

task_c9fj1si7l797equs_with_calculation

Student Group

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impedance, phasor, cutoff, exam ee1 SS2023

Exercise E1 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 $\underline{U}_O = 0.5 \text{ V} - j \cdot 1.5 \text{ V}$. Choose an appropriate scaling factor and write it down.

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


Solution $L = 3.5 \text{ mH}$

Result

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

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

The cutoff frequency is the absolute value of the imaginary part of the transfer function $H(j\omega) = \frac{U_O}{U_I}$. This leads to $\omega_c = \frac{1}{RC}$ with $R = 1.1 \text{ k}\Omega$ and $C = 10 \text{ nF}$. However, $\omega_c = \frac{1}{RC} = \frac{1}{1.1 \cdot 10^3 \cdot 10 \cdot 10^{-9}} = 90.9 \text{ rad/s}$. The cutoff frequency is $f_c = \frac{\omega_c}{2\pi} = 14.5 \text{ Hz}$.



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

Solution

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

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