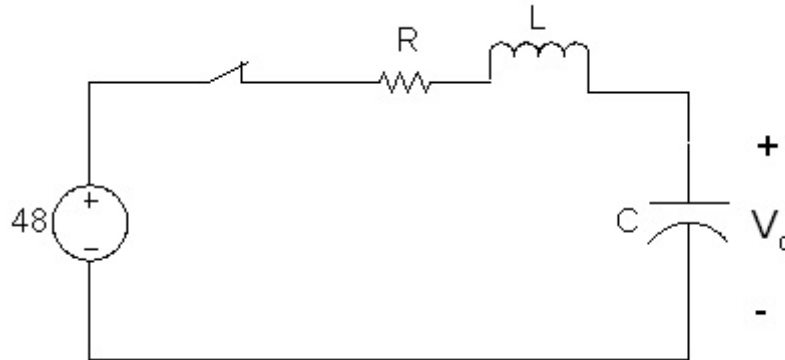


### Computing and plotting voltage across capacitor.

As usual, use praktikum.ee.itb.ac.id server for working and writing the program.

This week you are going to compute and plot the voltage across the capacitor  $V_c$  for the circuit shown in Figure 1. The voltage as a function of time is given by the equation



**Figure 1** RLC circuit

$$V_c = 48 - 48e^{-\alpha t} \cos(\omega_d t) - 14e^{-\alpha t} \sin(\omega_d t) \quad (1)$$

where

$$\alpha = \frac{R}{2L} \quad (2)$$

$$\omega_d = \sqrt{\omega_0^2 - \alpha^2} \quad (3)$$

and

$$\omega_0 = \frac{1}{LC} \quad (4)$$

Write a program to read in the values for the resistor (R), inductor (L) and capacitor (C) from an input file and compute  $V_c$  with the formula shown above. Do not ask the user at runtime to enter the values for the circuit elements. Use a for loop to iterate over time from  $t=0$  to  $t=.01$  seconds at intervals of .1 milliseconds. For each time step, print the time (t) and voltage ( $V_c$ ), with a space between the two values. Format both number to 8 places of accuracy past the decimal. Do **NOT** put any column headings in your output.

Next, start a file called lab6.in with text editor and type the input values 280, .1 and .4e-6 for the resistor, inductor and capacitor, respectively. Run your program with redirection for both input and output files:

```
lab6 < lab6.in > lab6.out
```

where `lab6` is the name of your executable file. To view the contents of the output file, type `more lab6.out`. There should be two columns of data, the first being time and the second being the voltage ( $V_c$ ). What voltage should you see at  $t=0$ ? How about as time goes to infinity?

Next, start a text editor session for the MATLAB commands. Enter the following instructions into this MATLAB command file:

```
load lab6.out
plot(lab6(:,1),lab6(:,2),'r:')
grid
xlabel('time (s)')
ylabel('V_c')
title('Step Response of an RLC Circuit')
```

Then save as `lab6.m`. The “.m” signifies that this file will contain MATLAB commands. When the above file is finished and saved, start MATLAB by typing

```
matlab
```

on the Command Prompt. When it has started, type

```
plot lab6.m
```

at the MATLAB prompt. This will run the MATLAB command file. You should see the plot of the voltage across the capacitor as a function of time appear on your screen. Show your lab instructor when you are done. Exit MATLAB by typing the word `quit` at the MATLAB command prompt.