

task_c9fj1si7l797equs_with_calculation

Student Group

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impedance, phasor, cutoff, exam ee1 SS2023

Exercise E11 Complex voltage dividers
(written test, approx. 16 % of a 60-minute written test, SS2023)

Task: Calculate the two impedances Z_1 and Z_2 in the circuit below resulting in the output voltage U_O . Choose an appropriate scaling factor and write it down.

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

Solution: $L = 3.5 \text{ mH}$

Result:

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

$$\underline{Z}_1 = 50 \text{ k}\Omega$$

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

The cutoff frequency is the absolute value of the imaginary part of the transfer function $H(j\omega) = \frac{U_O}{U_I}$. This leads to $\omega_c = \frac{1}{RC} = \frac{1}{1.1 \text{ k}\Omega \cdot 3.5 \text{ mH}} \approx 260 \text{ rad/s}$. This corresponds to a cutoff frequency $f_c \approx 41 \text{ Hz}$.

.. 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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