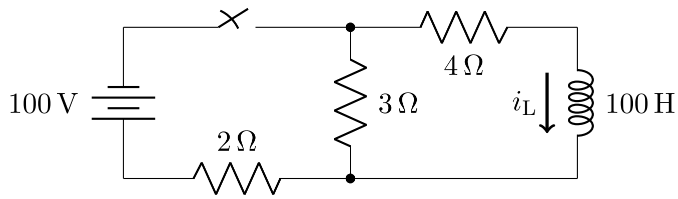
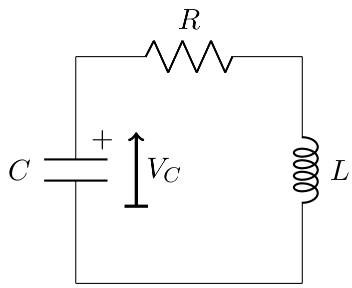
(3) **1.** Complete *EFTS* developed during the lecture: complete by hand and/or using Maple or Matlab the matrix-method solutions to the remaining currents: I_B and I_C for the mesh solution; and $i_1..i_6$ for the KCL/KVL solution. Verify that the two agree.

(4) **2.** (a) At time $t = 10\,\text{s}$, the switch is open and $i_L = 1.0\,\text{A}$. What is i_L at $t = 20\,\text{s}$?

(b) At time $t = 20\,\text{s}$, the switch is closed. At what subsequent time is $i_L = 0$?

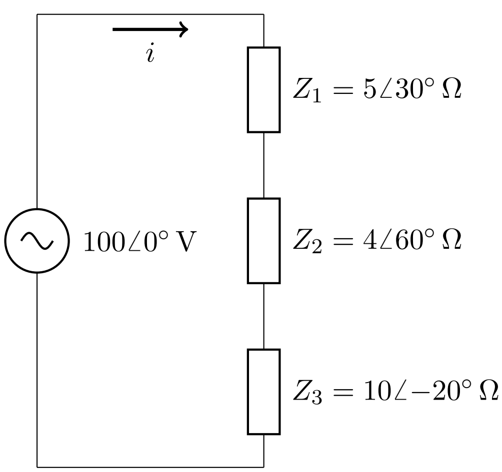


(3) **3.** At time $t = 0$ capacitor C is charged up to voltage of $V_\text{C} = 100\,\text{V}$.



(a) If $C = 1\,\mu\text{F}$, $R = 10\,\Omega$, $L = 0.1\,\text{H}$, show that the current after $t = 0$ is oscillatory. What is the frequency of oscillation? How long does it take for the voltage amplitude to drop to 10 V?

(b) Calculate and plot the energies stored in C, L, and the energy dissipated in R as functions of time. Verify (graphically) that the total energy is conserved.



(4) **4.** (a) Find the current i.

(b) Find the voltage across each impedance.

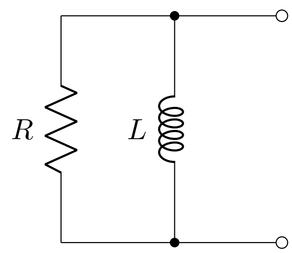
(c) Construct the voltage phasor diagram which verifies (graphically) that $V_1 + V_2 + V_3 = 100\angle 0°\,\text{V}$.

(5) **5.** A two-terminal black-box circuit is connected to a variable load resistor, R_L. A non-ideal voltmeter (internal resistance $R_V = 1000\,\Omega$) and a non-ideal ammeter are used to measure the voltage across the terminals of the black box and the current through the load resistor. As the load resistance is varied, the data in the table is obtained.

I, mA	V, V
0 ($R_L = \infty$)	0.468
1	0.405
2	0.342
3	0.279
4	0.216
5	0.153
6	0.090
6.4 ($R_L = 0$)	0.064

(a) Use the measured values of I and V to estimate the internal resistance R_A of the ammeter.

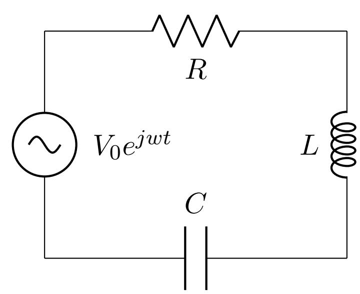
(b) Plot (using `extrema`, for example) load power VI and measured resistance V/I against V. Compare load resistance at maximum power point with R_T. You may need to fit a curve to the data.



(3) **6.** Find the impedance of this parallel combination of elements. Explore and discuss ω–dependence of Z.

(3) **7.** (a) Calculate the peak value of the voltage across the inductor. Here

$$V_0 = 10\,\text{V}$$
$$\omega = 2\pi \times 10^3\,\text{s}^{-1}$$
$$R = 1\,\Omega$$
$$L = 25\,\text{mH}$$
$$C = 1\,\mu\text{F}$$



(b) Calculate the Q of the circuit. What is the peak voltage across the inductor on-resonance?