Exercise week #8

Time-dependent RRC and RL circuits

Problem 1:

Consider the electrical circuit shown in Fig. 1 with the following parameters:

$U = 10$ V, $R_1 = 4\ \Omega$, $R_2 = 5\ \Omega$ and $C = 1.2$ mF.

We turn on the circuit at $t = 0$ and then turn it off $\Delta t = 10\ ms$ later. At the moment of switch-on, the voltage across the capacitor is $u_C(t \to 0, t < 0) = U_{C0} = 2\ V$.

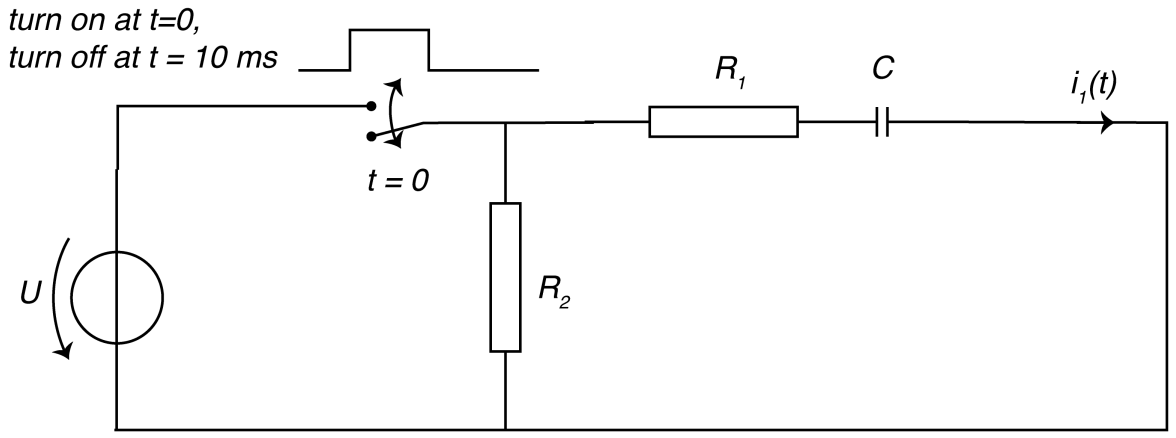

Figure 1: Electrical circuit.

a) Calculate the current $i_1(t)$ for $t \in [0, \infty)$. Plot the current i_1 and the voltage drop across the capacitor u_c as a function of time t.

b) What do you observe about the temporal decay of the current in the two time windows (switch-on vs. switch-off)?

Problem 2:

Consider the electrical circuit shown in Fig. 2 with the following parameters:

$U = 50$ V, $R_1 = 600\ \Omega$, $R_2 = 200\ \Omega$ and $L = 200$ mH.

We turn on the switch at time $t = 0$ and shortcut the resistor R_1. At the moment before the switch-on, the current flowing through the circuit is $i(t \to 0, t < 0) = 50$ mA.

a) Calculate the voltage across the inductor u_L and the current i flowing through the circuit for $t \in [0, \infty)$.

b) Plot them in a graph and reason what happens for $t \to \infty$.

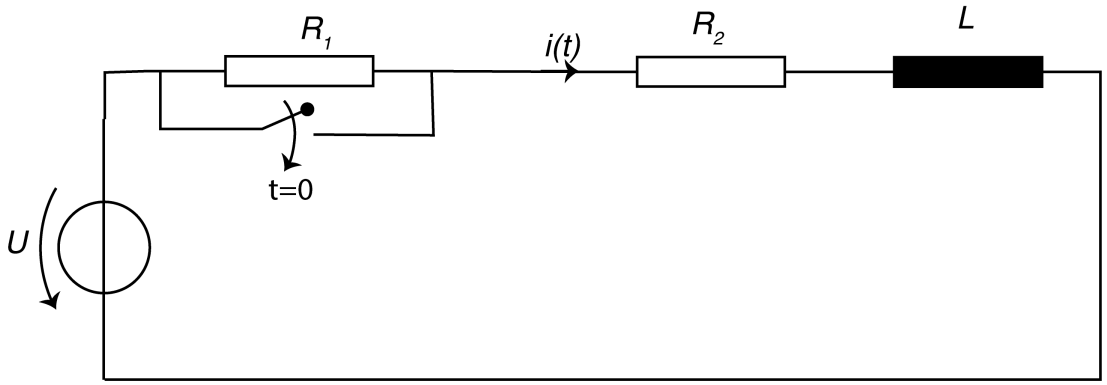

Figure 2: Electrical circuit.