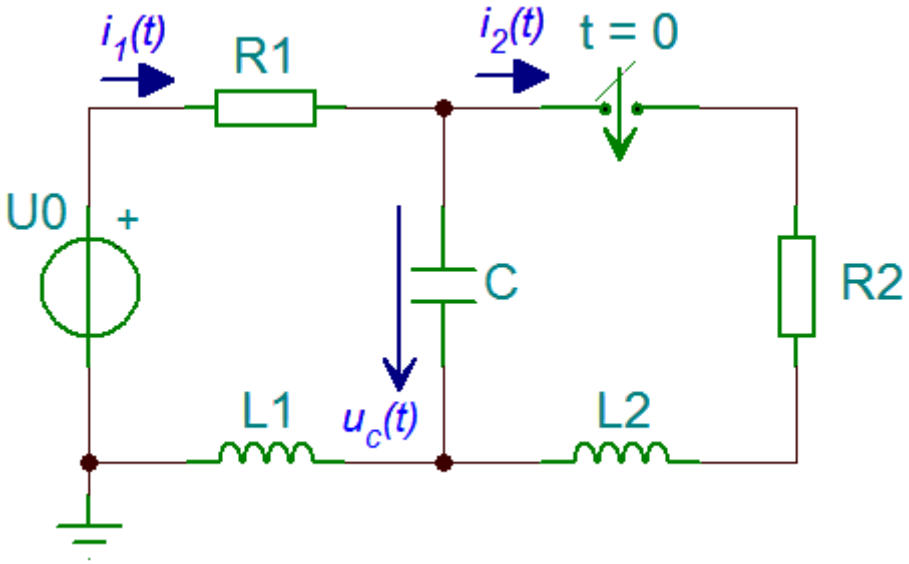
Practicing

Exercise 1 - Transient Analysis

For the circuit shown below find the currents $i_1(t)$, $i_2(t)$ and the voltage $u_C(t)$. Use a numerical solution to the differential equations (graphs for end time = 0.01 s), when R_1 = 5 Ω, R_2 = 5 Ω, L_1 = 5 mH, L_2 = 10 mH, C = 50 µF and U_0 = 20 V. The switch has been opened for a long time.



Circuit

Fill in differential equations in matrix form and values of initial conditions and values of steady states.

$$\begin{bmatrix} \frac{di_1(t)}{dt} \\ \frac{di_2(t)}{dt} \\ \frac{du_C(t)}{dt} \end{bmatrix} = \begin{bmatrix} & & \\ & & \\ & & \end{bmatrix} \cdot \begin{bmatrix} i_1(t) \\ i_2(t) \\ u_C(t) \end{bmatrix} + \begin{bmatrix} \\ \\ \end{bmatrix}$$

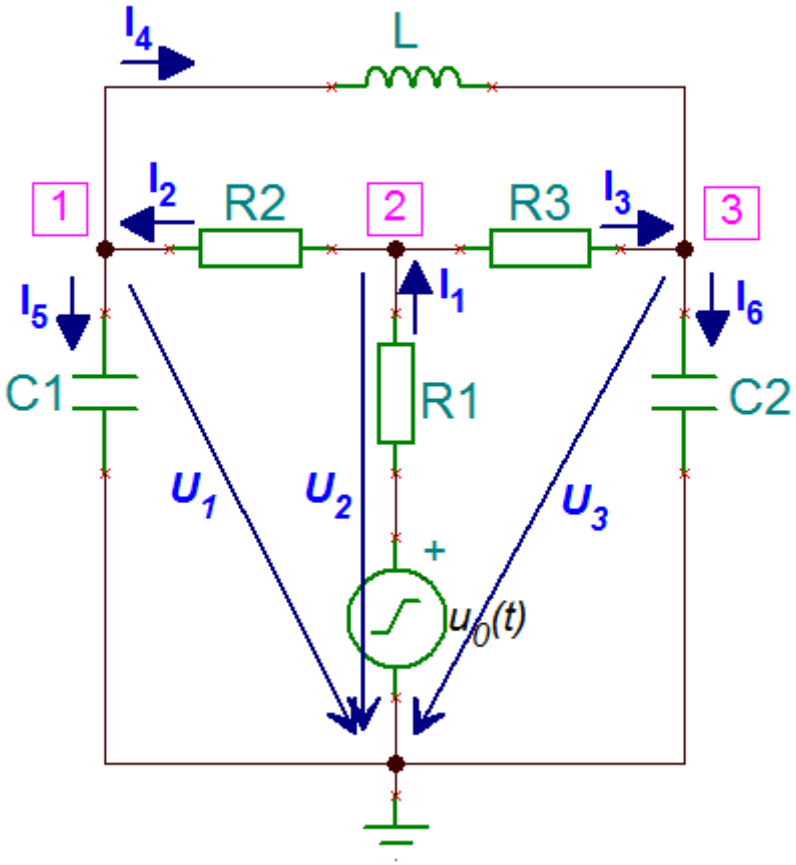
$$\begin{bmatrix} i_1(0) \\ i_2(0) \\ u_C(0) \end{bmatrix} = \begin{bmatrix} \\ \\ \end{bmatrix} \qquad \begin{bmatrix} i_1(\infty) \\ i_2(\infty) \\ u_C(\infty) \end{bmatrix} = \begin{bmatrix} \\ \\ \end{bmatrix}$$

Exercise 2 - Nodal Analysis

For the circuit shown below find the branch currents $\boldsymbol{I_1}$ to $\boldsymbol{I_6}$ (maximum value and phase degree), the nodal voltages $\boldsymbol{U_1}$ to $\boldsymbol{U_3}$ and the active power P supplied by the source. For impedances use a general label $\boldsymbol{Z_i}$.
Print of the nodal voltages to file "voltages.txt" in the form (example):

U1m = 20.00 < -60° [V]

Circuit values are
R_1 = 50 Ω, R_2 = 20 Ω, R_3 = 50 Ω, L = 100 mH, C_1 = 25 µF, C_2 = 25 µF, $u_0(t) = 200 \sin(\omega t + 30°)$ V and $\omega = 10^3$ rad/s.



Circuit