CENTER OF NANOELECTRONICS & DEVICES

Lab 3

Circuits Containing Reactive Components

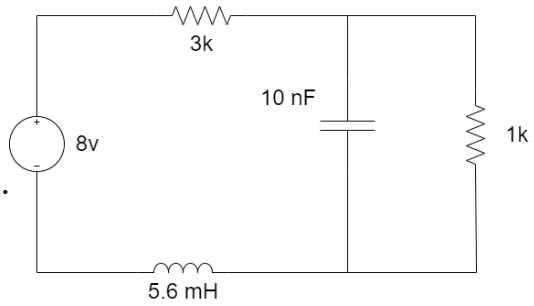
Introduction:

In this experiment, we introduce the inductors and capacitors as passive elements of the circuit.

A- DC Analysis Passive components:

I. Experiment:

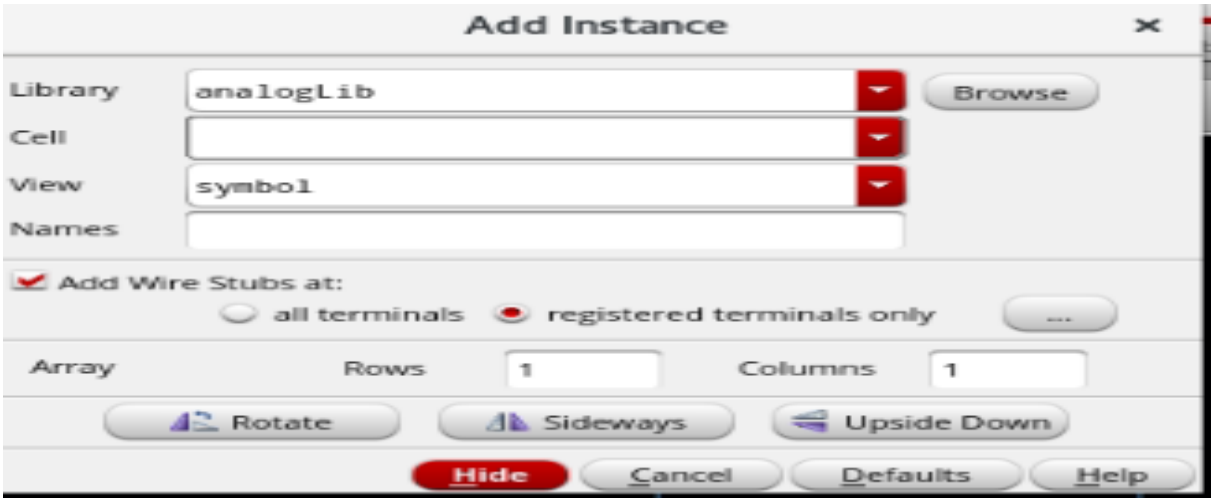
1- Connections are made as shown.
2- Measure actual values as described in Table 1.
3- Plot the output signals at each node.



	V_{C1}	V_{R1}	V_{R2}	V_{L1}
Value				
	I_{C1}	I_{R1}	I_{R2}	I_{L1}
Value				

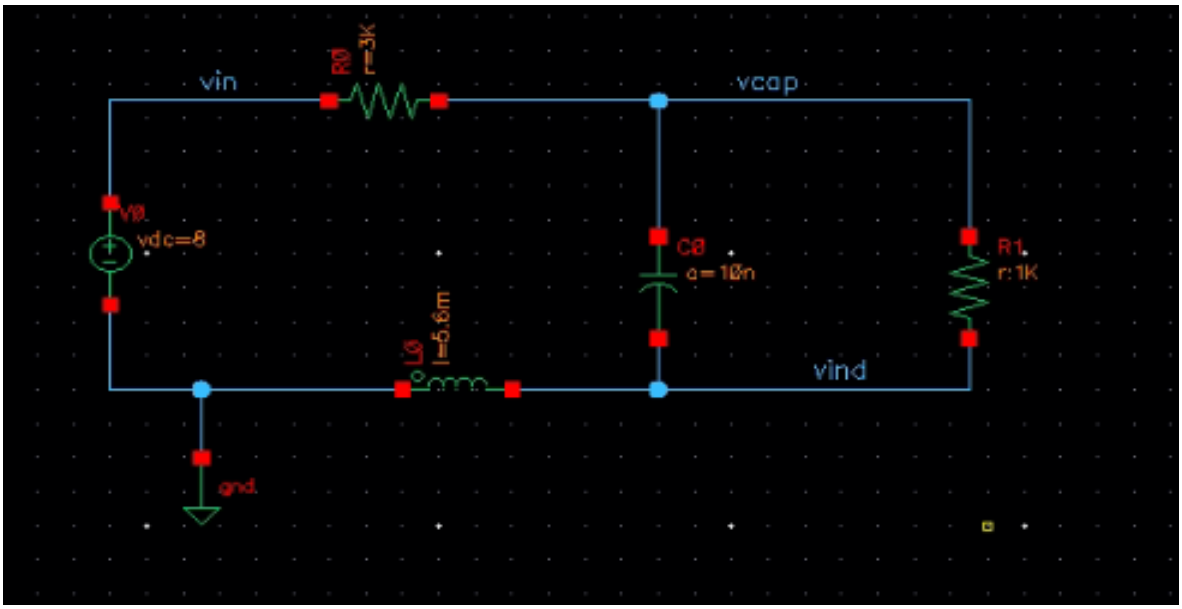
II. Simulation Procedures:

- Open cadence, and create your library and cell view.
- Press (I) to add an instance.
- Choose: analog lib



- Choose your components from cell in the figure above:

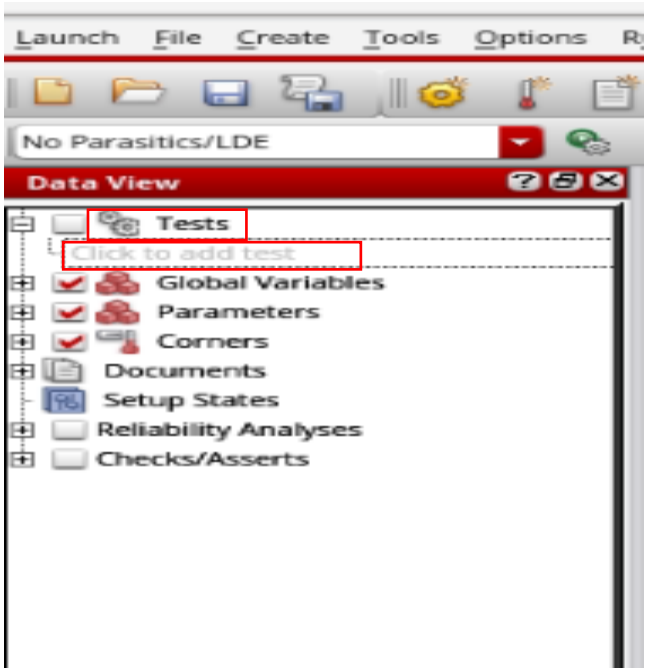
- Adjust the values of the components as in the following figure. (You can name each node by pressing (L) and name each node.)



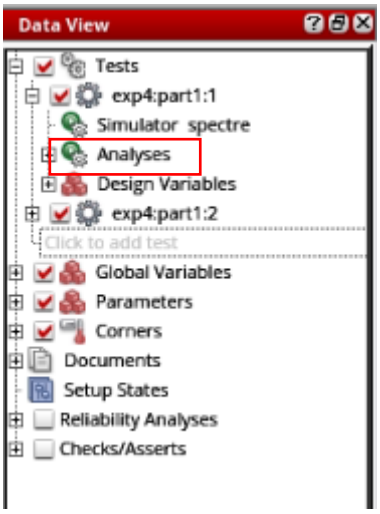
- Click save and check.

- From launch, choose ADE XL

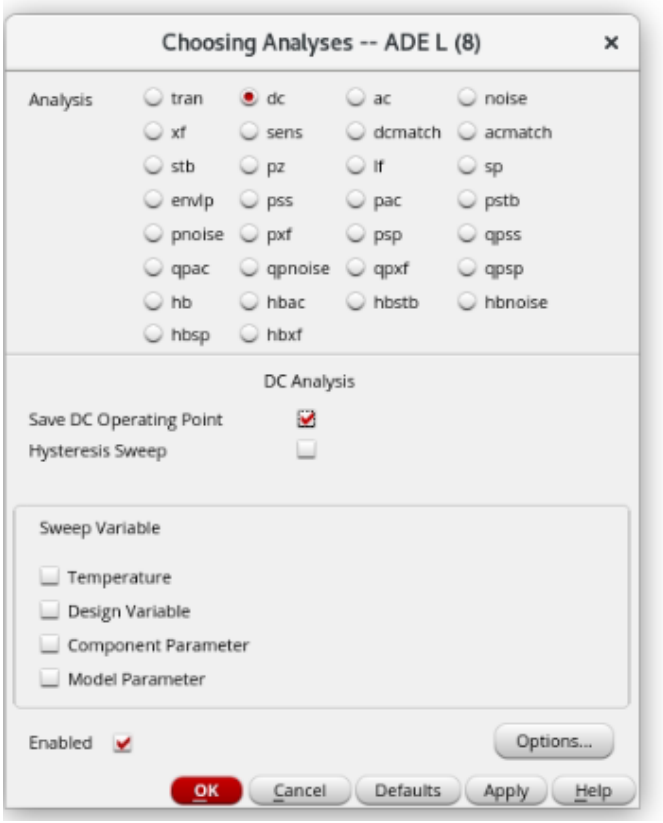
- Choose: “Create New View”
- Select “tests” and click on “click to add test”.



- Choose the following settings and choose analyses.

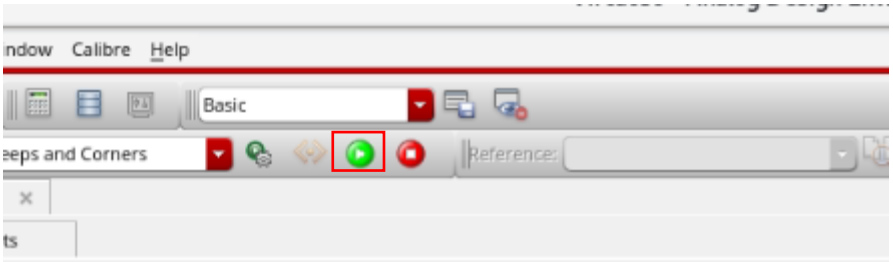


- Adjust the options as in the following figure :

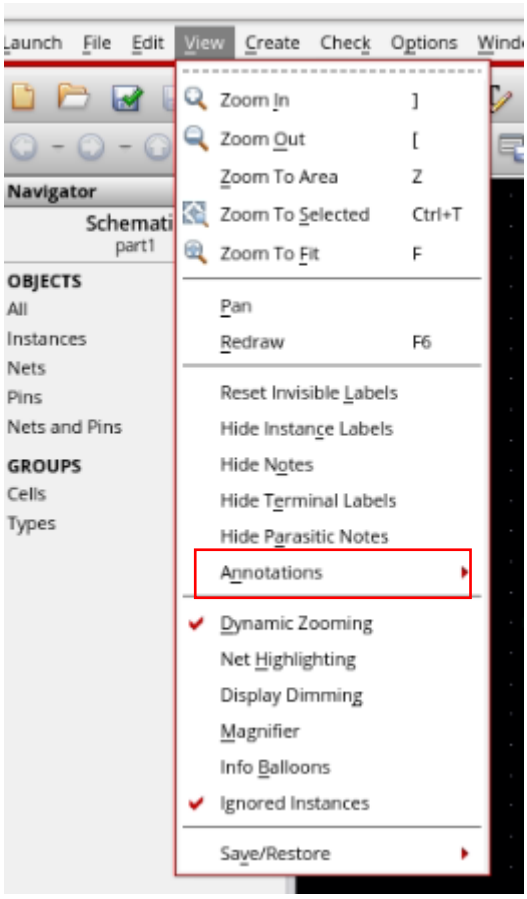


- Press ok.

- Run simulation.

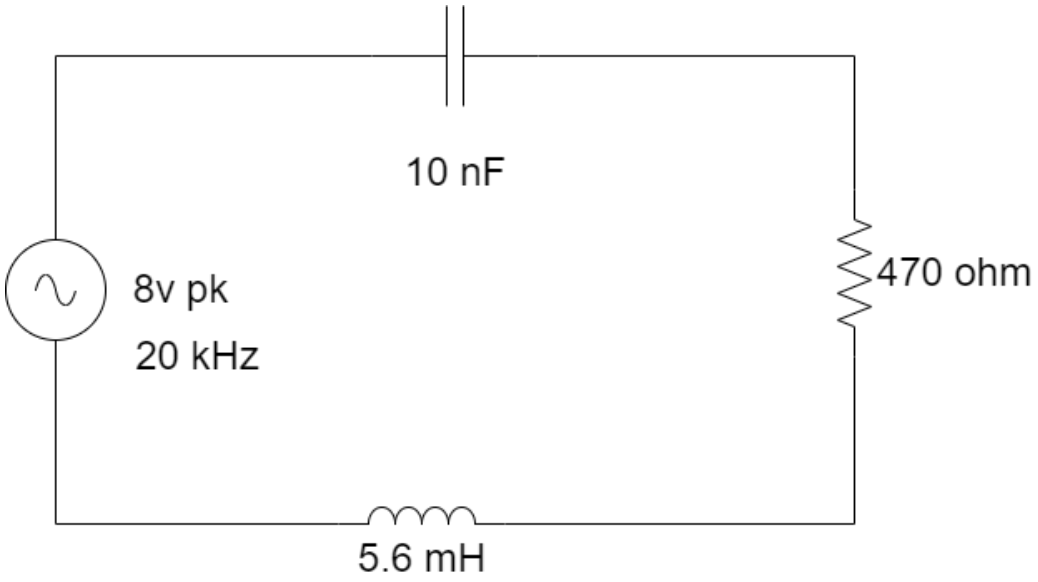


- From “view”, choose annotations.



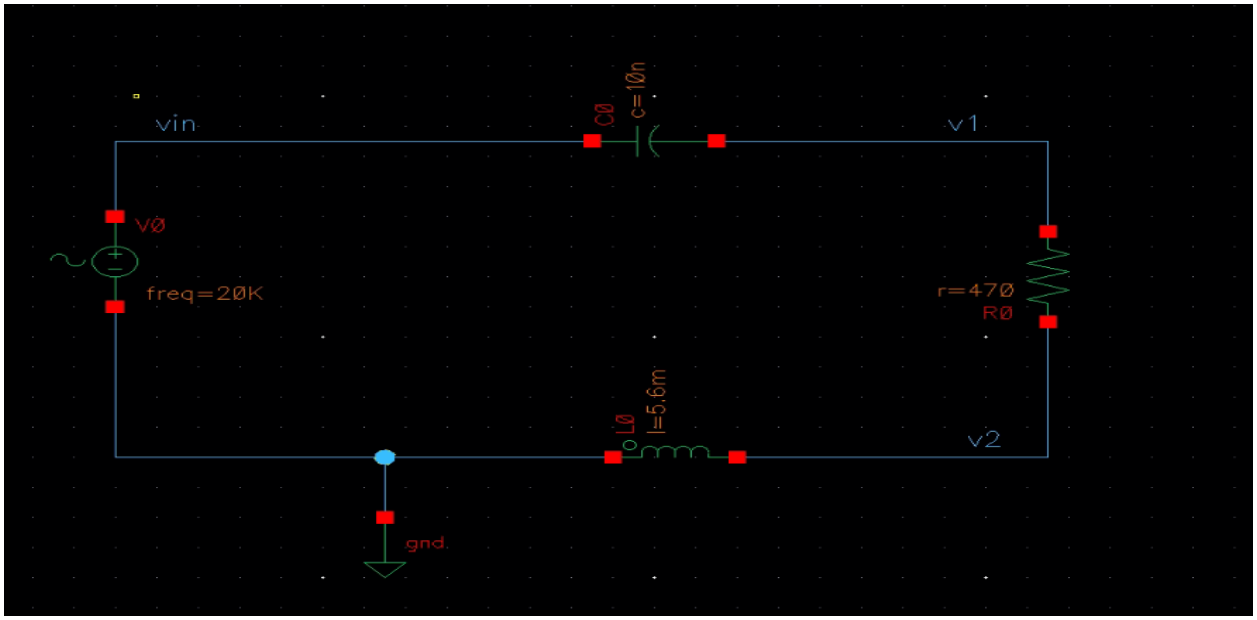
- Choose “Dc Voltages”
- You will find the value of voltage at each node.

B- Transient RLC analysis:



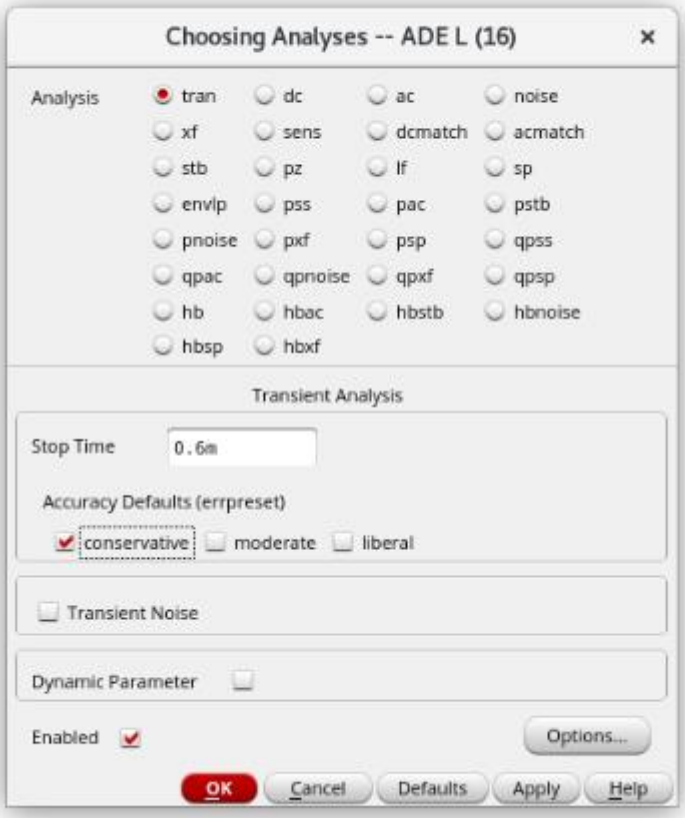
Simulation Procedures:

- Choose components as in the first part.
- Choose "Vsin" from analoglib (you can name nodes).
- The circuit will be as shown:



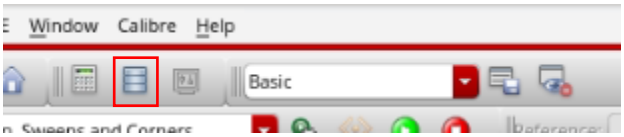
- Save and check.
- Then open ADE XL.

- This time, choose transient from analyses.
- Adjust your stop time as shown:

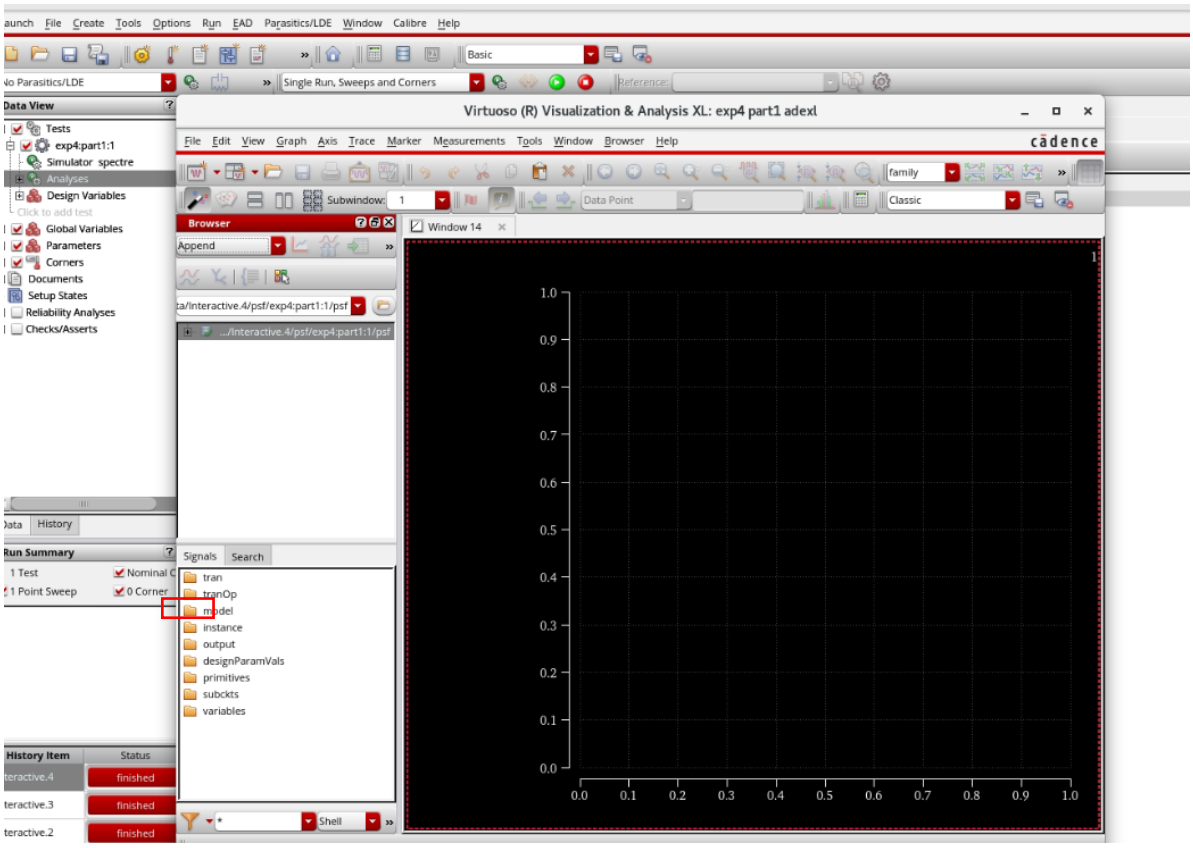


- Then, run.

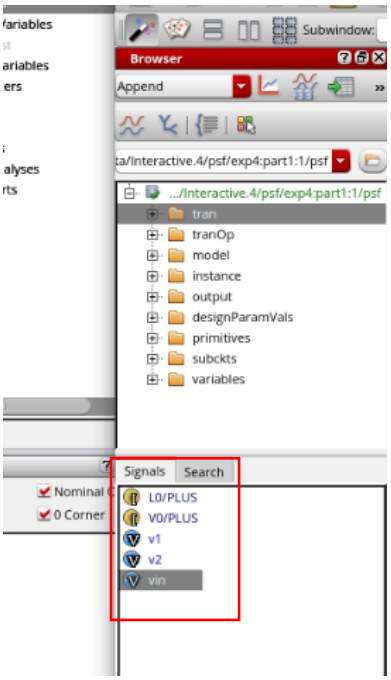
-
- The click on results browser.



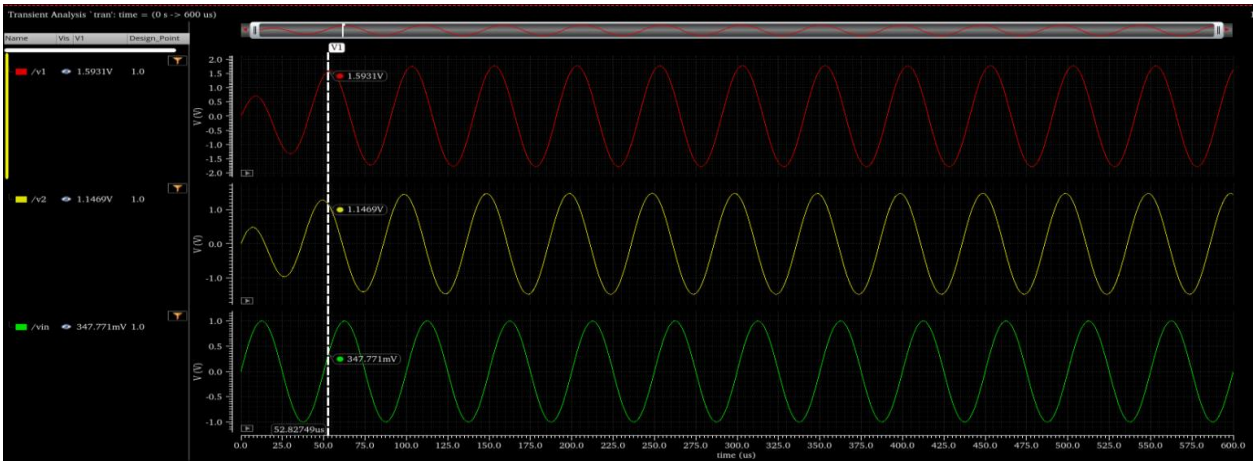
- Choose trans.



- Double-click the nets you want.



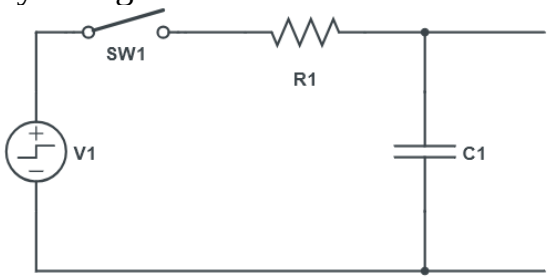
- you can make sure that signals of V1 and V2 are phase-shifted from the input signal.



C- Transients in RC circuit:

1. Introduction

A transient in an RC circuit is a quick shift in current that happens when the applied voltage is rapidly changed.



2. For Transients in RC

Let:

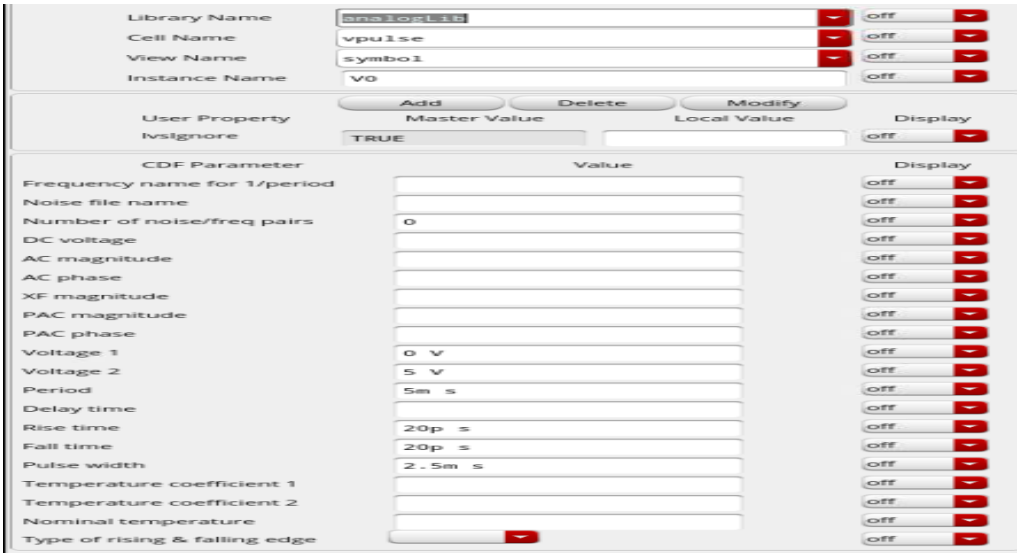
- R1 = 10 KΩ
- C1 = 20 nF
- V1 = 5 Vp, 200 Hz.

3. Experiment

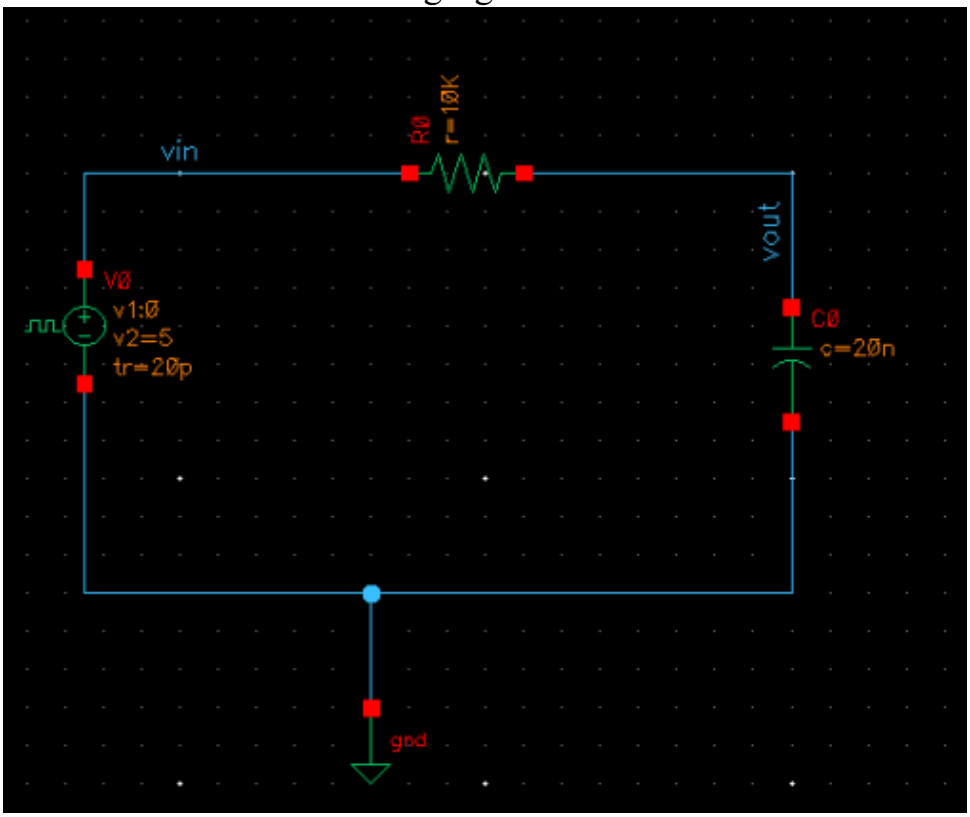
- In this part, you are required to plot Vin and Vout=Vc.
- Measure t (*0.632* of its final steady-state value) and compare it with the calculated t.

Simulation Procedures:

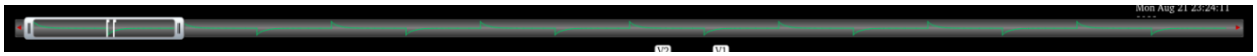
- do same as previous parts.
- To add the source, choose “vpulse” from analoglib and choose the parameters of the source as indicated in the figure to be consistent with the given frequency.



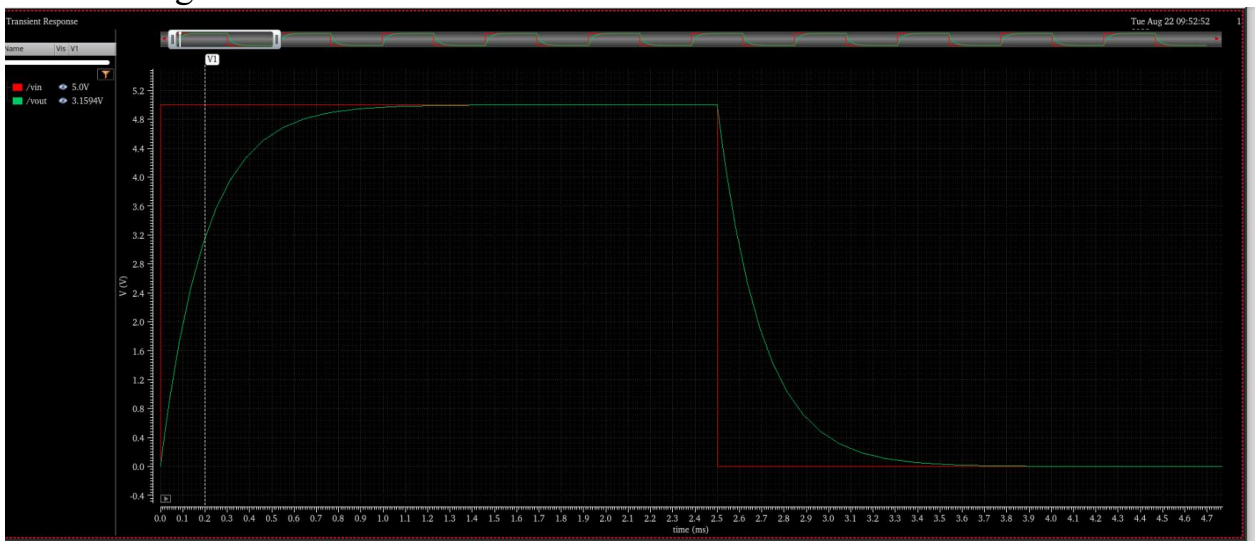
- Circuit will be as in the following figure.



- Choose the stop time for transient analysis to be appropriate(50ms).
- Use this to zoom in.

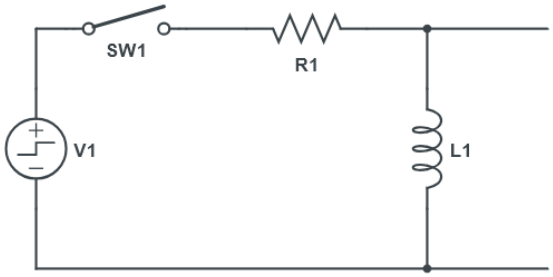


- When showing plot press (V) to get vertical curser to show the value of voltage at certain time.



- Adjust the cursor to be 63.2% from the steady state value(5v).
- You can expect the time required analytically(R*C).

D- Transients Analysis in RL circuit



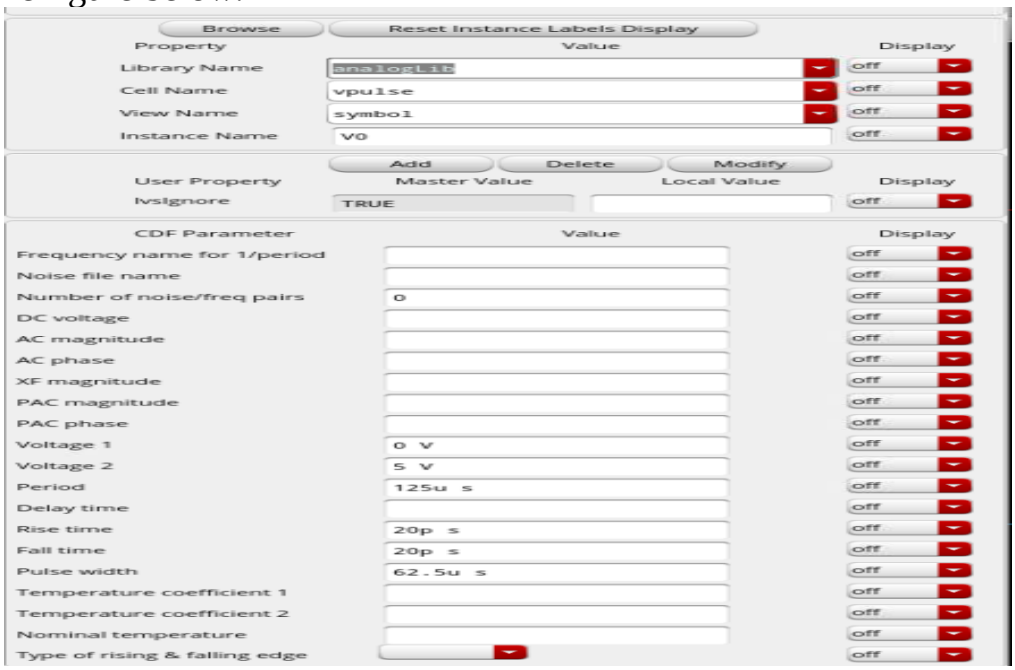
1. **For Transients in RL**

   Let:
   - R1 = 1 KΩ
   - L1 = 5.6 mH
   - V1 = 5 Vp, 8 KHz.

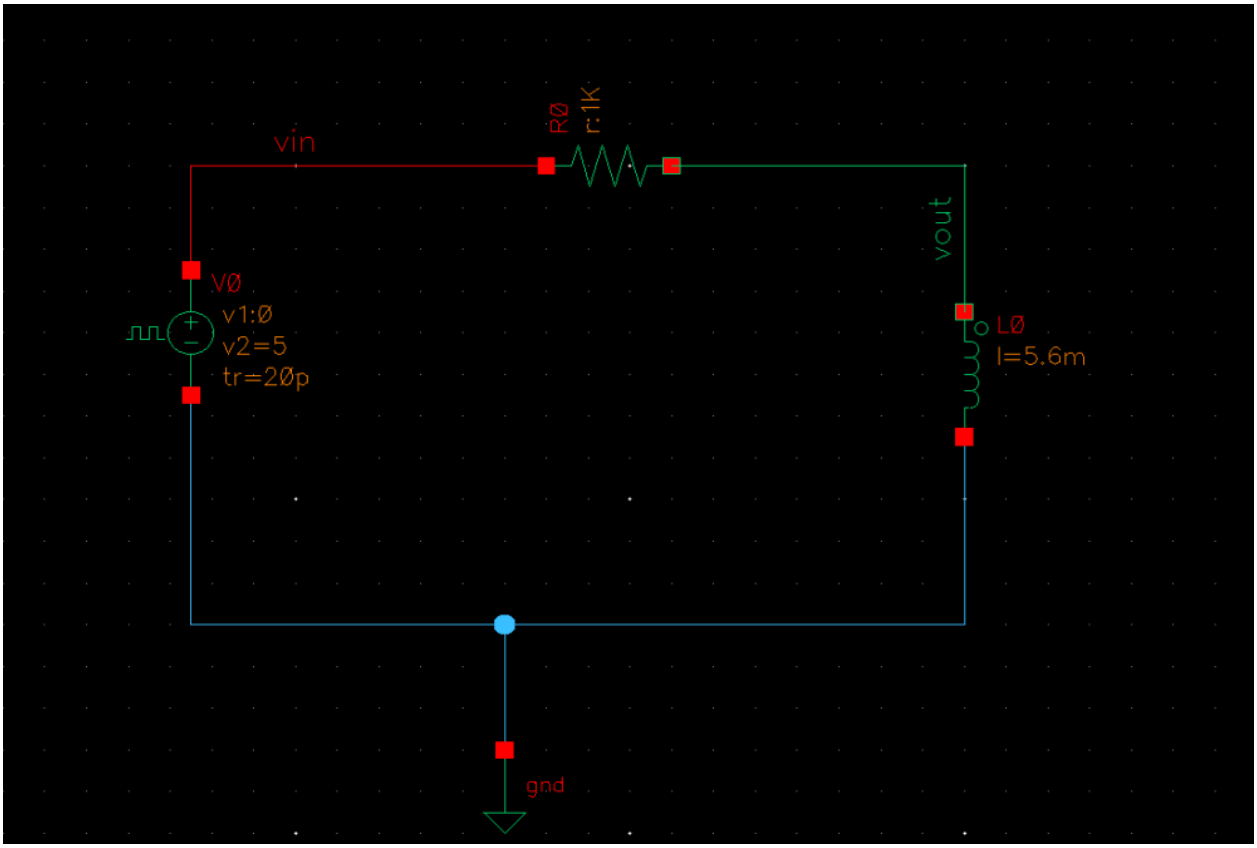
2. **Experiment:**
   - Plot Vin and Vout = VL.
   - Measure t (0.632 of its final steady-state value) and compare it with the calculated t.

3. **Simulation Procedures:**
   - Add the components as you learnt before.

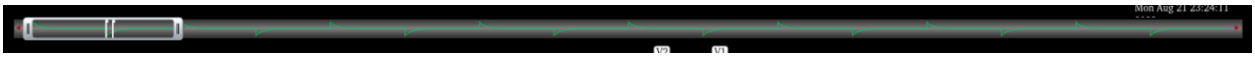
- Add the voltage source as indicated: the following parameters are to be consistent with the required frequency, so adjust these parameters as in the figure below.



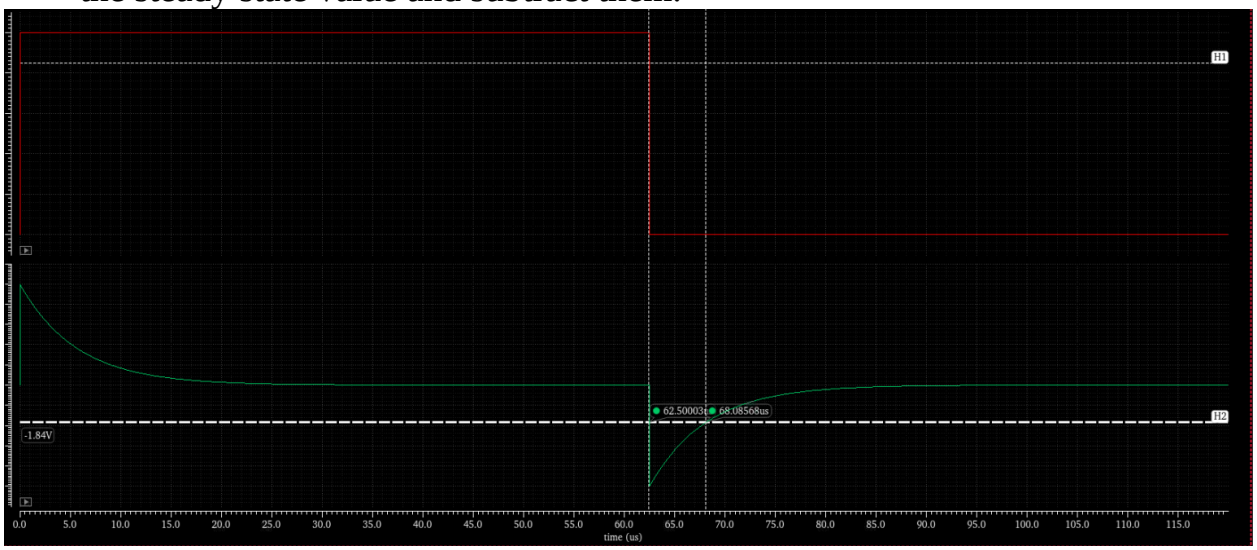
- The circuit will be as indicated:



- Using ADE L or ADE XL, you should do transient analysis and plot the results using a stop time of 1ms.
- You can zoom in using this.



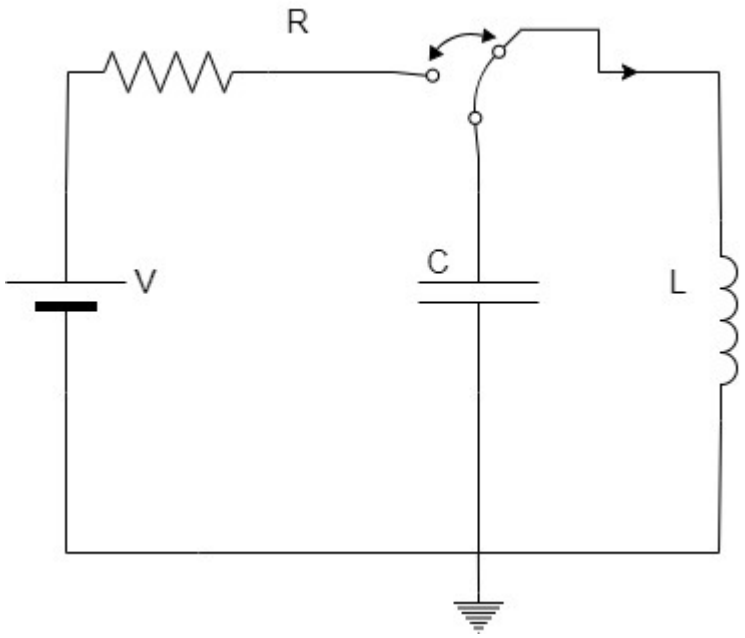
- You can use horizontal curser by pressing (H) and vertical curser by pressing (V).
- Double clicking on any curser allows you to choose the value you want to intersect the plot.
- In this plot the steady state value is at zero, while the starting value is -5 V, so you put a curser at -5v and the other curser at the value representing 63.2% of the steady state value and subtract them.



- Compare this with the theoretical value (L/R).

Assignment 3

- Using cadence virtuoso, design a signal generator with (R, L&C) components
- Let the input signal sinusoidal wave with
  -V_{dc}=9v.
  -c=10pF
  -L=40mH
  -R=10ohm
- Try to change values of capacitor, coil and mention your own notes of the output (5values).



Bonus Questions of Lab 3

Using cadence, try to design a simple pace-maker was shown in figure 2

and Mention that:-

- what is a pacemaker and how it works.
- your notes for the output simulation (transient analysis)

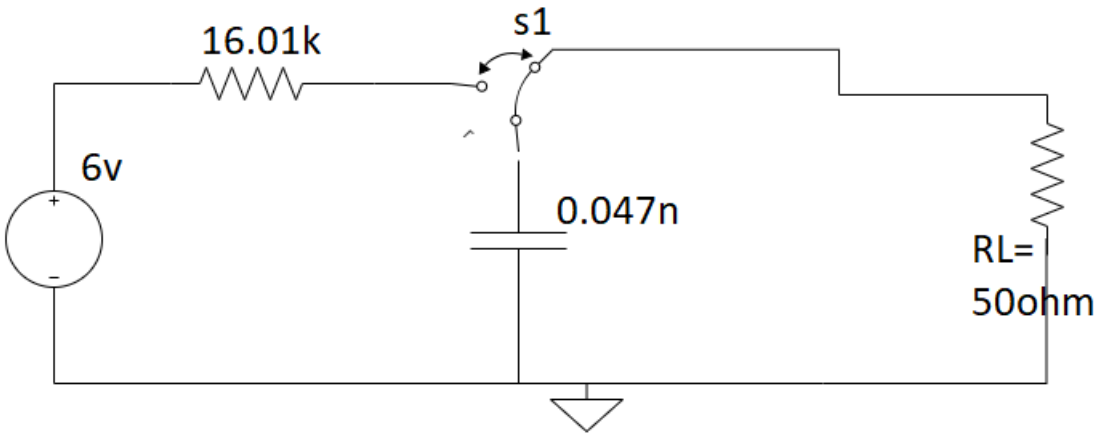


Figure 2 pace-maker circuit