task_uzbbnoz8abe6201d_with_calculation

Student Group

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exam ee1 SS2023

Exercise E5 Impedances at Frequencies
(written test, approx. 14 % of a 60-minute written test, SS2023)

At which frequencies f_2 and f_3 have the impedances of the capacitor with $C_2 = 5.6 ~\rm nF$ the same absolute value as the inductor with $L_1 = 15.9 ~\rm \mu H$?
Results:
1. An inductor with $X_{L1} = 60 ~\rm m\Omega$ and $L_1 = 15.9 ~\rm \mu H$.

Solution
Solution

\begin{align*} f_2 &= 3000.5 ~\rm kHz \rightarrow f_2 = 3000 ~\rm kHz \end{align*}
kHz\end{align*}

\begin{align*} X_{C2} &= X_{L1} \rightarrow \omega_2 \cdot C_2 = \frac{1}{\omega_2 \cdot L_1} \rightarrow f_2 = \frac{1}{2\pi \cdot \sqrt{L_1 \cdot C_2}} \\
\begin{align*} X_{L1} &= \omega_1 \cdot L_1 = 2\pi f_1 \cdot L_1 \rightarrow f_1 = \frac{X_{L1}}{2\pi \cdot L_1} \\
&= \frac{60 ~\rm m\Omega}{2\pi \cdot 15.9 ~\rm \mu H} = \frac{60 \cdot 10^{-3}}{2\pi \cdot 15.9 \cdot 10^{-6}} ~\rm \frac{V/A}{Vs/A} \\ \end{align*}