

Lab 3

Circuits Containing Reactive Components

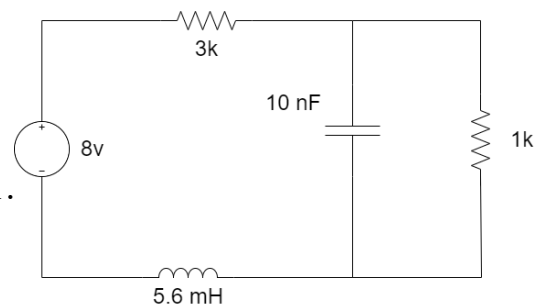
Introduction:

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

A- DC Analysis Passive components:

I. Experiment:

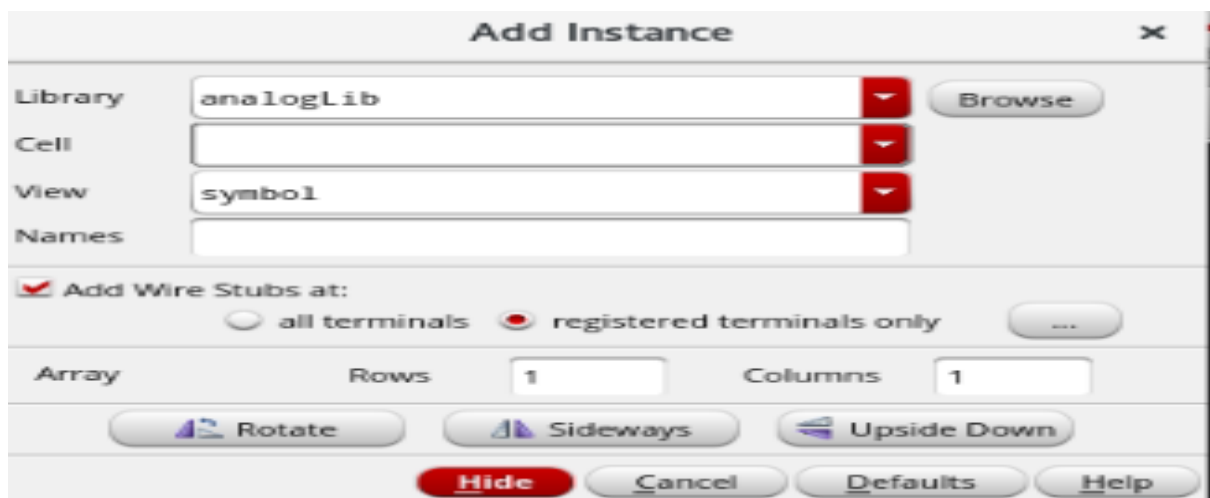
- 1- Connections are made as shown.
- 2- Measure actual values as described in Table 1.
- 3- Plot the output signals at each node.



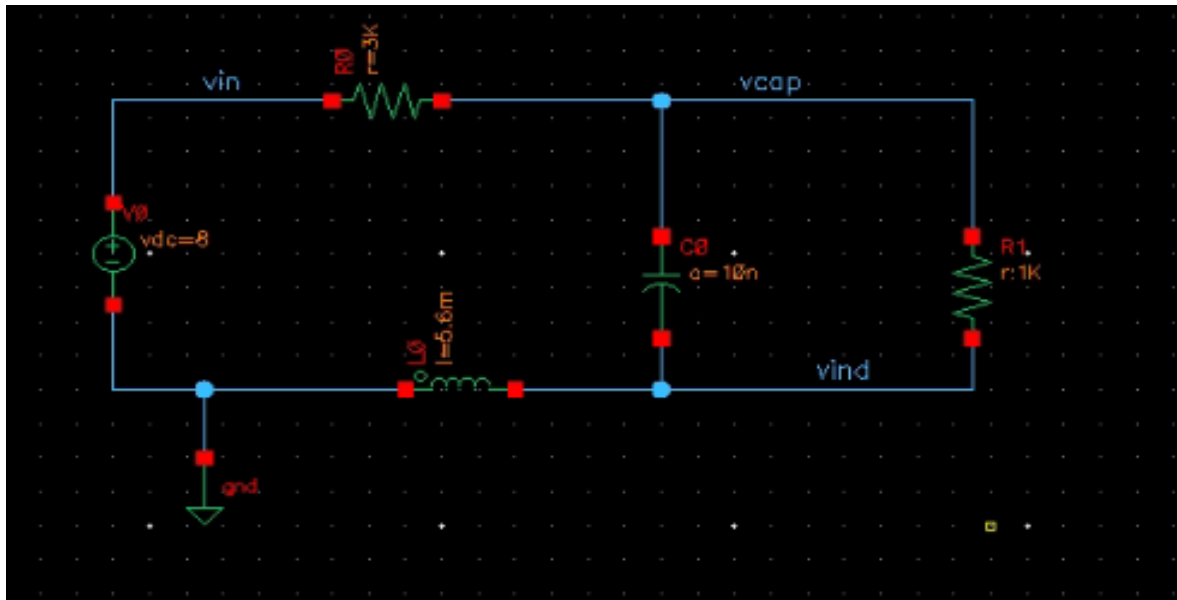
	V_{C1}	V_{R1}	V_{R2}	V_{L1}
Value				
	I_{C1}	I_{R1}	I_{R2}	I_{L1}
Value				

II. Simulation Procedures:

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



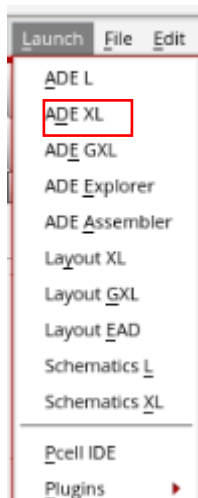
- Choose your components from cell in the figure above:
- Adjust the values of the components as in the following figure. (You can name each node by pressing (L) and name each node.)



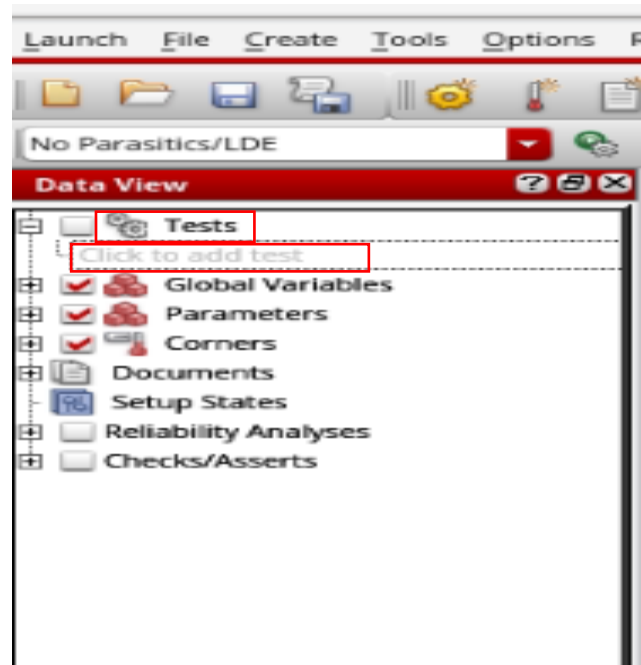
- Click save and check.



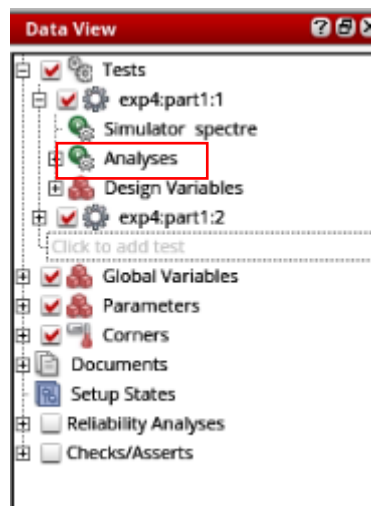
- From launch, choose ADE XL



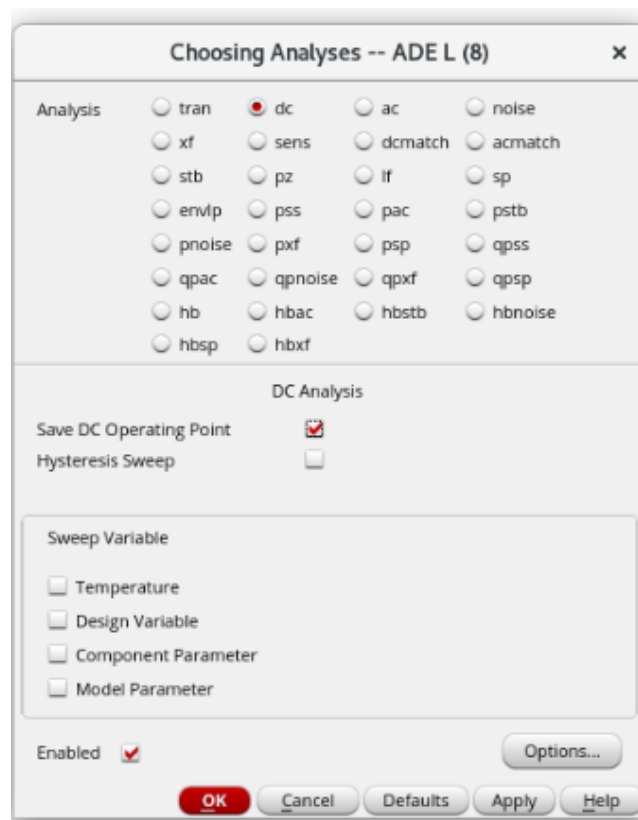
- Choose: “Create New View”
- Select “tests” and click on “click to add test”.



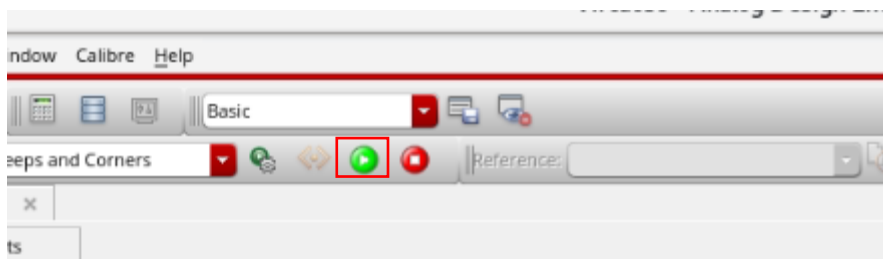
- Choose the following settings and choose analyses.



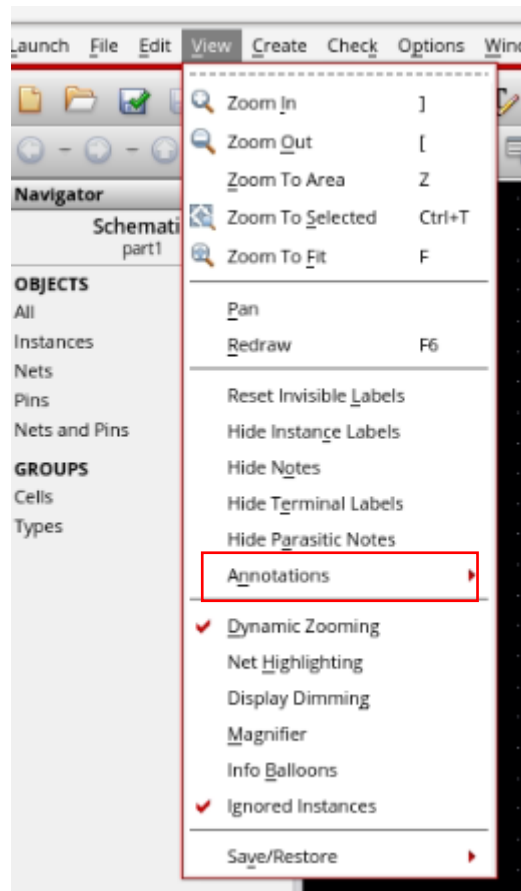
- Adjust the options as in the following figure :



- Press ok.
- Run simulation.



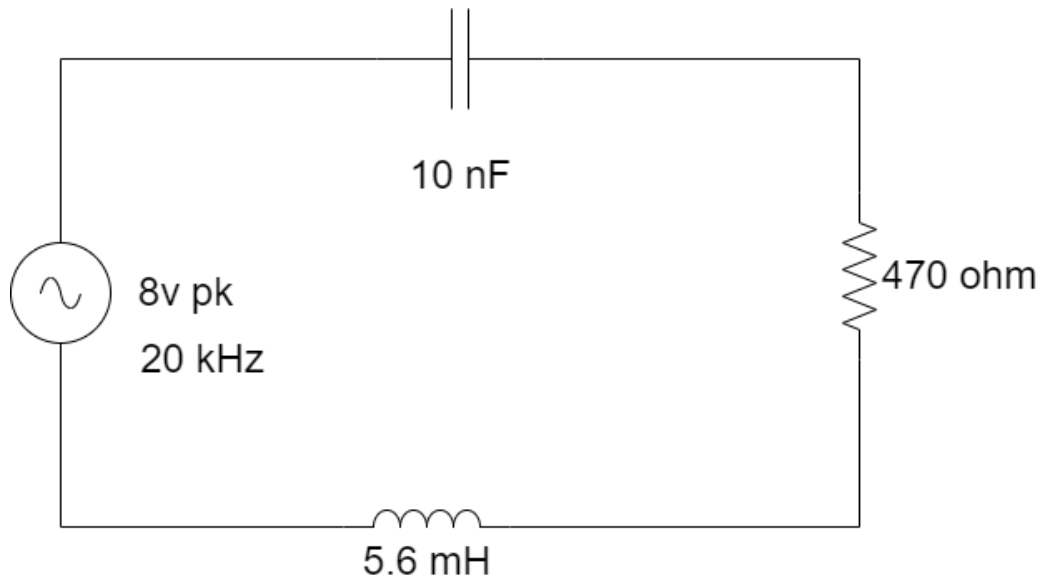
- From “view”, choose annotations.



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

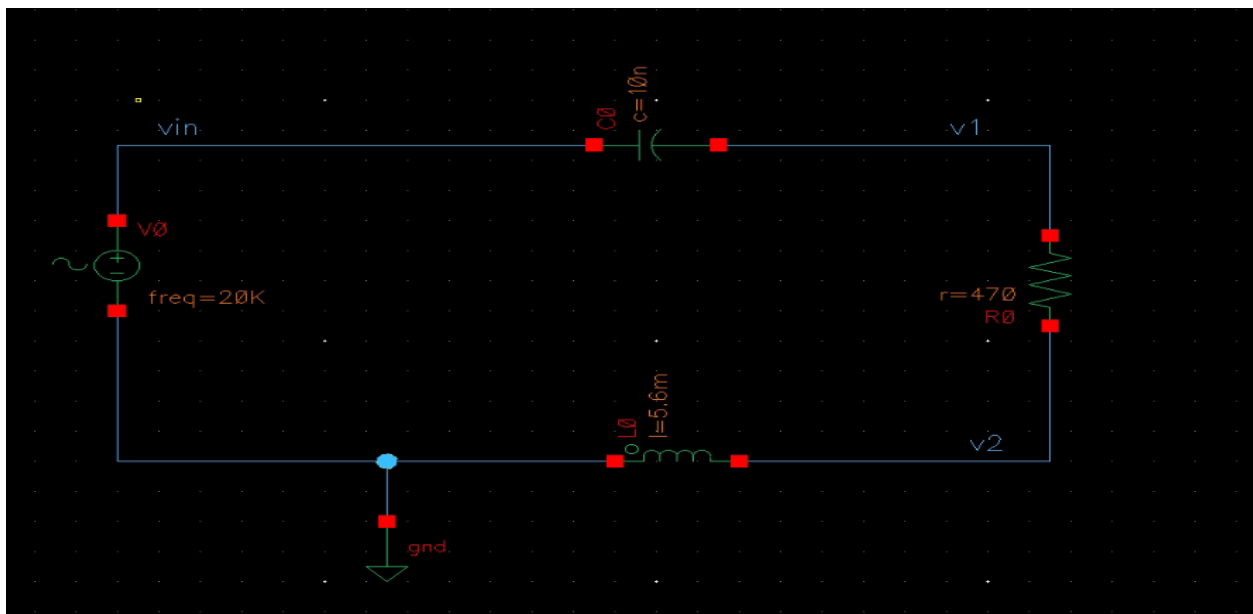


B- Transient RLC analysis:



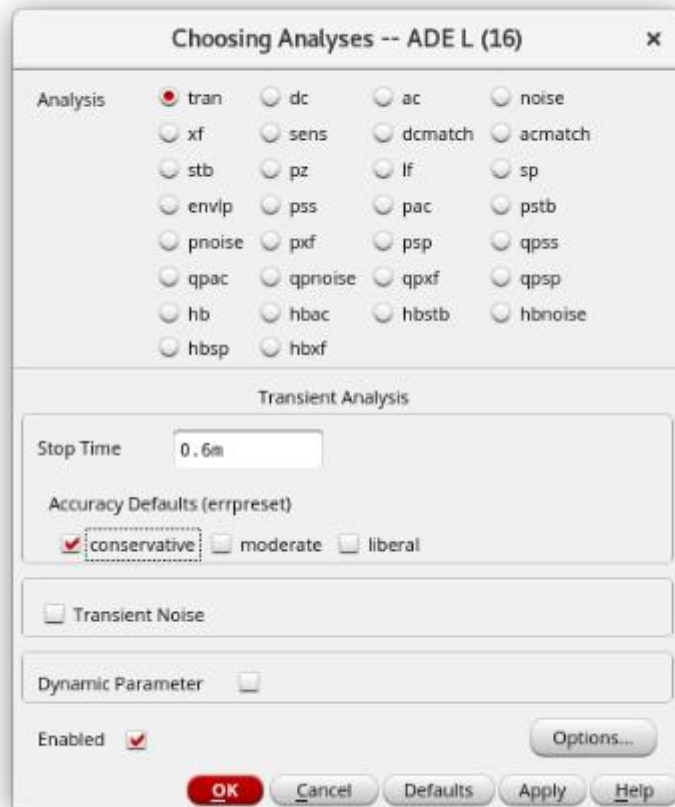
Simulation Procedures:

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

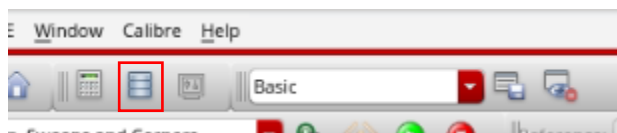


- Save and check.
- Then open ADE XL.

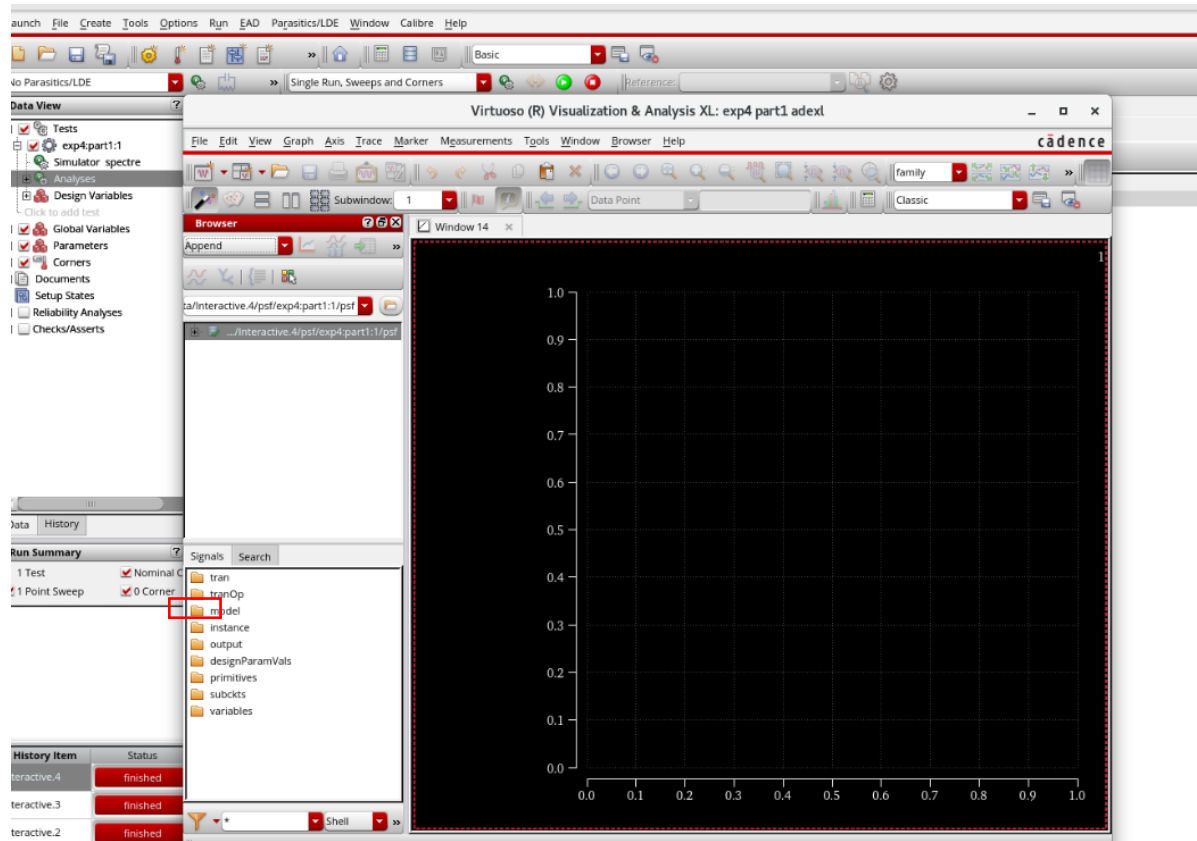
- This time, choose transient from analyses.
- Adjust your stop time as shown:



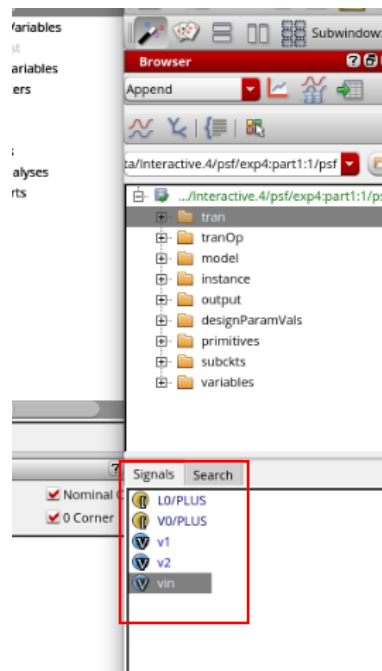
- Then, run.
-
- The click on results browser.



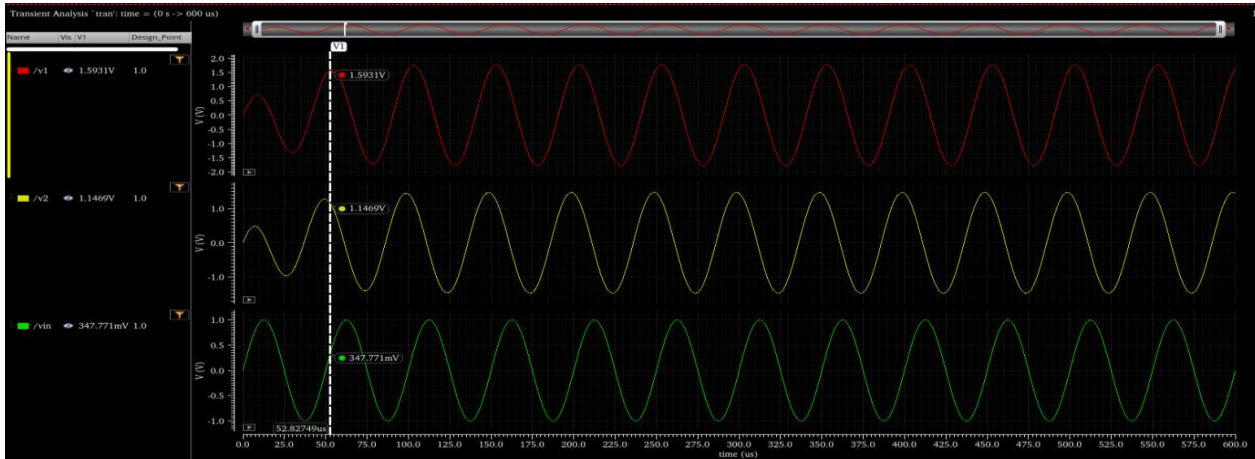
- Choose trans.



- Double-click the nets you want.



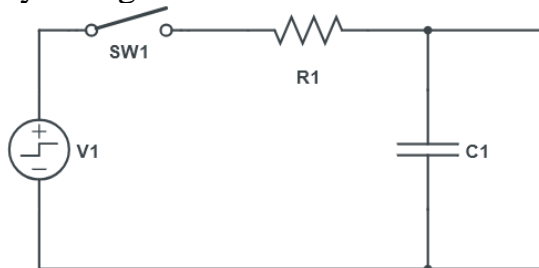
- you can make sure that signals of V1 and V2 are phase-shifted from the input signal.



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:

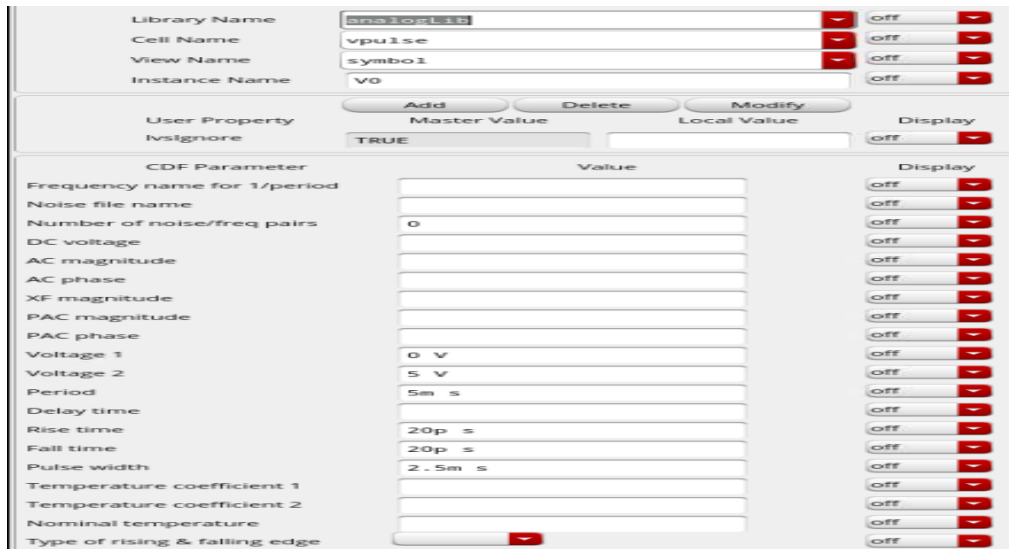
- $R1 = 10 \text{ K}\Omega$
- $C1 = 20 \text{ nF}$
- $V1 = 5 \text{ Vp}, 200 \text{ Hz}$.

3. Experiment

- In this part, you are required to plot V_{in} and $V_{out}=V_c$.
- 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.



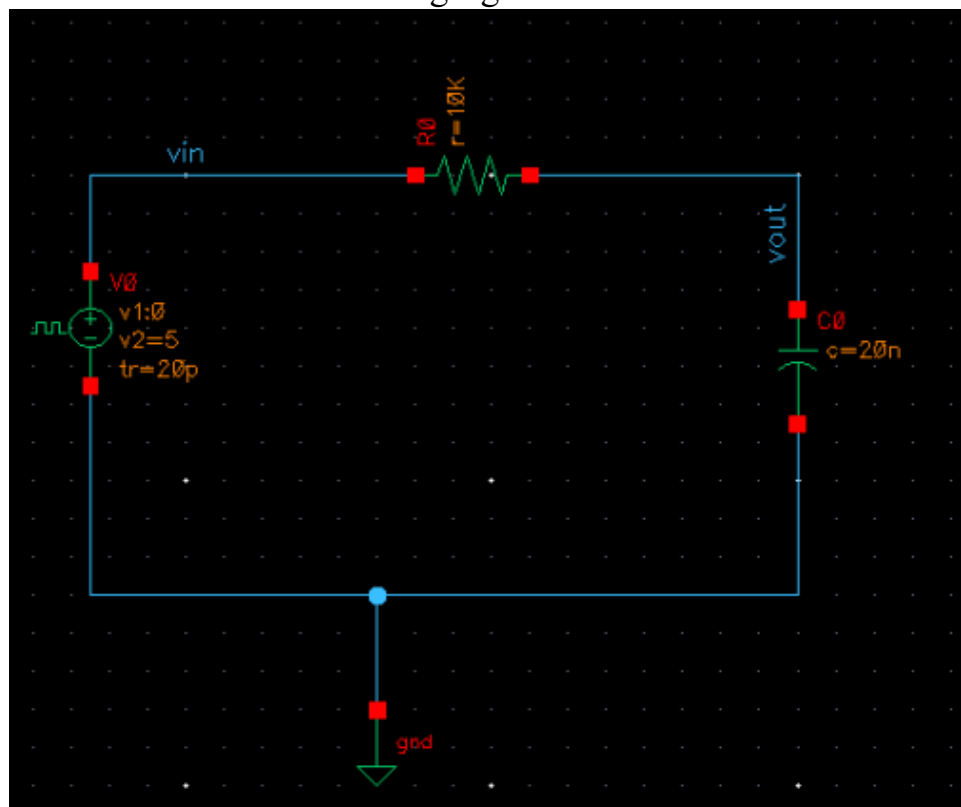
Library Name: analoglib
Cell Name: vpulse
View Name: symbol
Instance Name: V0

User Property: Ivsignore: TRUE

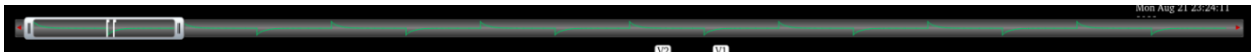
CDF Parameter: Value

Parameter	Value	Display
Frequency name for 1/period		off
Noise file name		off
Number of noise/freq pairs	0	off
DC voltage		off
AC magnitude		off
AC phase		off
XF magnitude		off
PAC magnitude		off
PAC phase		off
Voltage 1	0 V	off
Voltage 2	5 V	off
Period	5m s	off
Delay time		off
Rise time	20p s	off
Fall time	20p s	off
Pulse width	2.5m s	off
Temperature coefficient 1		off
Temperature coefficient 2		off
Nominal temperature		off
Type of rising & falling edge		off

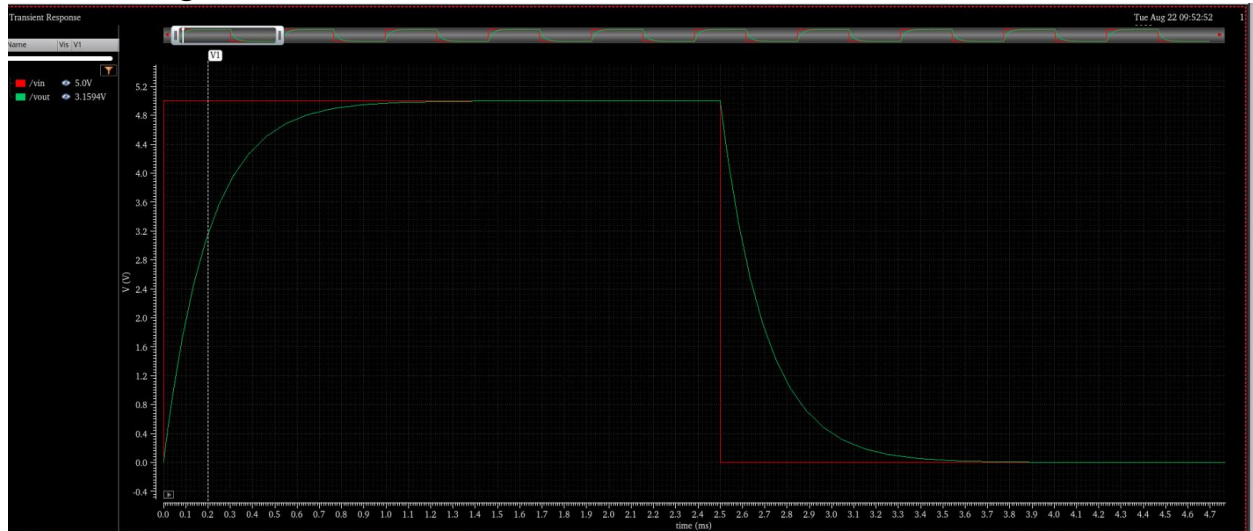
- Circuit will be as in the following figure.



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

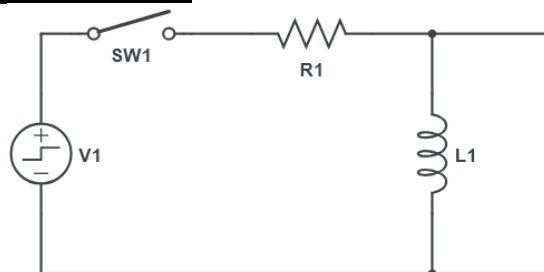


- When showing plot press (V) to get vertical curser to show the value of voltage at certain time.



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

D- Transients Analysis in RL circuit



1. For Transients in RL

Let:

- $R1 = 1 \text{ K}\Omega$
- $L1 = 5.6 \text{ mH}$
- $V1 = 5 \text{ Vp}, 8 \text{ KHz}$.

2. Experiment:

- Plot V_{in} and $V_{out} = V_L$.
- 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.

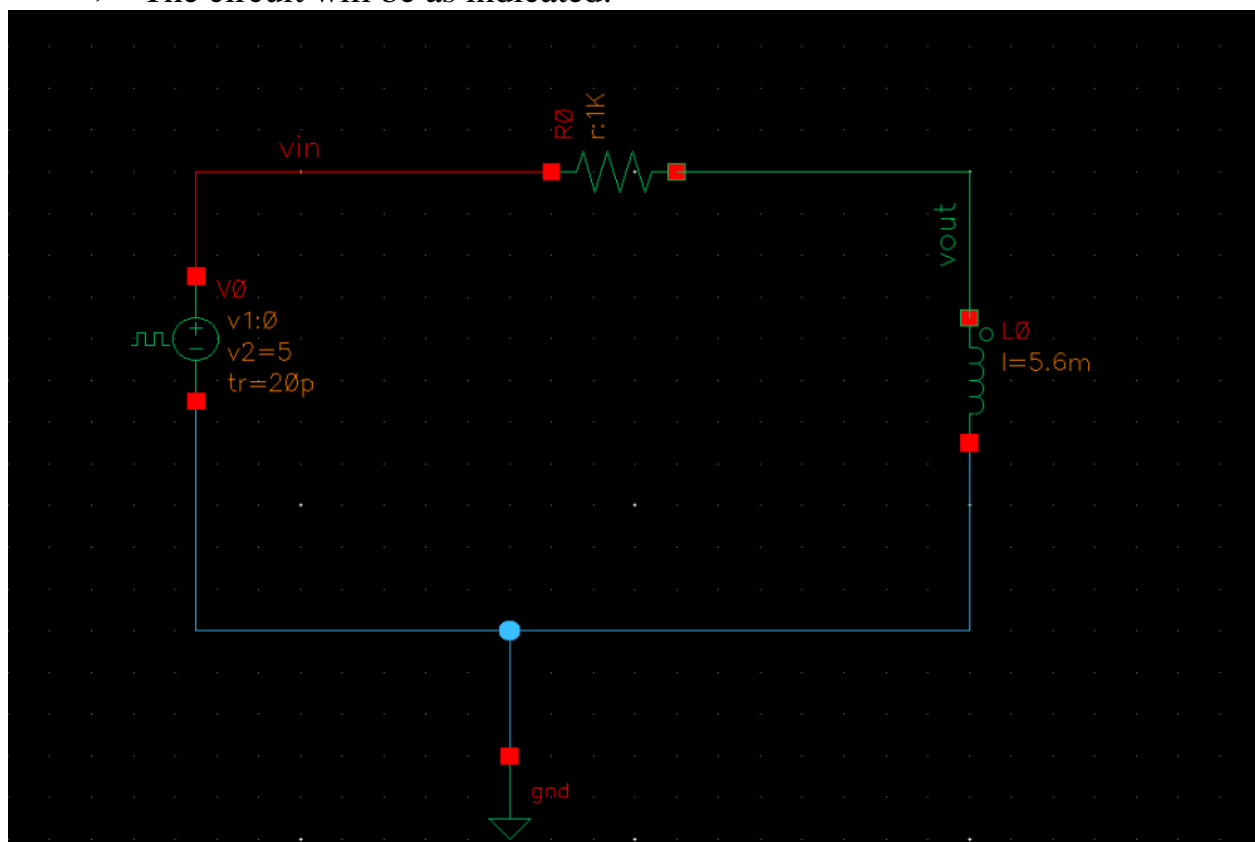
- Add the voltage source as indicated: the following parameters are to be consistent with the required frequency, so adjust these parameters as in the figure below.

Property		Reset Instance Labels Display		Value		Display	
Library Name	analoglib					off	on
Cell Name	vpulse					off	on
View Name	symbol					off	on
Instance Name	V0					off	on

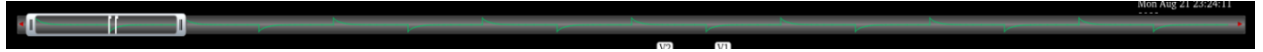
User Property		Add		Delete		Modify		Display	
lvignore	TRUE							off	on

CDF Parameter		Value		Display	
Frequency name for 1/period				off	on
Noise file name				off	on
Number of noise/freq pairs	0			off	on
DC voltage				off	on
AC magnitude				off	on
AC phase				off	on
XF magnitude				off	on
PAC magnitude				off	on
PAC phase				off	on
Voltage 1	0 V			off	on
Voltage 2	5 V			off	on
Period	125u s			off	on
Delay time				off	on
Rise time	20p s			off	on
Fall time	20p s			off	on
Pulse width	62.5u s			off	on
Temperature coefficient 1				off	on
Temperature coefficient 2				off	on
Nominal temperature				off	on
Type of rising & falling edge				off	on

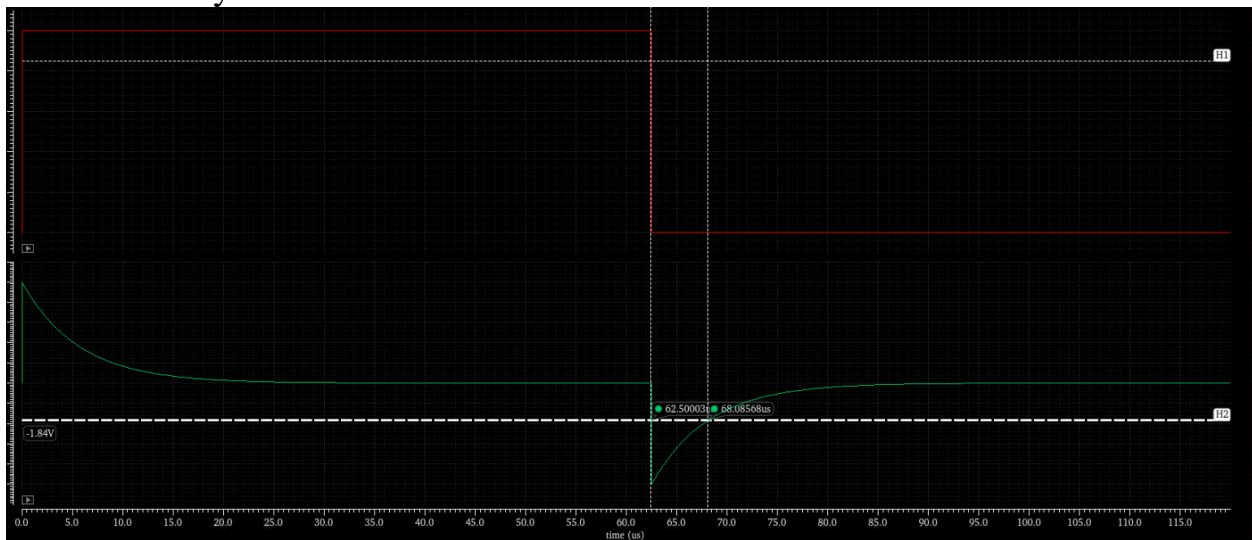
- The circuit will be as indicated:



- 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 cursor by pressing (H) and vertical cursor by pressing (V).
- Double clicking on any cursor 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 cursor at -5v and the other cursor at the value representing 63.2% of the steady state value and subtract them.

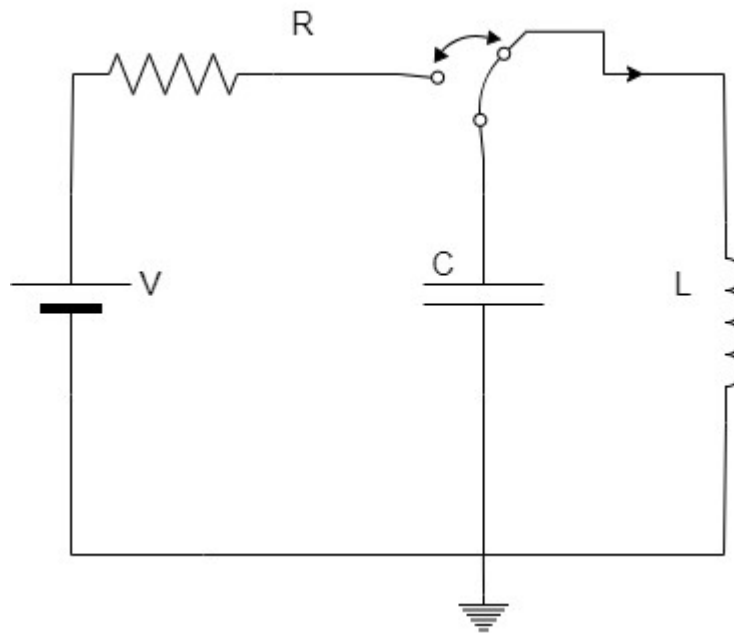


- Compare this with the theoretical value (L/R).



Assignment 3

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





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)

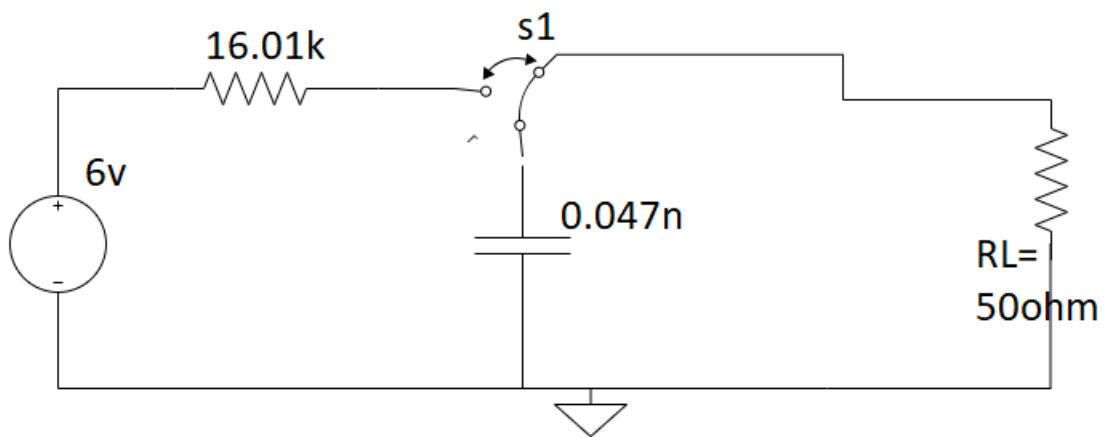


Figure 2 pace-maker circuit