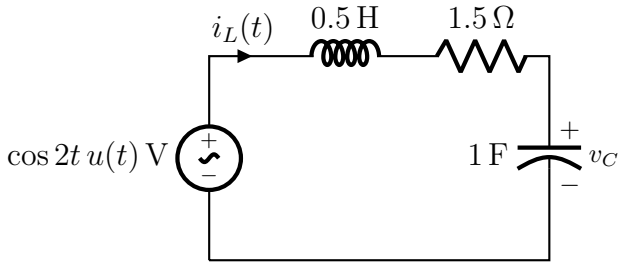
# EE2015: Electric Circuits and Networks

Tutorial 8

($4^{th}$ and $11^{th}$ October 2024)

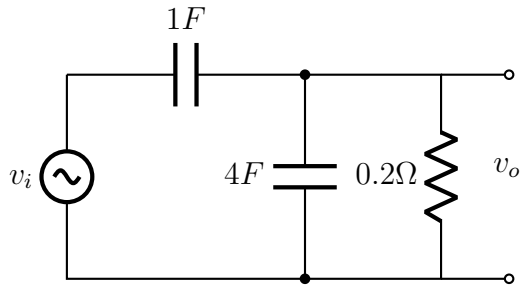
1. For the circuit shown on the right find $v_C(t)$ for $t \geq 0$. The initial conditions are: (i) $v_C(0^-) = 1\,\text{V}$, and (ii) $i_L(0^-) = 2\,\text{A}$.

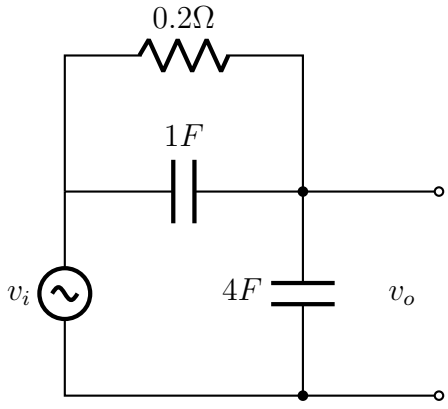



2. The circuit (same as Q6 in Tutorial-6) shown below is excited by $v_i(t)$, where $v_i(t) = \sum_{k=0}^{\infty} x(t - kT_0)$. The waveform $x(t)$ is defined as follows:

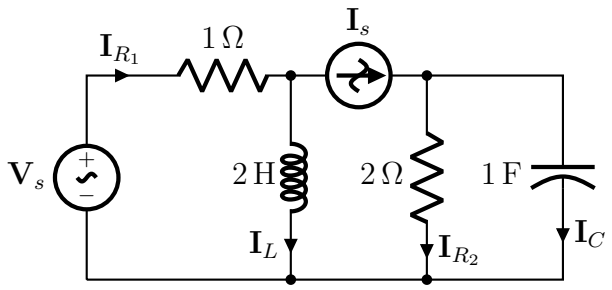
$$x(t) = \begin{cases} 10\,V & 0 < t < T_0/2 \\ -5\,V & T_0/2 < t < T_0 \end{cases}$$

where $T_0 = 2s$.
a) Sketch $v_o(t)$ after steady-state has been reached in both circuits and mark the important points. b) Sketch $v_o(t)$, if $T_0$ is increased or decreased by a factor of 10, keeping the component values the same.

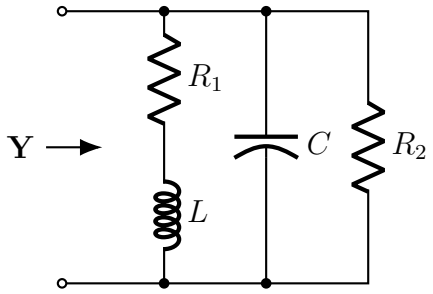


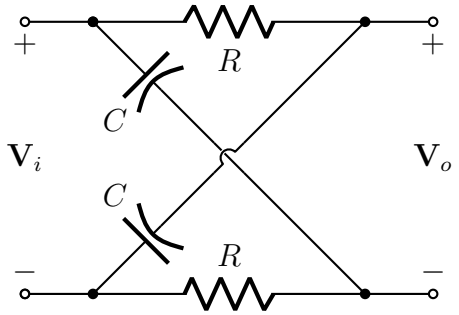
3. a) For the given RLC circuit, determine $I_s$ and $i_s(t)$ if both sources are operating at $\omega = 2\,\text{rad/s}$, and $I_C = 2\angle 28°$ A. b) Now let $\omega = 1\,\text{rad/s}$, $I_C = 2\angle 28°$ A and $I_L = 3\angle 53°$ A. Calculate (i) $I_s$ , (ii) $V_s$ , and (iii) $i_{R_1}(t)$. c) Find the Thevenin impedance as seen from the terminals of the current source. What should you assume before proceeding to calculate $Z_{Th}$?



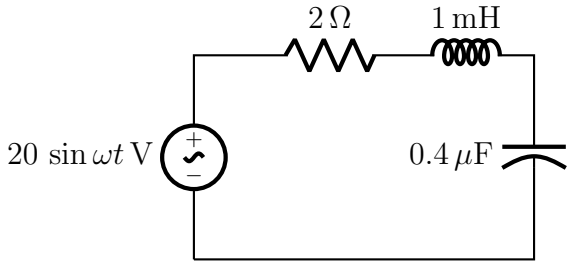

4. In the circuit given on the right, $R_1 = 1\,\text{k}\Omega$ and $C = 2.533\,\text{pF}$. Determine the inductance value that will make the circuit's resonance frequency as 1 MHz.




5. In the circuit shown on the left, $R = 1\,\text{k}\Omega$ and $C = 1\,\text{nF}$. Plot the magnitude and phase of $\dfrac{\mathbf{V}_o}{\mathbf{V}_i}$ versus frequency. For the magnitude response use a log-log plot, whereas, for the phase plot use a linear scale for $y$-axis and the log scale for the $x$-axis.



6. Consider the circuit shown on the right. a) Find the resonant frequency ($\omega_0$) and the half-power frequencies ($\omega_1$, $\omega_2$). b) Calculate the Q-factor and bandwidth. c) Determine the amplitude of the current at $\omega_0$, $\omega_1$, and $\omega_2$.




7. a) Derive the transfer function of the network whose magnitude Bode plot is shown below. Assume that the poles and zeros are either on the imaginary axis or in the left-half plane. b) Draw the phase Bode plot of the network