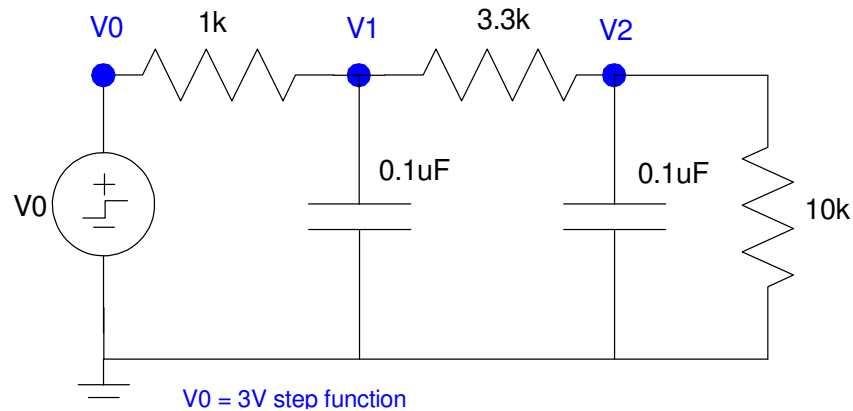


ECE 211: Homework #9

The p-operator. RC circuits. LC circuits.

RC Circuits



Problem 1-5

- 1) Assume V_0 is 3V for $t < 0$. Determine the voltages at V_1 and V_2 at $t = 0$
- 2) Give the differential equations which describe this two-stage RC circuit
- 3) Using the p-operator, determine the voltage $V_2(t)$ for $t > 0$
 - Note how long it takes for $V_2(t)$ to decay to about 5% of its initial value

CircuitLab:

- 4) Simulate this circuit using CircuitLab. Set V_0 to be a square wave which goes from 0V to 3V. Set the frequency long enough that V_1 and V_2 reach steady-state before switching

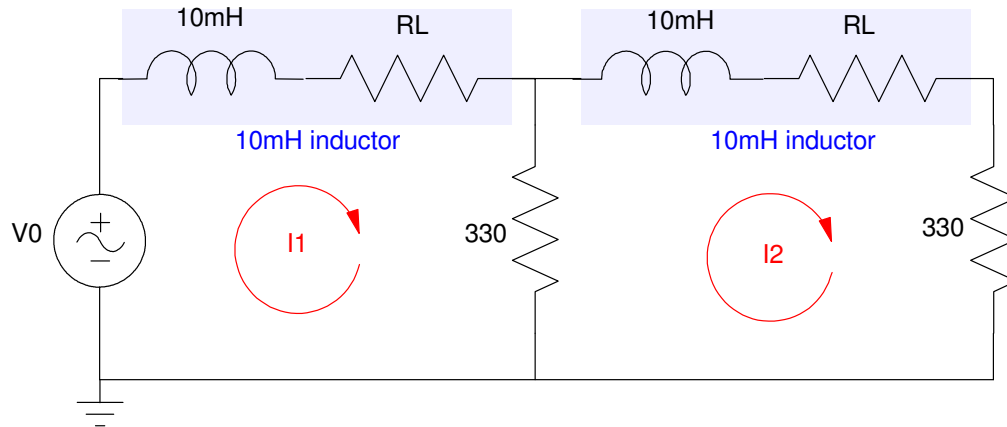
Define $t=0$ to be the time when V_0 goes from 3V to 0V. Measure the following

- $V_1(t=0)$
- $V_2(t=0)$
- The settling time (how long it takes $V_2(t)$ to decay to about 5% of their initial voltage)

Lab

- 5) Build this circuit with your breadboard.
 - Use your FNRSI signal generator for V_0 . Set it to be a 3V square wave with the period long enough that the voltages at V_1 and V_2 reach steady-state before V_0 switches.
 - Include a photo of your circuit
- 6) Define $t=0$ to be the time when V_0 goes from 3V to 0V. Measure the following
 - $V_1(t=0)$
 - $V_2(t=0)$
 - The settling time (how long it takes $V_2(t)$ to decay to about 5% of their initial voltage)

RL Circuits



Problem 7-13

7) Measure the DC resistance of your 10mH inductors in your lab kit. This is R_L in the circuit above. (R_L isn't added to the circuit: it's the series resistance of the 10mH inductor).

8) Assume V_0 is 3V for $t < 0$. Determine the currents I_1 and I_2 at $t = 0$

9) Give the differential equations which describe this two-stage RL circuit

10) Using the p-operator, determine the current $I_2(t)$ for $t > 0$

- Note how long it takes for $I_2(t)$ to decay to about 5% of its initial value

CircuitLab:

11) Simulate this circuit using CircuitLab. Set V_0 to be a wave which goes from 0V to 3V. Set the frequency long enough that I_1 and I_2 reach steady-state before switching.

Assume $t=0$ is defined when V_0 goes from 3V to 0V. From the CircuitLab simulation, determine the following.

- $I_1(t=0)$
- $I_2(t=0)$
- The time it takes $I_2(t)$ to decay to about 5% of its initial value