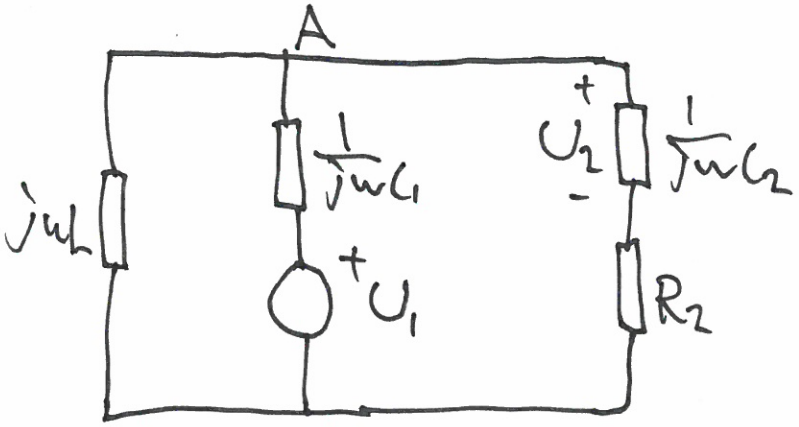
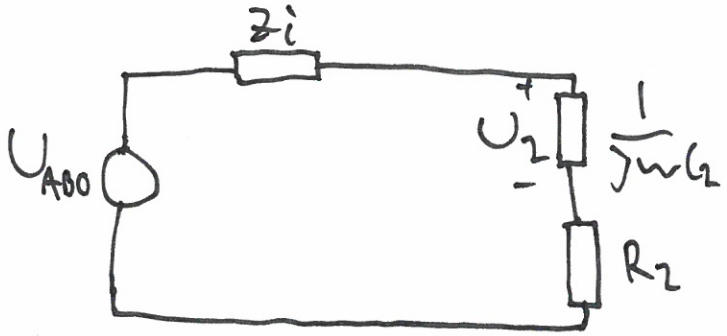
B 1.9) Komplexschema



$R_2 = 400\,\Omega$
$C_2 = 0.50\,\mu F$
$L = 4.0\,H$
$\omega = 500$ rad/s

Bestäm C_1 så att $\arg(U_1) = \arg(U_2)$.

Ersätt med ekv. tvåpol:



$$Z_i = \frac{j\omega L \cdot \frac{1}{j\omega C_1}}{j\omega L + \frac{1}{j\omega C_1}} = \frac{j\omega L}{1-\omega^2 C_1 L}$$

$$U_{ABO} = U_1 \cdot \frac{j\omega L}{j\omega L + \frac{1}{j\omega C_1}} = U_1 \cdot \frac{-\omega^2 C_1 L}{1-\omega^2 C_1 L}$$

$$U_2 = U_{ABO} \cdot \frac{\frac{1}{j\omega C_2}}{Z_i + R_2 + \frac{1}{j\omega C_2}} = U_{ABO} \frac{1}{Z_i j\omega C_2 + R_2 \cdot j\omega C_2 + 1}$$

$$= U_1 \cdot \frac{-\omega^2 C_1 L}{(1-\omega^2 C_1 L)\left(\frac{j\omega L \cdot j\omega C_2}{1-\omega^2 C_1 L} + j\omega C_2 R_2 + 1\right)}$$

$$= U_1 \cdot \underbrace{\frac{-\omega^2 C_1 L}{-\omega^2 C_2 L + j\omega C_2 R_2 - j\omega^3 C_1 C_2 L R_2 + 1 - \omega^2 C_1 L}}_{K} \qquad \underbrace{\qquad\qquad}_{P}$$

$\arg U_1 = \arg U_2 \Rightarrow \arg(K) = 0 \Rightarrow P = 0 \Rightarrow$

$j\omega C_2 R_2 - j\omega^3 C_1 C_2 L R = 0 \Rightarrow 1 - \omega^2 C_1 L = 0$

$\Rightarrow C_1 = \frac{1}{\omega^2 L} = \frac{1}{500^2 \cdot 4} = 1\,\mu F$