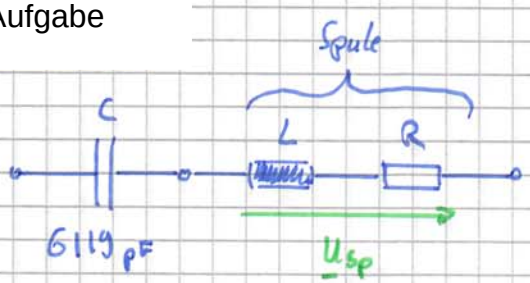
1. Aufgabe



a) $\underline{Z} = R + j\left(\omega L - \frac{1}{\omega C}\right) = 2\,k\Omega - j\,2{,}5\,k\Omega$

→: $R = 2\,k\Omega$ (2)

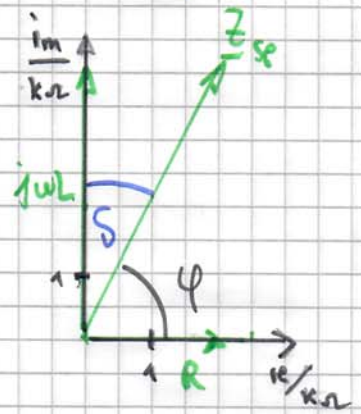
→: $\omega L - \frac{1}{\omega C} = -2{,}5\,k\Omega$

$\omega L = \frac{1}{8000\,\pi\,\frac{1}{s} \cdot 6119 \cdot 10^{-12}\,\frac{As}{V}} - 2500\,\Omega$

$\omega L = 4003\,\Omega$

$L = \frac{4003\,\Omega}{8000\,\pi\,\frac{1}{s}} = 159{,}3\,mH$ (4)

b) „Verlustwinkel" ≙ Winkel, der Verluste repräsentiert ; Winkel, der auf 90° fehlt



$\delta = \arctan\frac{R}{\omega L} = \arctan\frac{2000}{4003}$

$\delta = 26{,}5°$ (3) $\left(\varphi = 63{,}5°\right)$

c) $f_0 = \frac{1}{2\pi\sqrt{LC}} = \frac{1}{2\pi\sqrt{159{,}3\,mH \cdot 6119\,pF}}$

$f_0 = 5{,}098\,kHz$ (2)

$Z_0 = \sqrt{\frac{L}{C}} = \sqrt{\frac{159{,}3\,mH}{6119\,pF}} = 5{,}102\,k\Omega$ (2)

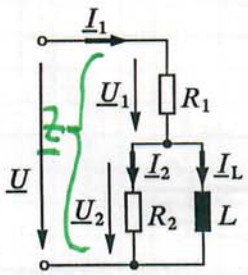
d) $Q = Z_0/R = \frac{5{,}102\,k\Omega}{2\,k\Omega} = 2{,}551$ (2) (Reihen-SK)

e) $f = f_0$: $U = U_R = 100\,V$

$\frac{U_L}{U} = \frac{Z_0}{R} = Q \Rightarrow U_L = Q \cdot U = 255{,}1\,V$

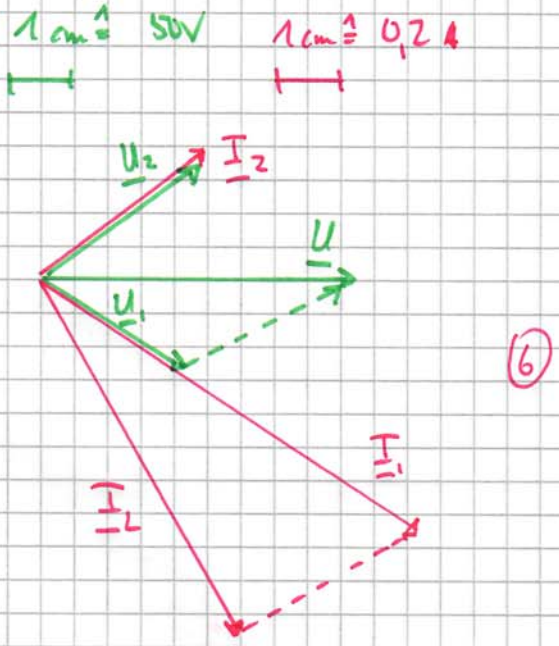
$U_{sp} = \sqrt{U_R^2 + U_L^2} = \sqrt{100^2 + 255{,}1^2}\,V = 274\,V = U_{sp}$ (5)

2. Aufgabe



$R_1 = 94\,\Omega$
$R_2 = 240\,\Omega$
$L = 382\,\mathrm{mH}$

b)



(6)

a) $\underline{U} = 230\,\mathrm{V} \cdot e^{j0°}$

$$\underline{Y}_2 = \frac{1}{R_2} + \frac{1}{j\omega L} = \frac{1}{240\,\Omega} - j \cdot \frac{1}{100\pi \cdot 0{,}382\,\Omega}$$

(2)

$$\underline{Y}_2 = 4{,}167\,\mathrm{mS} - j\,8{,}333\,\mathrm{mS} = 9{,}317\,\mathrm{mS} \cdot e^{-j63{,}43°} = \underline{Y}_2$$

$$\underline{Z} = R_1 + \frac{1}{\underline{Y}_2} = 94\,\Omega + \frac{1}{9{,}317\,\mathrm{mS} \cdot e^{-j63{,}43°}}$$

$$= 94\,\Omega + 107{,}3\,\Omega \cdot e^{j63{,}47°} = 142\,\Omega + j\,96\,\Omega$$

(2)

$$\underline{Z} = 171{,}4\,\Omega \cdot e^{j34{,}06°}$$

$$\underline{I}_1 = \frac{\underline{U}}{\underline{Z}} = 1{,}342\,\mathrm{A} \cdot e^{-j34{,}06°} \longrightarrow \underline{I}_1 = 1{,}342\,\mathrm{A}$$ (2)

$$\underline{U}_1 = R_1 \cdot \underline{I}_1 = 126{,}1\,\mathrm{V} \cdot e^{-j34{,}06°} \longrightarrow \underline{U}_1 = 126{,}1\,\mathrm{V}$$ (2)

$$\underline{U}_2 = \frac{\underline{I}_1}{\underline{Y}_2} = 144{,}04\,\mathrm{V} \cdot e^{j29{,}37°} \longrightarrow \underline{U}_2 = 144\,\mathrm{V}$$ (2)

$$\underline{I}_2 = \underline{U}_2 / R_2 = 0{,}60\,\mathrm{A} \cdot e^{j29{,}37°} \longrightarrow \underline{I}_2 = 600\,\mathrm{mA}$$ (2)

$$\underline{I}_L = \frac{\underline{U}_2}{j\omega L} = \frac{144{,}04\,\mathrm{V} \cdot e^{j29{,}37°}}{e^{j90°} \cdot 100\pi \cdot 0{,}382\,\Omega} = 1{,}200\,\mathrm{A}\, e^{-j60{,}63°} \longrightarrow \underline{I}_L = 1{,}200\,\mathrm{A}$$ (2)