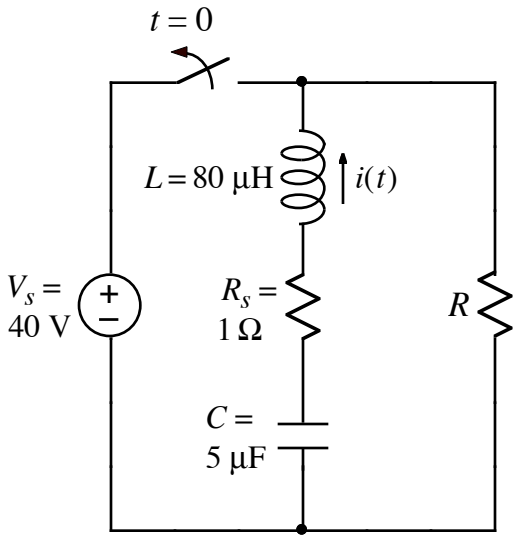
1.



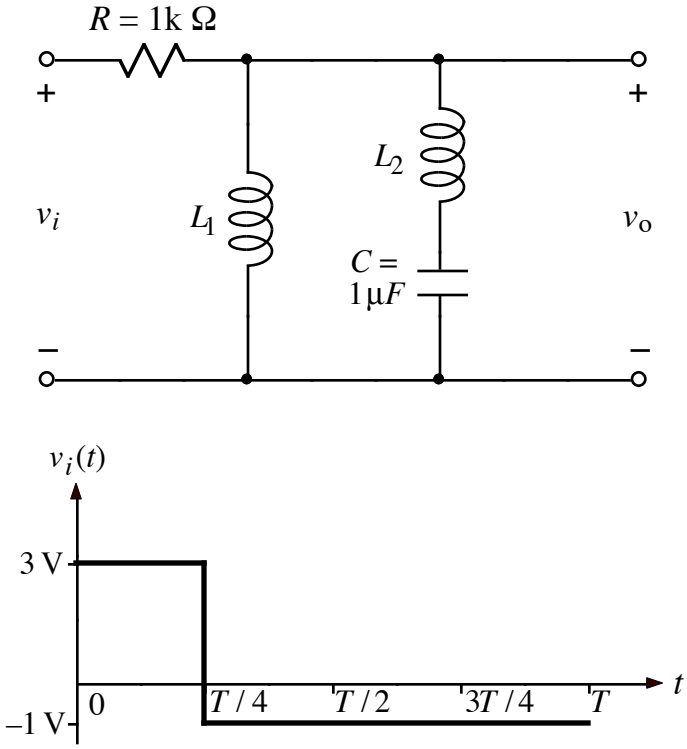
After being closed for a long time, the switch opens at $t = 0$.

The above circuit is an analog "one-shot" circuit that, once charged, produces a short, rounded current-pulse resembling the current that flows in a synapse of a neuron. The circuit is critically damped.

Find the value of R that makes the circuit critically-damped.

2. Using the R value from (a), find a numerical expression for the inductor current, $i(t)$, for $t > 0$ in problem 2.

3.



T = one period of $v_i(t) = 2\pi$ ms

$$v_i(t) = \begin{cases} 3 \text{ V} & 0 < t \le T/4 \\ -1 \text{ V} & T/4 < t \le T \end{cases}$$

Find values of $L_1 \neq 0$ and $L_2 \neq 0$ for the above filter circuit such that the magnitude of the transfer function equals one for the fundamental and zero for the second harmonic of $v_i(t)$, also shown above.

4. Find numerical values of coefficients a_v, and a_1 for the Fourier series for $v_i(t)$ in problem 3:

$$v_i(t) = a_\text{v} + \sum_{k=1}^{\infty} a_k \cos(k\omega_0 t) + b_k \sin(k\omega_0 t)$$

5. Find the numerical value of coefficient b_1 for the Fourier series for $v_i(t)$ in problem 4.