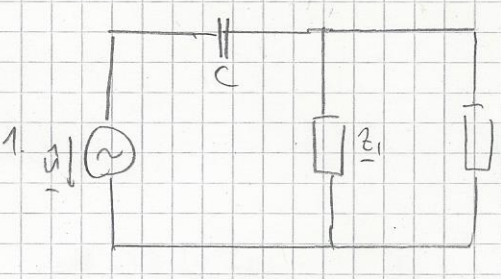
Scozzafava Alessandro
15-913-981

(8) $\underline{\hat{u}} = \hat{u} \cdot e^{i\varphi}$

a)

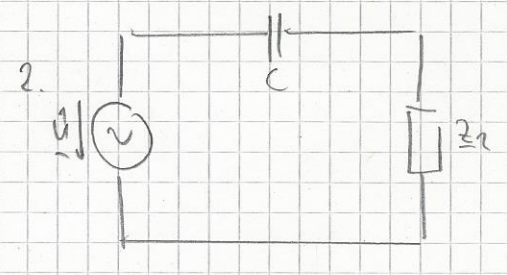
1.



$\underline{Z}_1 = R_w + j\omega L$

$\times (= 1{,}24\,\Omega \cdot e^{j\,14{,}07°})$

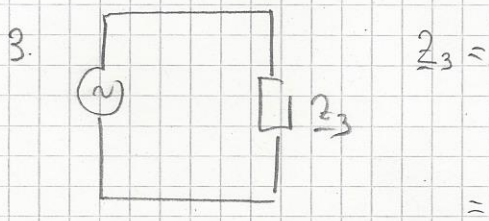
2.



$$\underline{Z}_2 = \underline{Z}_1 \| R = \frac{(R_w + j\omega L)\cdot R}{R + R_w + j\omega L}$$

$$= \frac{RR_w + j\omega RL}{R + R_w + j\omega L} \qquad \gamma (= 883{,}562\,m\Omega\, e^{j\,10{,}39°}$$

3.



$$\underline{Z}_3 = \frac{1}{j\omega C} + \frac{RR_w + j\omega RL}{R + R_w + j\omega L}$$

$$= \frac{R + R_w + j\omega L + j\omega C(RR_w + j\omega RL)}{j\omega C(R + R_w + j\omega L}$$

$$= \frac{R + R_w + j\omega L + j\omega RR_wC - \omega^2 RLC}{j\omega RC + j\omega R_wC - \omega^2 LC}$$

$$= \frac{R + R_w - \omega^2 RLC + j\omega(L + RR_wC)}{-\omega^2 LC + j\omega(RC + R_wC)}$$

$z (= 991{,}47\,m\Omega \cdot e^{-j\,28{,}77°})$

$$\underline{\hat{u}}_R = \underline{\hat{u}} \cdot \frac{\frac{RR_w + j\omega RL}{R + R_w + j\omega L}}{\frac{1}{j\omega C} + \frac{RR_w + j\omega RL}{R + R_w + j\omega L}}$$

$$= \hat{u}\, \frac{\frac{RR_w + j\omega RL}{\cancel{R + R_w + j\omega L}}}{\frac{R + R_w + j\omega L + (RR_w + j\omega RL)j\omega C}{j\omega C\cancel{(R + R_w + j\omega L)}}}$$

$$= \hat{u}\, \frac{(RR_w + j\omega RL)\, j\omega C}{R + R_w + j\omega L + j\omega RR_wC - \omega^2 RLC} = \hat{u}\, \frac{-\omega^2 RLC + j\omega RR_wC}{R + R_w + \omega^2 RLC + j\omega(RR_wC + L)}$$

$$\underline{Z}_{in} = \frac{R + R_w - \omega^2 RLC + j\omega(L + RR_wC)}{-\omega^2 LC + j\omega(RC + R_wC)}$$

$$\underline{\hat{U}}_R = \hat{U} \; \frac{-\omega^2 RLC + j\omega RR_wC}{R + R_w - \omega^2 RLC + j\omega(RR_wC + L)}$$

b) $R = 3\Omega$, $C = 5mF$, $L = 1mH$, $\underline{R}_w = 1{,}2\Omega$, $\omega = 2\pi 50\,Hz$

$\hat{U} = 5V \cdot e^{j0°}$

$$\underline{\hat{U}}_R = 4{,}46\,V \cdot e^{j39{,}16°}$$

$$\underline{\hat{I}} = \frac{\underline{\hat{U}}}{\underline{Z}_{in}} = 5{,}04\,A \cdot e^{j28{,}79°}$$

c) $$\underline{\hat{I}}_L = \frac{\underline{\hat{U}}_R}{\underline{Z}_1} = 3{,}59\,A \cdot e^{j14{,}67°}$$

$$\underline{\hat{I}}_R = \frac{\underline{\hat{U}}_R}{R} = 1{,}485\,A \cdot e^{j39{,}16°}$$

$$\underline{\hat{U}}_L = \underline{\hat{U}} \cdot \frac{\frac{1}{j\omega C}}{\frac{1}{j\omega C} + \underline{Z}_2} = 3{,}21\,V \cdot e^{-j3{,}93°}$$

$$\underline{\hat{U}}_L = j\omega L \cdot \underline{\hat{I}}_L = 1{,}13\,V \cdot e^{j114{,}49°}$$

d) $$\omega_0 = \frac{1}{\sqrt{LC}} = 447{,}21\,\frac{1}{s} \Rightarrow \underline{\underline{f_0 = 71{,}2\,Hz}}$$

$Im(\underline{\hat{I}}) \overset{!}{=} 0$

$5{,}04\,A\,e^{j\omega} \overset{!}{=} 0 \Rightarrow$