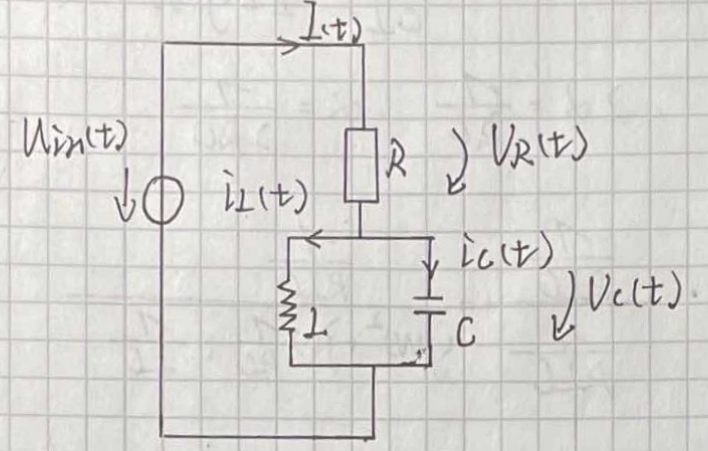
Aufgabeblatt 2 Yaoran Wang - 719611 - RAS

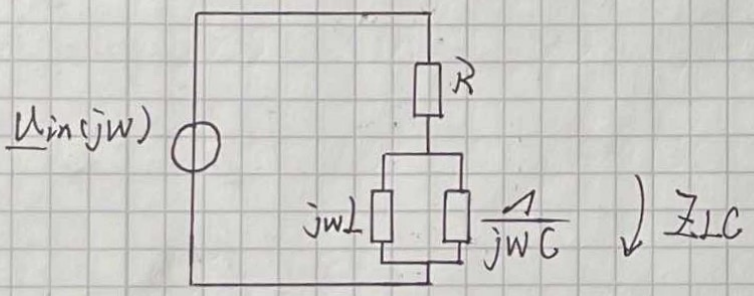
Aufgabe 2



Es gilt:

$$\begin{cases} I(t) = i_L(t) + i_C(t) \\ V_{in}(t) = V_R(t) + V_C(t) \\ V_C(t) = V_C(t) = V_L(t) \end{cases}$$

Ersatzschaltbild:



$$Z_{LC} = jwL \parallel \frac{1}{jwC}$$

$$= \frac{jwL \cdot \frac{1}{jwC}}{jwL + \frac{1}{jwC}} = \frac{L}{jwcL + \frac{1}{jw}} = \frac{jwL}{j^2w^2cL + 1}$$

$$\begin{cases} \underline{I}_L(jw) \cdot jwL = \underline{I}_C(jw) \cdot \frac{1}{jwC} \\ \underline{I}_C(jw) + i_L(t) = \frac{\underline{V}_{in}(jw)}{R + Z_{LC}} \end{cases}$$

$$\Rightarrow \frac{\underline{i}_L(jw)}{\underline{V}_{in}(jw)} = \frac{1}{Z_{LC}(1 + j^2w^2LC)} = \frac{1}{jwL + j^2w^2RCL + R}$$

$$\Rightarrow \frac{1}{RCL} \cdot \underline{V_{in}}(jw) = \frac{1}{RC}\,\underline{i_L}(jw)\cdot jw + \underline{i_L}(jw)\cdot j^2w^2 + \frac{1}{CL}\cdot \underline{i_L}(jw)$$

$$\Rightarrow w_0^2 = \frac{1}{CL}\,,\; w_0 = \frac{1}{\sqrt{CL}}\,,\; 2\alpha = \frac{1}{RC}\,,\; \alpha = \frac{1}{2RC}$$

$$\underline{H}(jw) = \frac{1}{R + jwL + j^2w^2RCL} \cdot \frac{\frac{1}{RLC}}{\frac{1}{RLC}} = \frac{\frac{1}{RLC}}{(jw)^2 + jw\frac{1}{RC} + \frac{1}{LC}}$$

$w = 0 \Rightarrow \underline{H}(jw) = \frac{1}{R}$

$w \to \infty \Rightarrow \underline{H}(jw) = 0$