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)

~~**Draw the two impedances in the complex plane.** **Calculate the resulting phasor** for the total impedance~~
~~Result~~ ~~**Choose an appropriate scaling** factor and write it down.~~

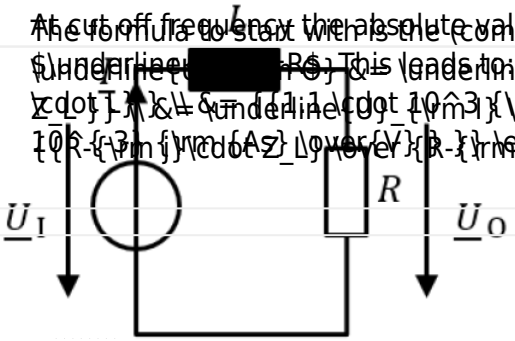
- $R = 1.1 ~\rm k\Omega$
- $L = 3.5 ~\rm mH$
- $\underline{U}_\rm I = 5 ~\rm V$

Solution

~~Solution~~

~~\begin{align*} \underline{Z}_L &= 50{\rm j}\Omega \end{align*}~~
\begin{align*} \underline{U}_{\rm O} &= 0.5 ~\rm V - j \cdot 1.5 ~V \end{align*}

~~The formula to start with is the (complex) voltage divider: \begin{align*}~~
~~\underline{U}_{\rm O} &= \underline{U}_{\rm I} \cdot {R} \over {R + {\rm j}\cdot Z_L }~~
~~\end{align*} This leads to: \begin{align*} f_{\rm cutoff} &= {R} \over {2\pi \cdot L} \\ &= {1.1 \cdot 10^3 {\rm V} \over A} } \over {2\pi \cdot 3.5 \cdot 10^{-3} {\rm As} \over {\rm V} } \end{align*}~~



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

Solution

\begin{align*} \underline{Z}_L &= {\rm j} \cdot \omega \cdot L \\ &= {\rm j} \cdot 2\pi \cdot 150 ~\rm kHz \cdot 3.5 ~\rm mH \end{align*}