

task_c9fj1si7l797equs_with_calculation

Student Group

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impedance, phasor, cutoff, exam ee1 SS2023

Exercise E3 Complex voltage dividers
(written test, approx. 16 % of a 60-minute written test, SS2023)

The circuit below is a voltage divider. The input voltage is $\underline{U}_I = 5 \text{ V}$ and the output voltage is $\underline{U}_O = 0.5 \text{ V} - j \cdot 1.5 \text{ V}$. The input impedance is $\underline{Z}_L = 50 \text{ }\Omega$. Choose an appropriate scaling factor and write it down.

- $R = 1.1 \text{ k}\Omega$

Solution $L = 3.5 \text{ mH}$

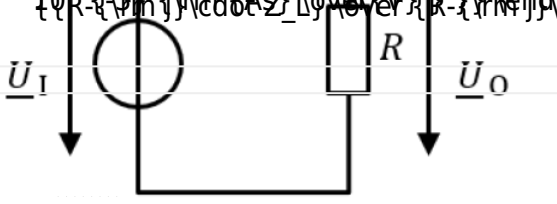
Result

$$\underline{U}_I = 5 \text{ V}$$

$$\underline{Z}_L = 50 \text{ }\Omega$$

$$\underline{U}_O = 0.5 \text{ V} - j \cdot 1.5 \text{ V}$$

The cutoff frequency is the absolute value of the imaginary part of the transfer function $\underline{H}(j\omega) = \frac{\underline{U}_O}{\underline{U}_I}$. This leads to $\omega_c = \frac{1}{RC}$ or $f_c = \frac{1}{2\pi RC}$. In this case, $f_c = 10 \text{ kHz}$. However, $R = 1.1 \text{ k}\Omega$ and $C = 3.5 \text{ }\mu\text{F}$ do not match the given values.



.. Calculate the impedance \underline{Z}_L .

Solution

$$\underline{Z}_L = j \cdot \omega \cdot L = j \cdot 2\pi \cdot 150 \text{ kHz} \cdot 3.5 \text{ mH}$$

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