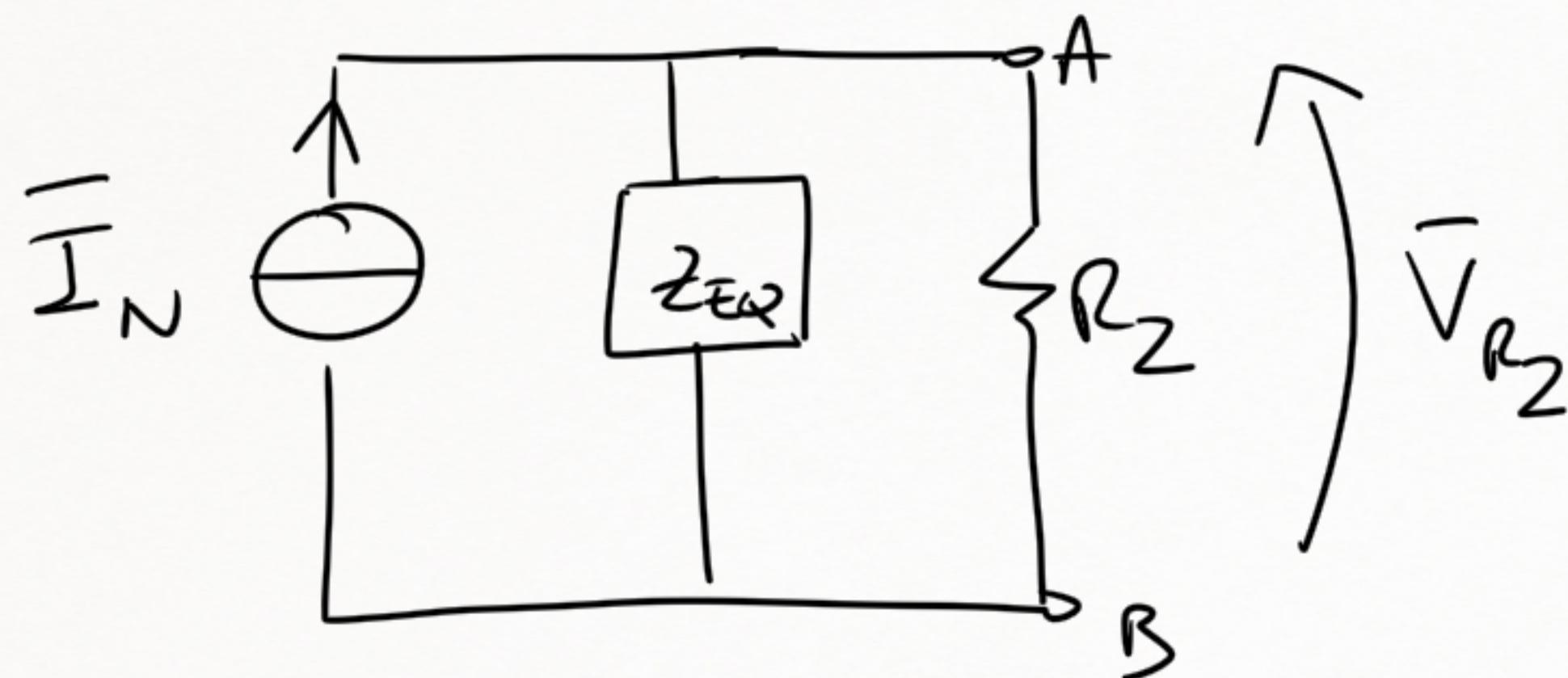
$$\textcircled{1} \quad \bar{V}_1 = jX_{11}\bar{I}_1 + jX_m\bar{I}_x \quad \Rightarrow \quad \bar{V}_1 = -\bar{I}_1 R_1$$

$$\textcircled{2} \quad \bar{V}_2 = jX_m\bar{I}_1 + jX_{22}\bar{I}_x$$

$$\textcircled{1} \quad -\bar{I}_1 R_1 = jX_{11}\bar{I}_1 + jX_m\bar{I}_x \Rightarrow \bar{I}_1 = -\bar{I}_x \frac{jX_m}{R_1 + jX_{11}}$$

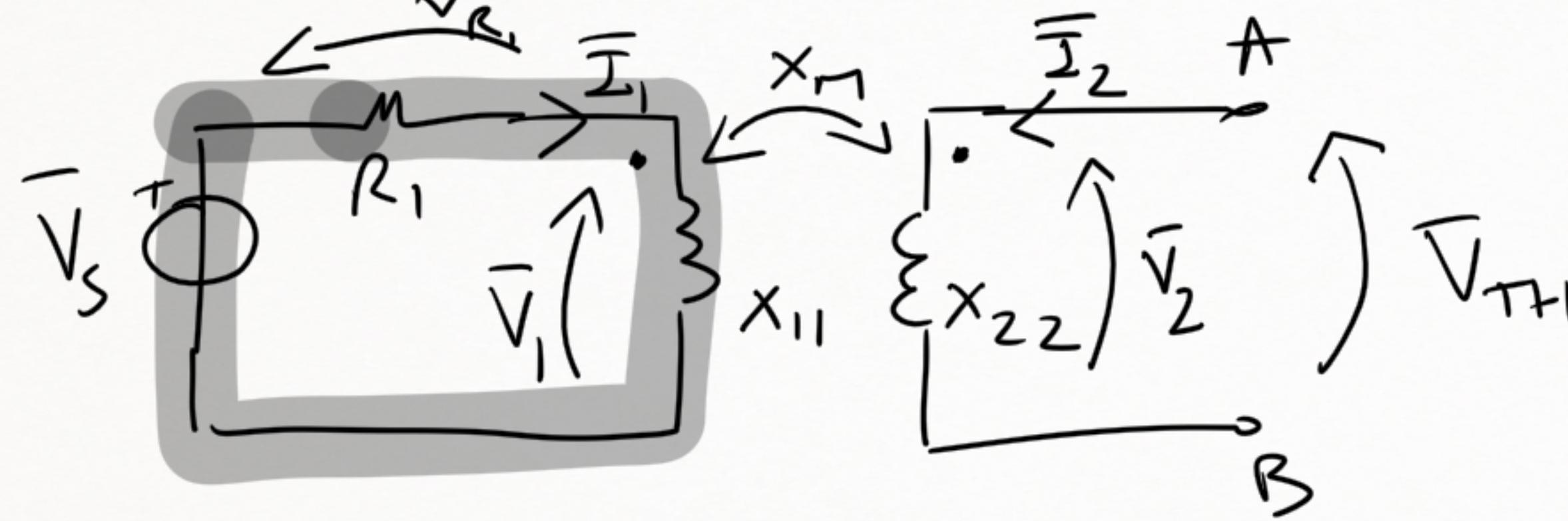
$$\textcircled{2} \quad \bar{V}_2 = jX_m \left(-\bar{I}_x \frac{jX_m}{R_1 + jX_{11}} \right) + jX_{22} \bar{I}_x$$

$$Z_{EQ} = \frac{\bar{V}_2}{\bar{I}_x} = \frac{x_m^2}{R_1 + jX_{11}} + jX_{22} = (5, 12 + j8, 16) \Omega$$



$$\bar{V}_{R_2} = \bar{I}_N (Z_{EQ} // R_2) = (0,534 + j1,708) V$$

THEVENIN



$$\bar{I}_2 = 0A$$

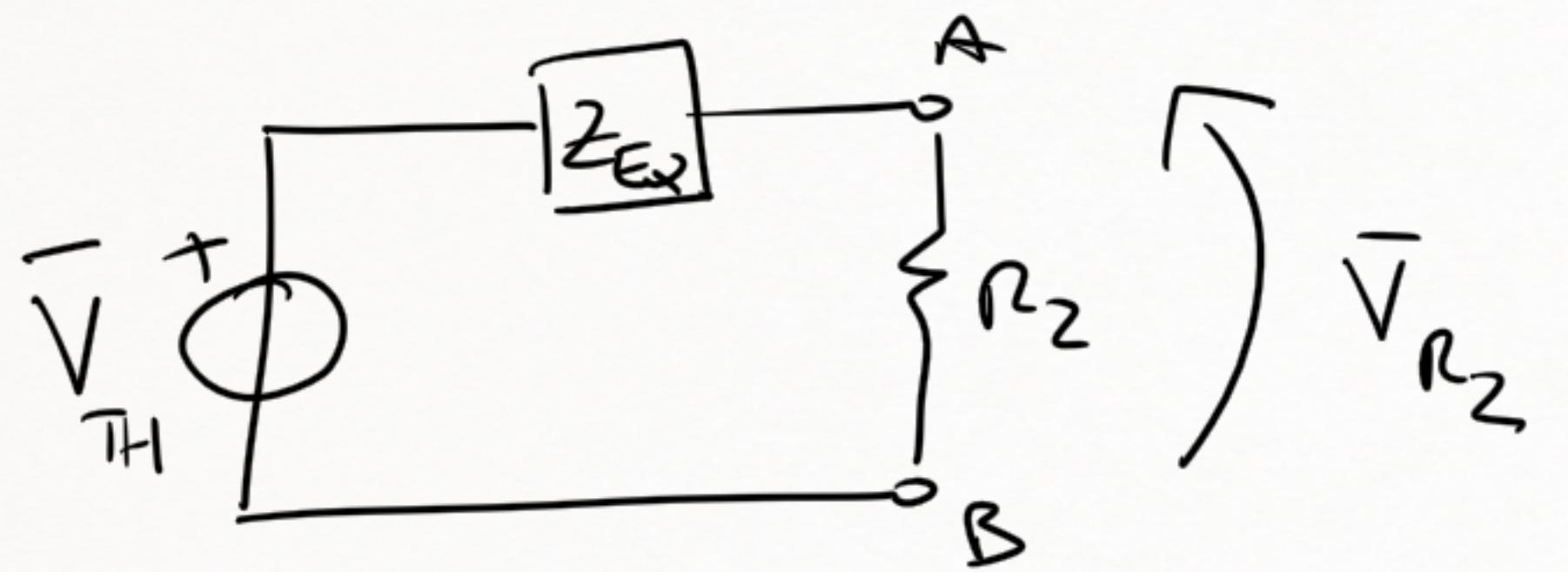
$$\bar{V}_2 = \bar{V}_{TH}$$

$$① \bar{V}_1 = jX_{11} \bar{I}_1$$

$$② \bar{V}_2 = jX_M \bar{I}_1 = \bar{V}_{TH}$$

$$① \quad \bar{V}_1 = \bar{V}_s - \bar{V}_{R_1} = \bar{V}_s - \bar{I}_1 R_1 = jX_{11} \bar{I}_1 \Rightarrow \bar{I}_1 = \frac{\bar{V}_s}{R_1 + jX_{11}}$$

$$② \bar{V}_{TH} = jX_M \frac{\bar{V}_s}{R_1 + jX_{11}}$$



$$\bar{V}_{R2} = \bar{V}_{TH} \cdot \frac{R_2}{Z_{EQ} + R_2}$$