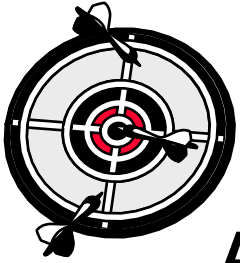


Introduction to Cadence

Dr Basel Halak

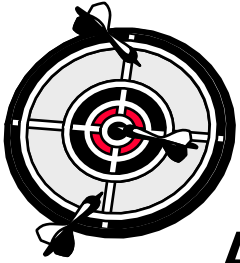
Learning Outcomes



After completing this unit, you should be able to:

- 1. Set up a directory to run Cadence**
- 2. Install the design files for the AMS 0.35um PDK**
- 3. Run the Cadence Design Manager (ICFB)**
- 4. Create a Cadence Project**
- 5. Create a simple Cadence Cell View (Schematic)**
- 6. Link to an external library in Cadence**
- 7. Use the external blocks in your design**

Learning Outcomes



After completing this unit, you should be able to:

1. **Set up a directory to run Cadence**
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7. **Use the external blocks in your design**

Introduction

- **The first thing we need to do is to create a directory that has the correct setup and config files to run:**
 - A: Cadence
 - B: the AMS PDK (Process Design Kit)
- **Log onto a Unix Machine (hind) using NX Client or Exceed**
 - See instructions on:
 - <http://users.ecs.soton.ac.uk/bim/notes/cad/guides/begin.html>
- **Create a new directory in your home directory**
 - */home/username/EDA/lab1*



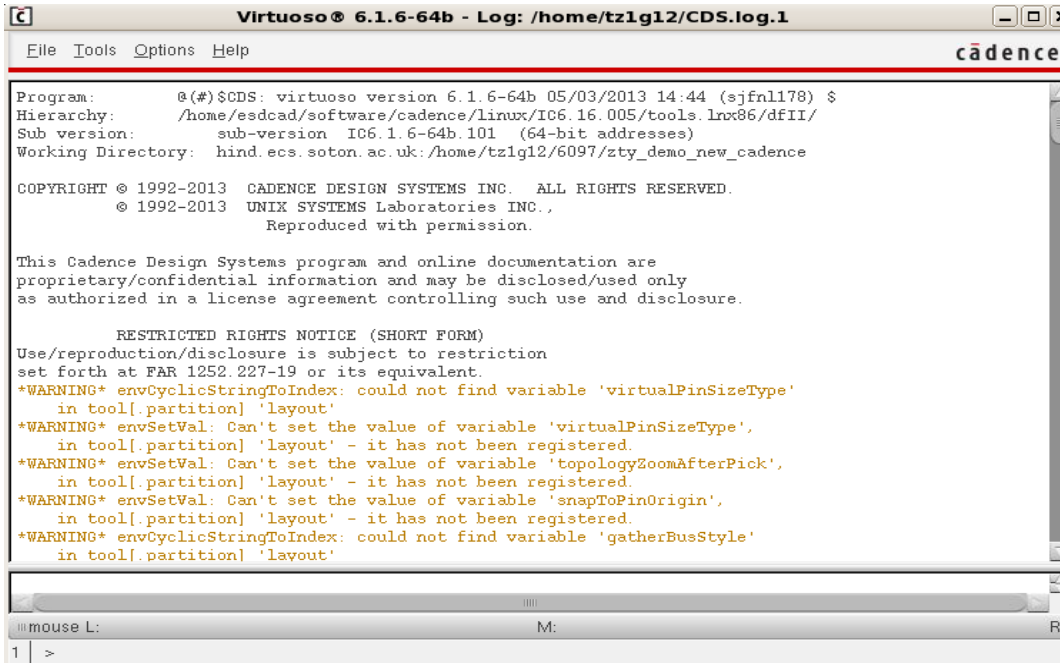
Set up the current working directory

- **The first step is to set up the local working directory for the AMS 0.35 μ m process.**
- **open a new terminal and type the following:**
tcsh
source /opt/esdcad/scripts/ams_v400_tcshrc



Run Cadence Design Manager

- This will bring up the Cadence Design Manager:



```
Virtuoso® 6.1.6-64b - Log: /home/tz1g12/CDS.log.1
File Tools Options Help cadence
Program:      @(#)$CDS: virtuoso version 6.1.6-64b 05/03/2013 14:44 (sjfnll178) $
Hierarchy:    /home/esdcad/software/cadence/linux/IC6.16.005/tools.lnx86/dfII/
Sub version:  sub-version IC6.1.6-64b.101 (64-bit addresses)
Working Directory: hind.ecs.soton.ac.uk:/home/tz1g12/6097/zty_demo_new_cadence

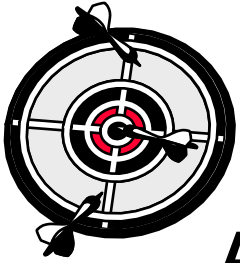
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set forth at FAR 1252.227-19 or its equivalent.
*WARNING* envCyclicStringToIndex: could not find variable 'virtualPinSizeType'
in tool[.partition] 'layout'
*WARNING* envSetVal: Can't set the value of variable 'virtualPinSizeType',
in tool[.partition] 'layout' - it has not been registered.
*WARNING* envSetVal: Can't set the value of variable 'topologyZoomAfterPick',
in tool[.partition] 'layout' - it has not been registered.
*WARNING* envSetVal: Can't set the value of variable 'snapToPinOrigin',
in tool[.partition] 'layout' - it has not been registered.
*WARNING* envCyclicStringToIndex: could not find variable 'gatherBusStyle'
in tool[.partition] 'layout'

mouse L: M: R:
1 >
```

Learning Outcomes

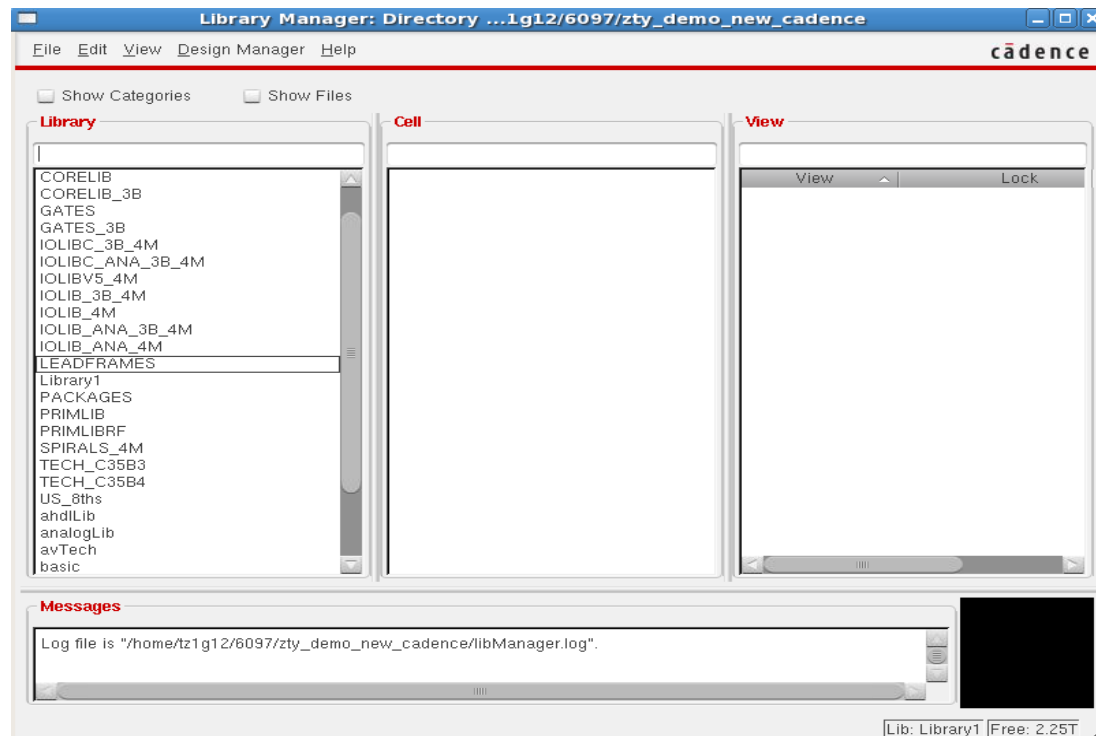


After completing this unit, you should be able to:

1. Set up a directory to run Cadence
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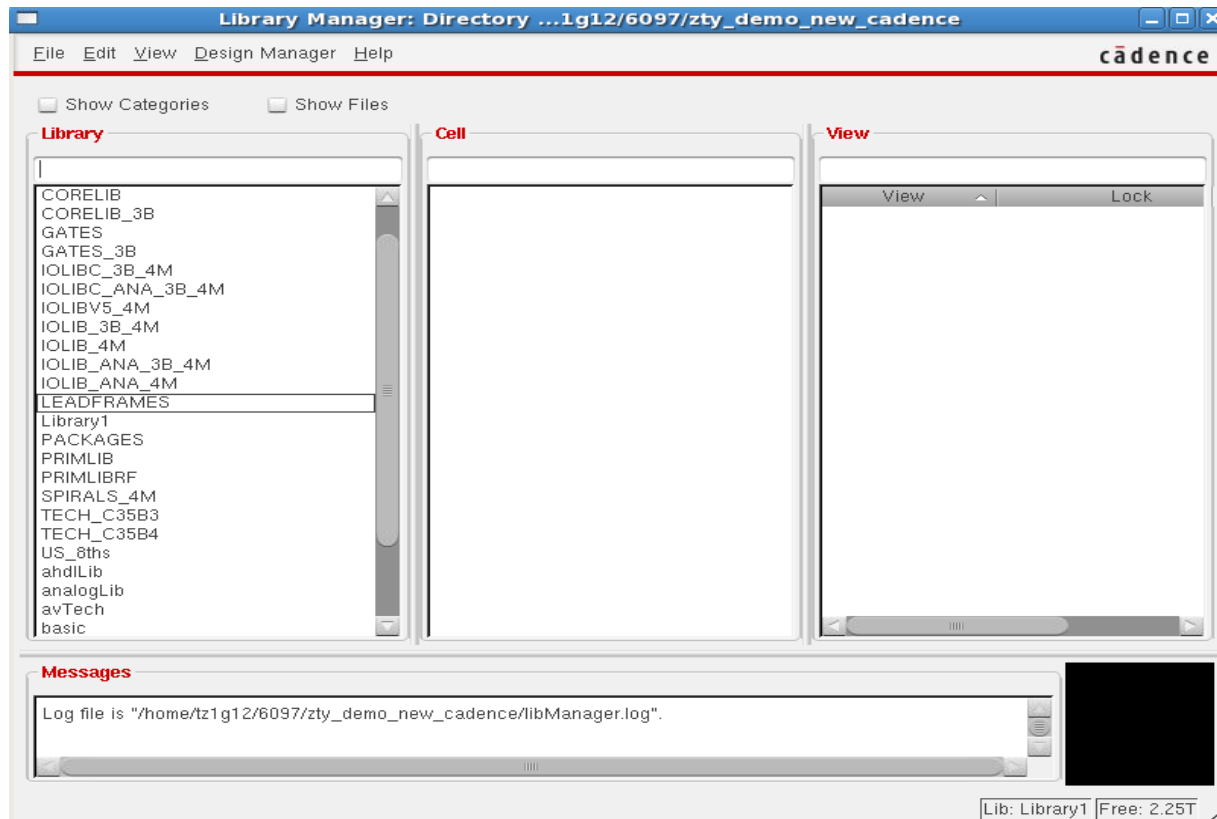
Create a new library

- Cadence works by creating multiple libraries in separate directories
- Using the Tools Menu – select the library manager



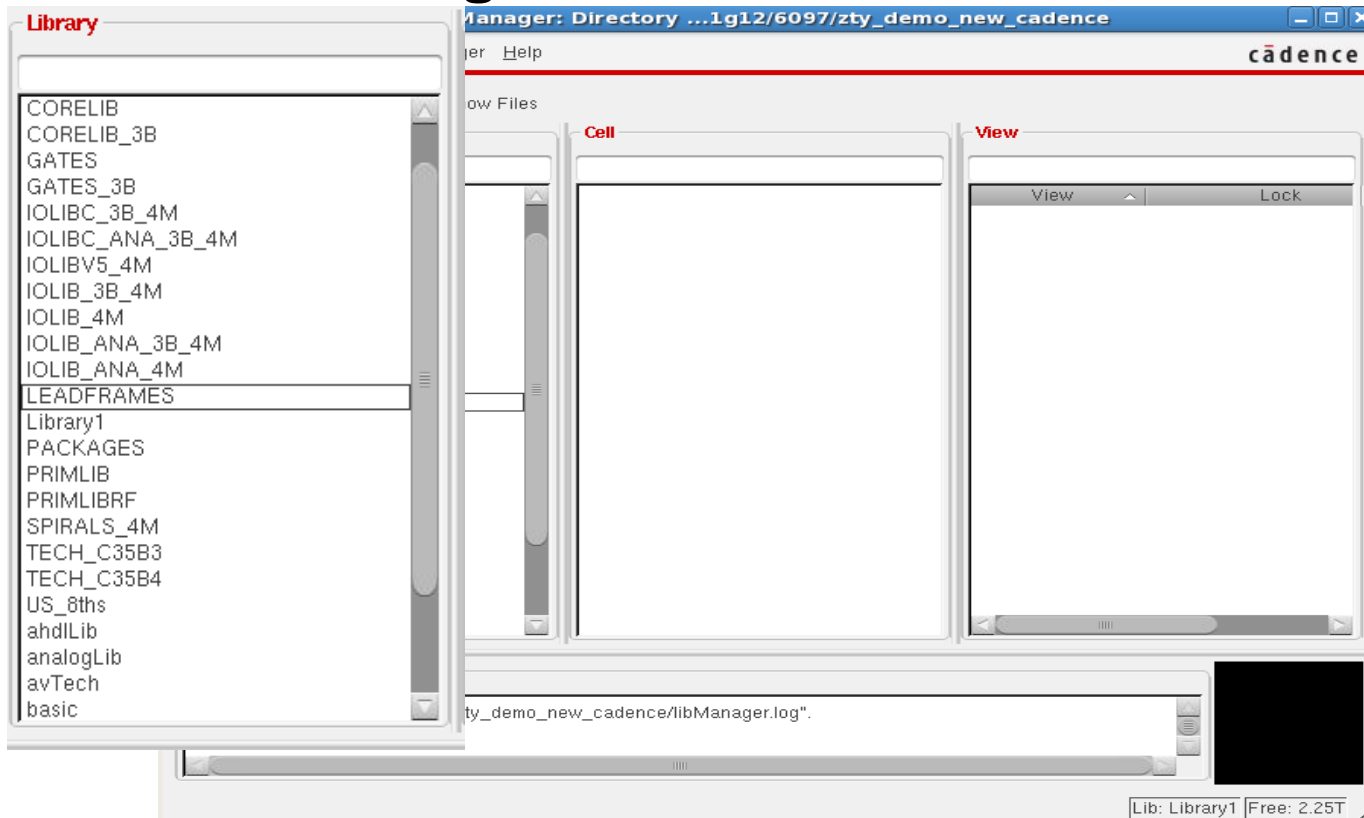
The Library Manager Explained

- The Library manager handles “libraries”, “cells” and “views”



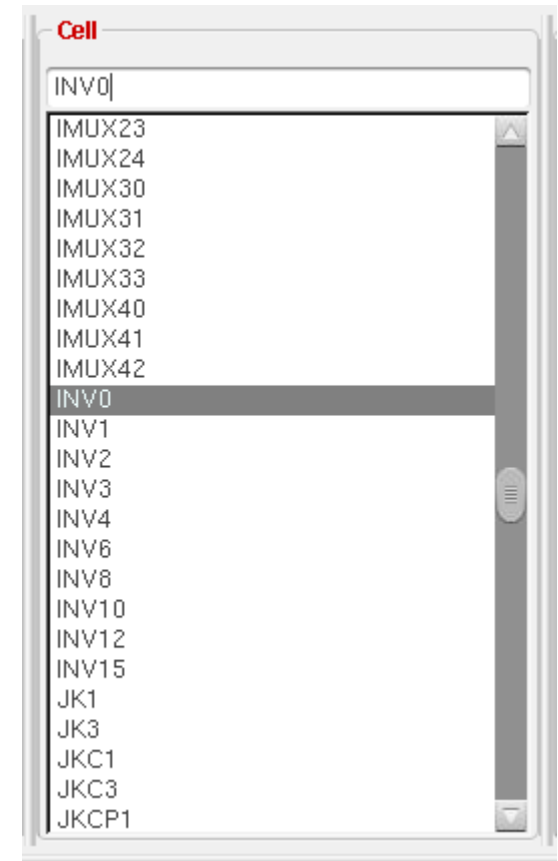
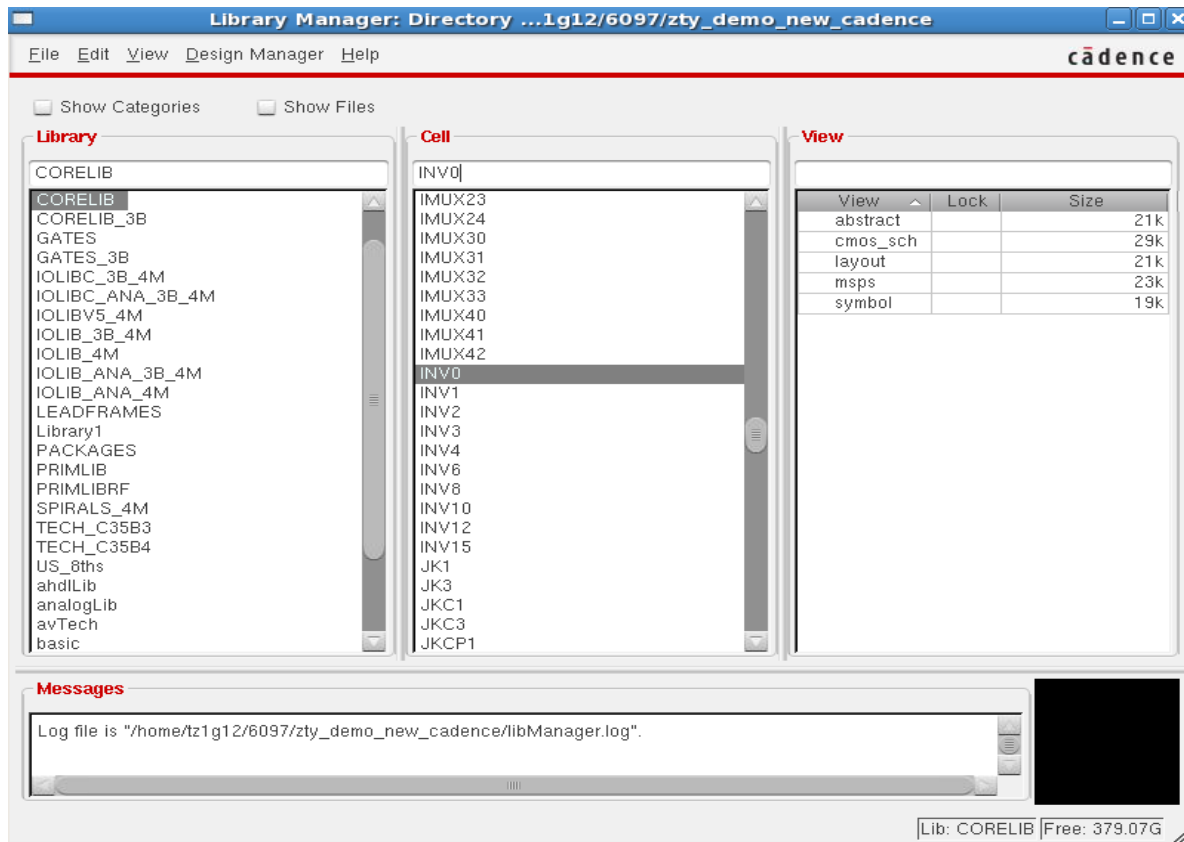
The Library Manager Explained

- Libraries are the containers for all the design elements. For example a standard cell library may contain all the gates available in the PDK



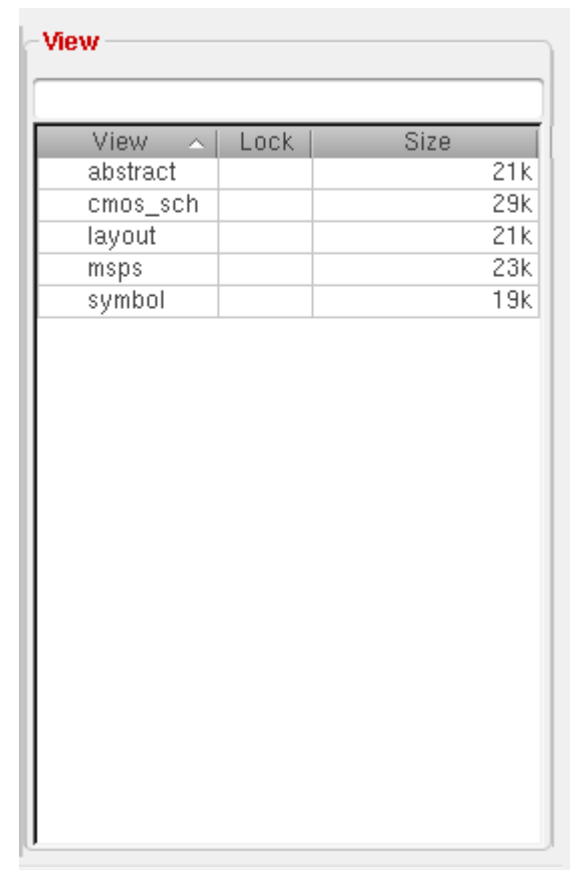
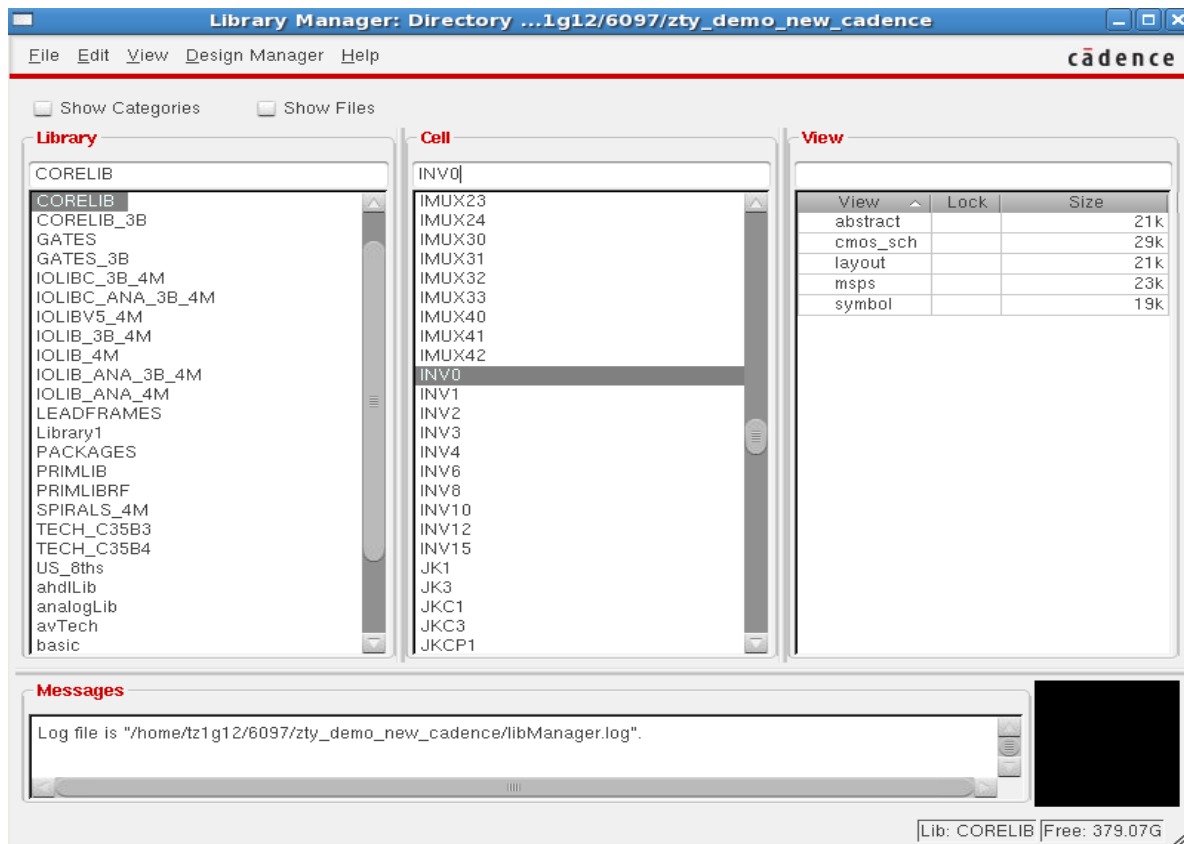
The Library Manager Explained

- Each element, such as a gate, in the library is called a cell – an example might be an inverter gate.



The Library Manager Explained

- Finally, each cell has a set of different views such as schematic, or layout, or a model



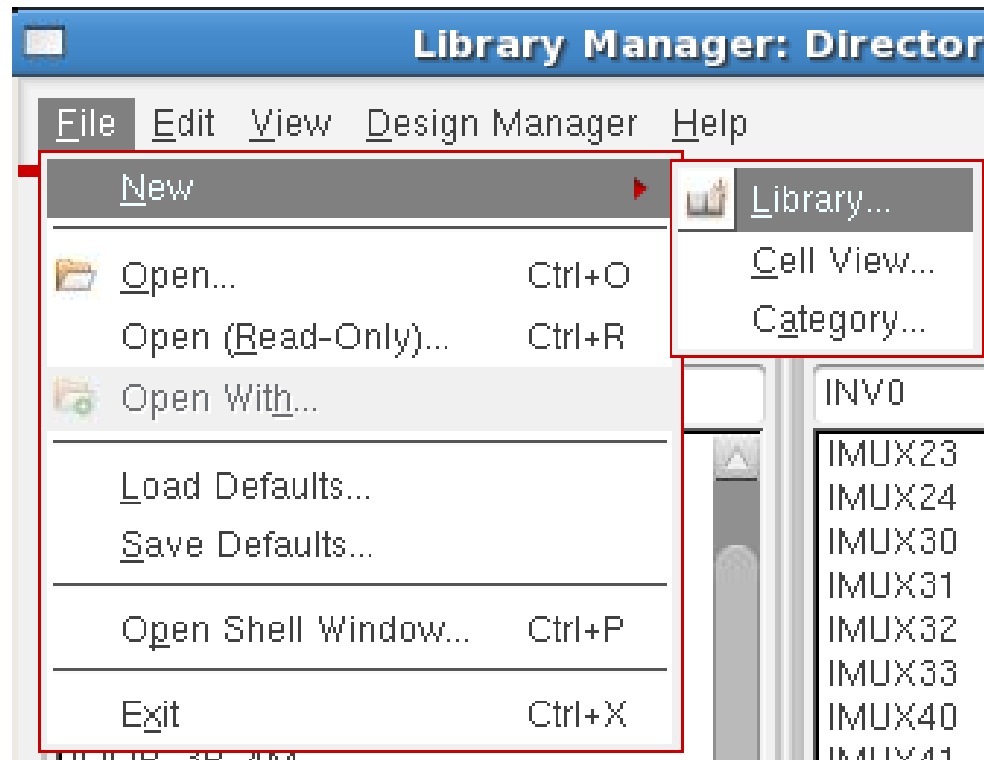
Libraries in Cadence

- **The library definition in Cadence consists of two parts:**
 - 1. The library NAME – what you see in the library manager
 - 2. The library DIRECTORY – what is actually there in the file system
- **DO NOT just copy the library around, as this does not handle all the links properly.**



Create your first library

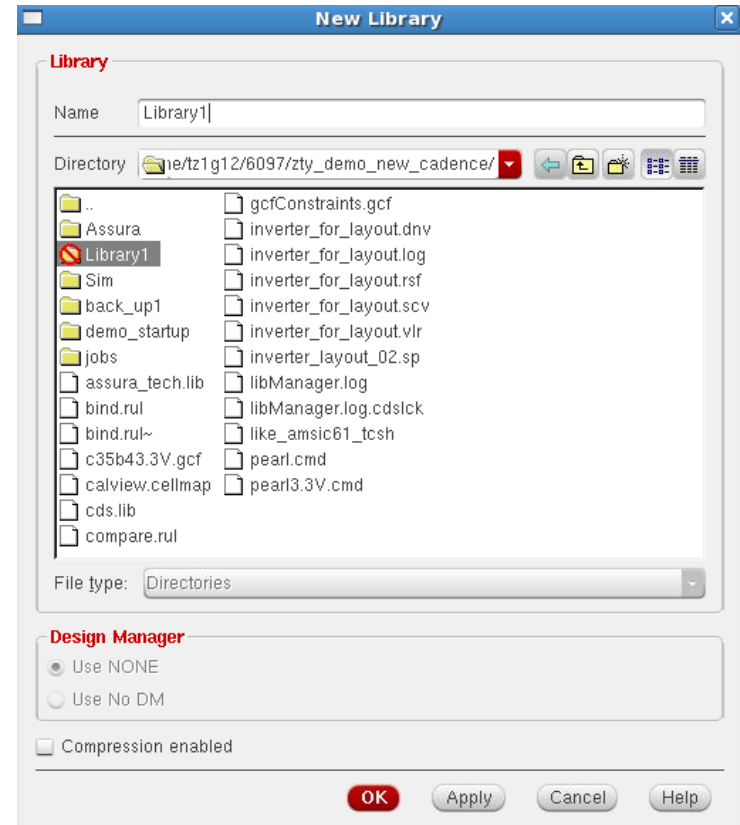
- To create new libraries, you can use the library manager (LM) to create a new library from scratch



Create your first library

- **The library manager will default to your current directory, and ask you for a library name:**

- enter *library1* or something similar
- remember:
 - ◆ Follow UNIX rules
 - ◆ Don't use spaces
 - ◆ Don't start with a number



Creating your first library

- **When you create a library, you will be asked whether you want to attach to a technology file**
- **What does this mean?**
- **When you create a design, you are working with either NO process, or a SPECIFIC process (this implies a certain number of layers, design rules, models etc)**
- **In this case we are working with the AMS C35B4C3 process.**

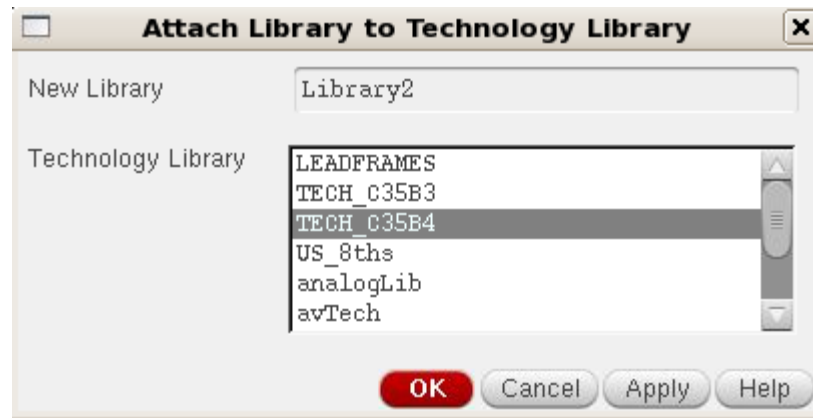


Creating your first library

- Choose “attach to an existing techfile”



- And choose TECH_C35B4



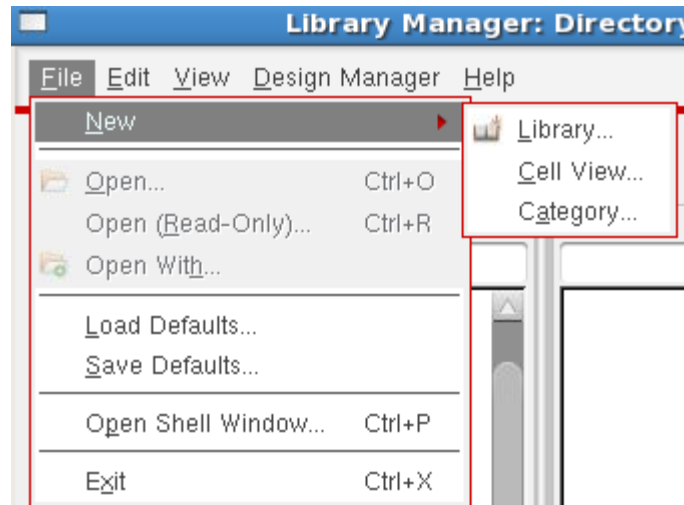
Creating your first library

- **Congratulations!, You will now have your first Cadence Library**



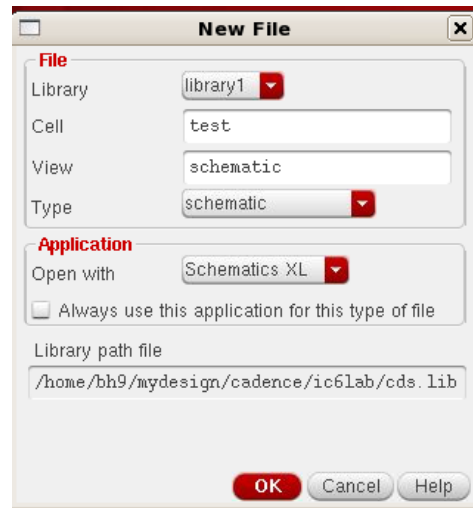
Creating your first cell view

- Now you have your first library, you can create your first cell view.
- Start from the library manager and choose New Cell View.



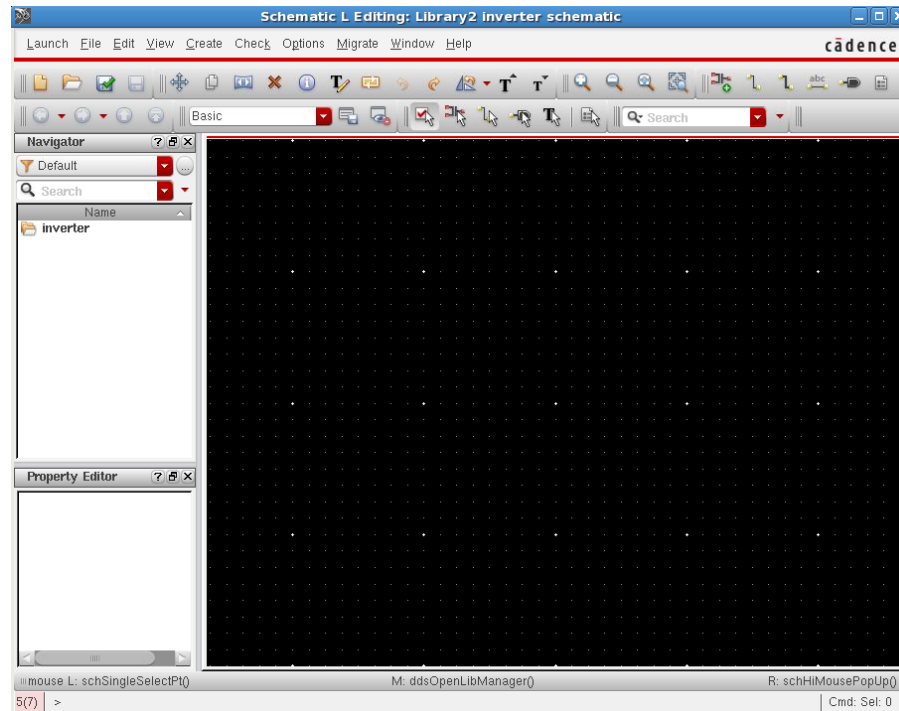
Creating a cell view

- Notice the library defaults to the one you have just created
- **If you *don't* have this selected, make sure that it is – the standard libraries will be READ ONLY**
- Notice the View Name – schematic
- The Tool pulldown should be Schematics XL
- Click OK



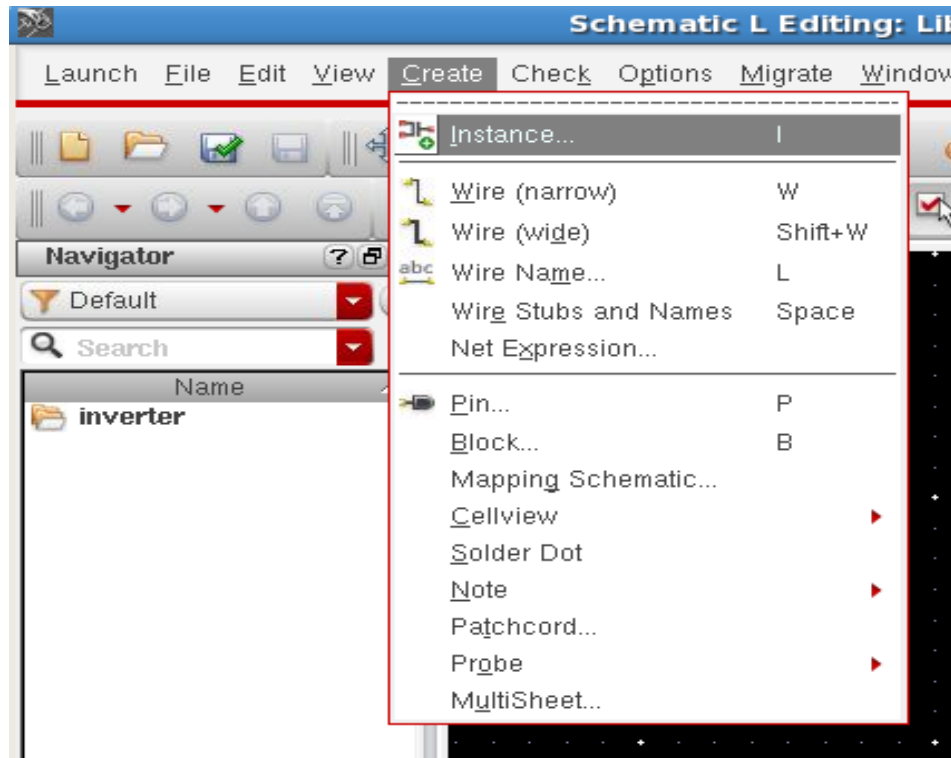
Creating a cell view

- When you create a new cell view, the Cadence Design manager will open the correct editing tool – in this case Schematic L (schematic editor) automatically



Adding Components

- You can now add components to the schematic
- To add components (transistors, passives, sources etc) you must use the Create -> Instance option



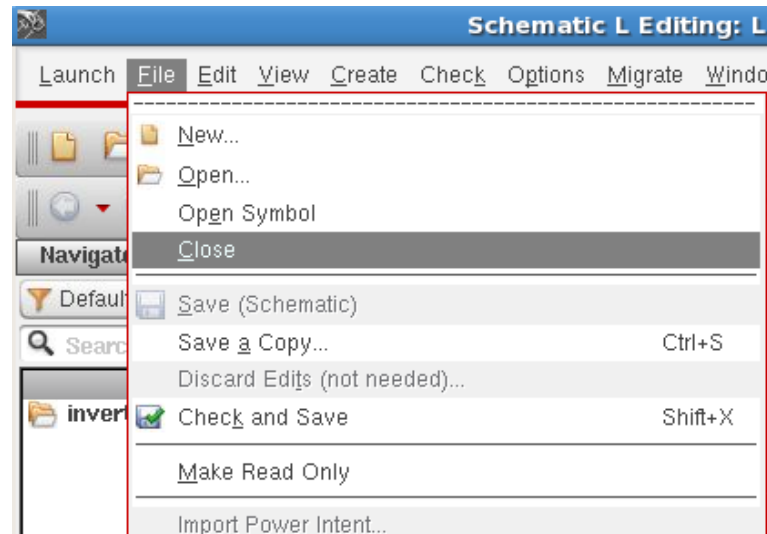
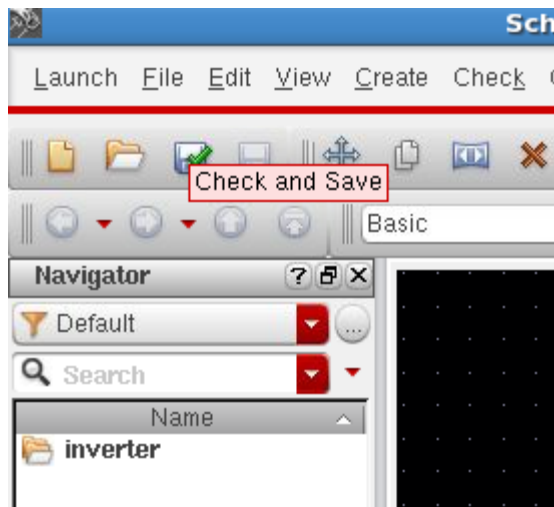
Adding Instances

- Whenever you add an instance you need to use the *same* library structure (library, cell, view) idea as when you created your own cells.
- You need to use the symbol view
- Luckily, Composer allows you to Browse for the correct cell using the library manager



Check and Save

- Don't forget to check and save your schematic
- Once you have saved the schematic, you can close it using File -> Close

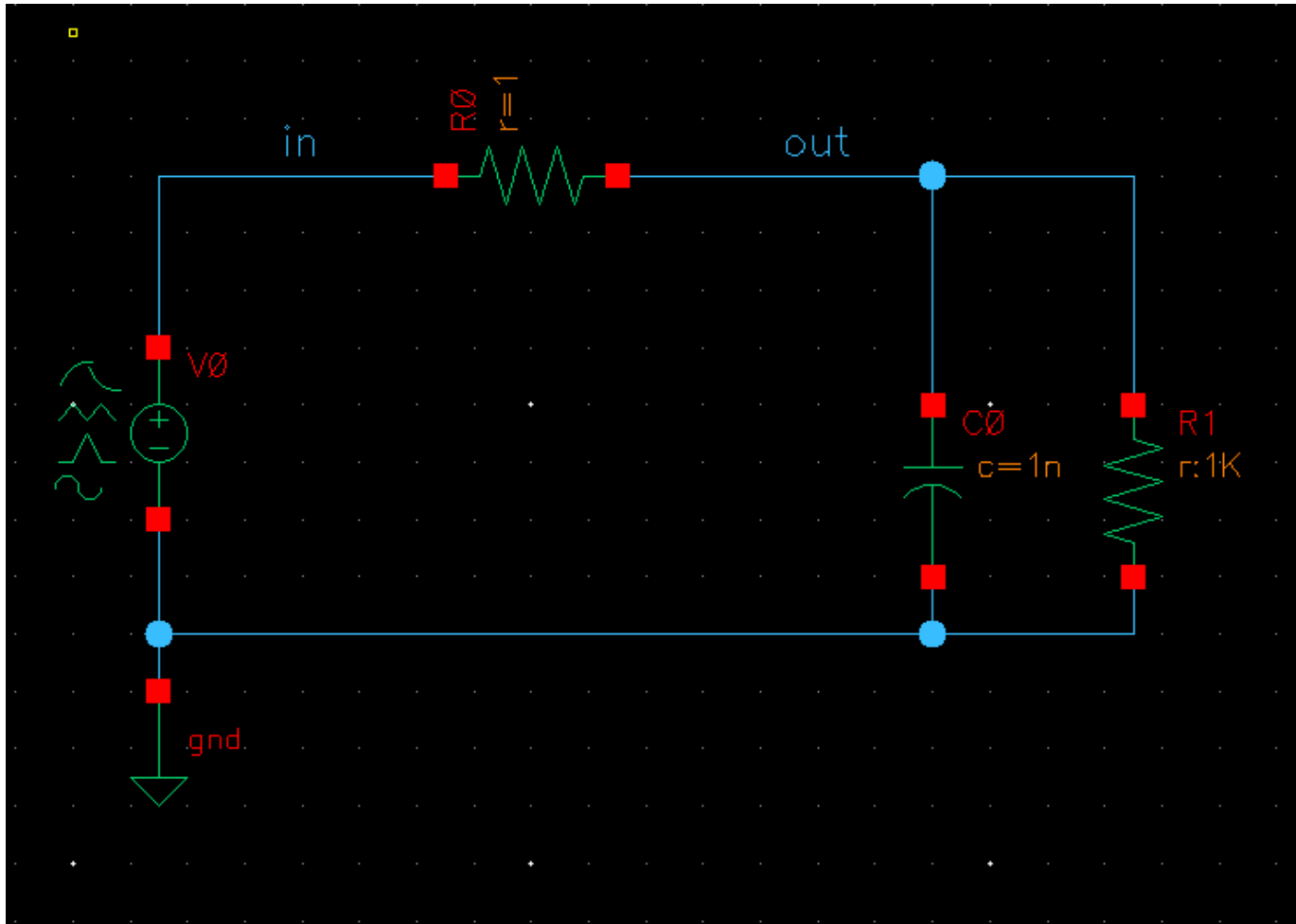


Create a simple circuit

- Cadence provide a simple library of electronic *primitives* such as voltage sources, resistors, capacitors etc
- These can be constructed into circuits and simulated, *however they do not have the information to be physically fabricated*
- We can use them to build a simple test circuit to learn how the design software works



Create a simple RC circuit



Add a pulse voltage source

■ AnalogLib->vsource

- Source type: pulse
- DC voltage=1
- Zero value: 0
- One Value: 1
- Period of waveform:20ns
- Pulse width: 10ns
- Rise time: 100ps
- Fall time: 100ps

The screenshot shows the 'Edit Object Properties' dialog box for a pulse voltage source. The dialog is organized into several sections:

- Apply To:** 'only current' and 'instance' (both selected).
- Show:** 'system' (unchecked), 'user' (checked), and 'CDF' (checked).
- Property Table:**

Property	Value	Display
Library Name	analogLib	off
Cell Name	vsource	off
View Name	symbol	off
Instance Name	v0	off
- User Property Table:**

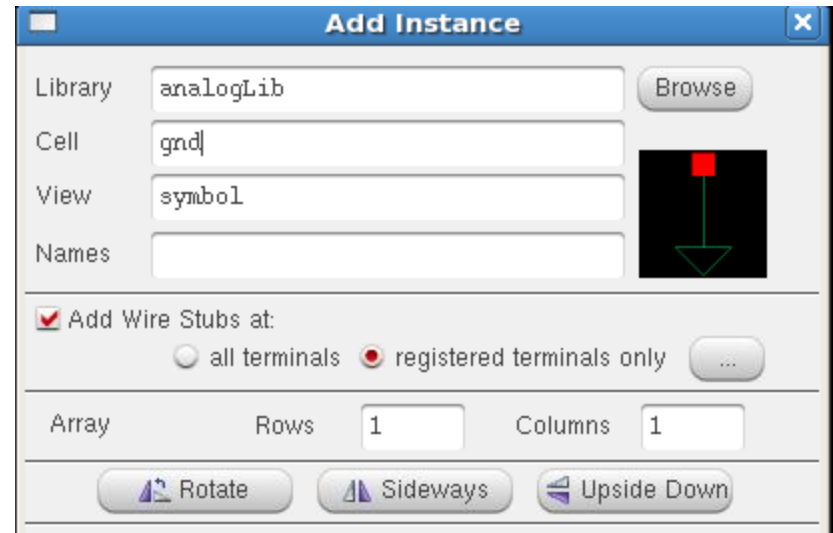
User Property	Master Value	Local Value	Display
Ivignore	TRUE		off
- CDF Parameter Table:**

CDF Parameter	Value	Display
DC voltage	1 v	off
Source type	pulse	off
Frequency name 1		off
Delay time	0 s	off
Type of rising & falling edge		off
Zero value	0 v	off
One value	1 v	off
Period of waveform	20n s	off
Rise time	100p s	off
Fall time	100p s	off
Pulse width	10n s	off
- Display Options:** 'Display small signal params', 'Display temperature params', and 'Display noise parameters' are all unchecked.
- Multiplier:** An empty text field.

Buttons at the bottom include 'OK', 'Cancel', 'Apply', 'Defaults', 'Previous', 'Next', and 'Help'.

Reference to ground

- **AnalogLib -> gnd**
- **No parameters**
- **Connects globally to ground**



Add resistors, inductor & capacitor

■ AnalogLib->res

- resistance = 1 for series
- resistance = 1k for load

■ AnalogLib->cap

- capacitance = 1n



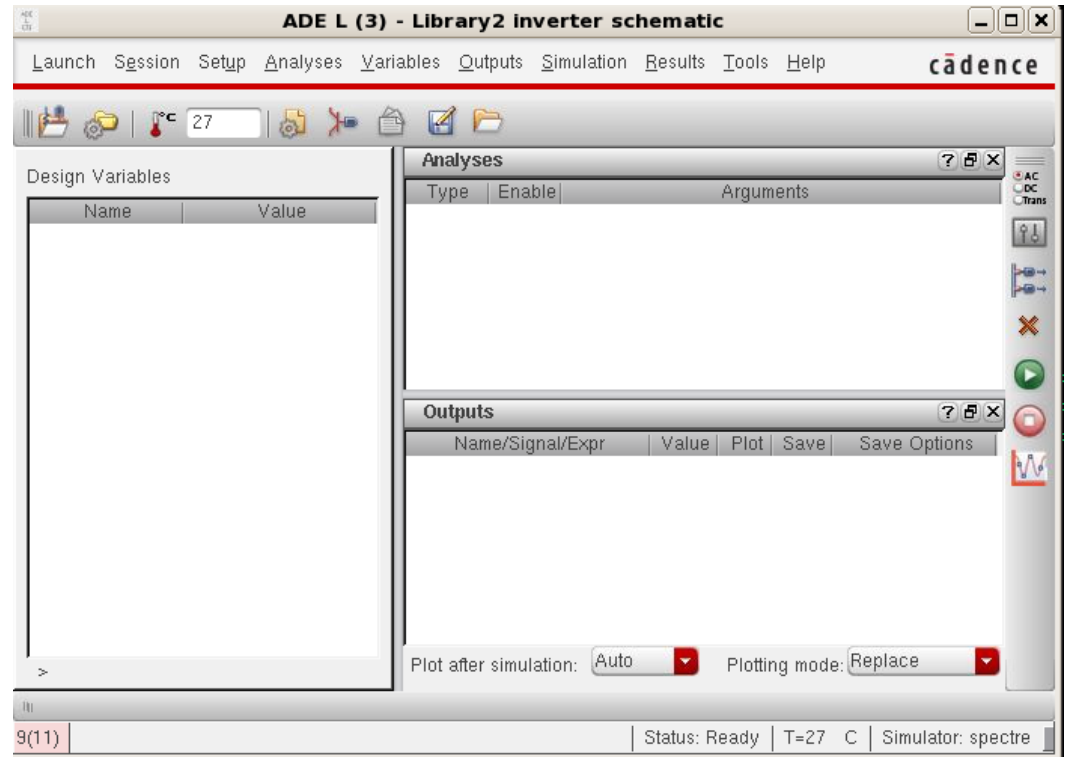
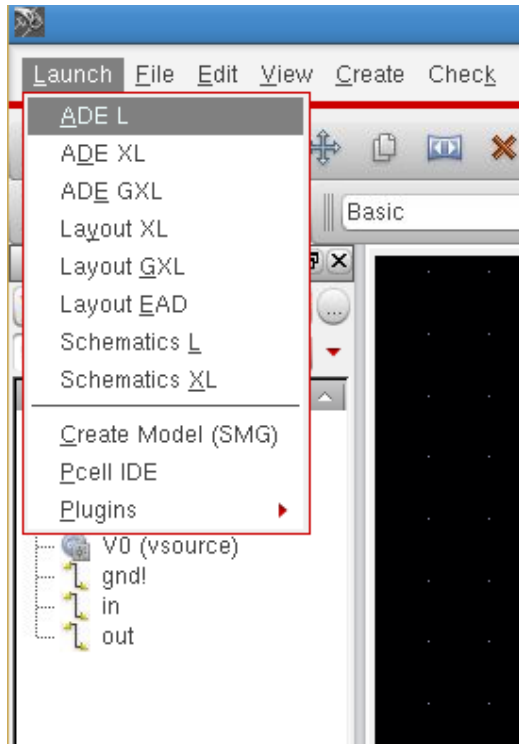
Connect up

- **Use Create -> Wire(narrow)**
 - this gives a connect function – wire up the circuit
- **Add wire names**
 - Create -> Wire Name
 - Label the input vin and the output vout
- **Check and Save**



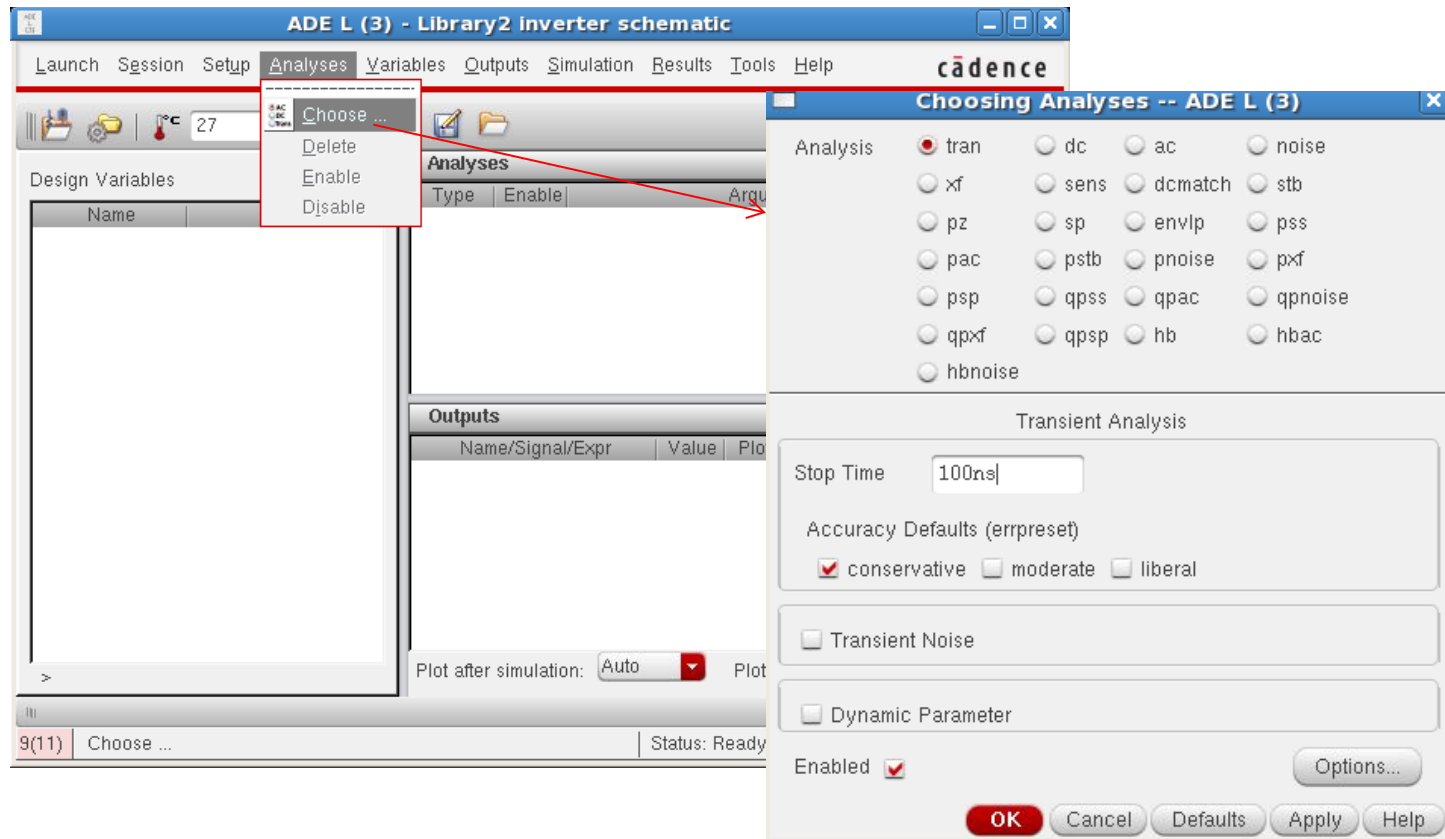
Simulate

■ Click on Launch – ADE L



Simulate

- Click on Analyses Tab and choose tran analysis and set Stop Time: 100ns as shown below

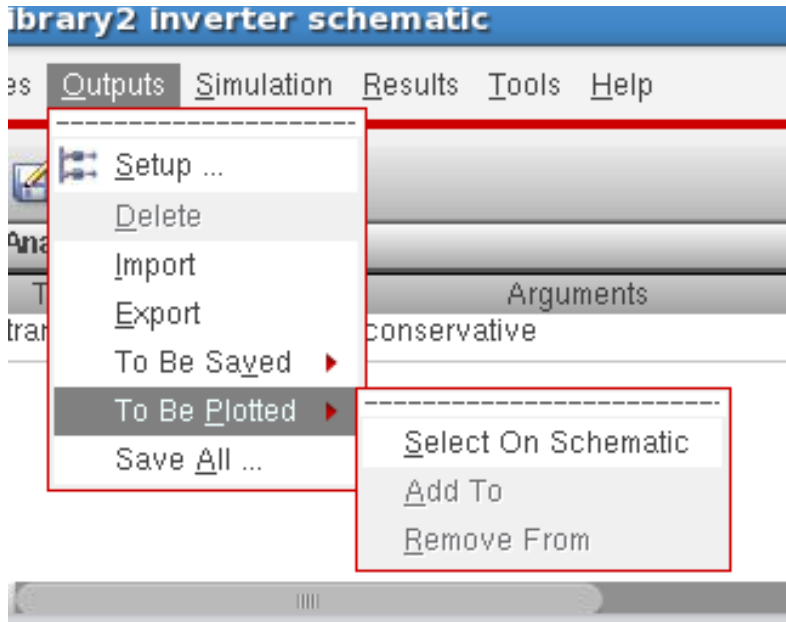


Simulate

- Select output to be plotted by clicking on:

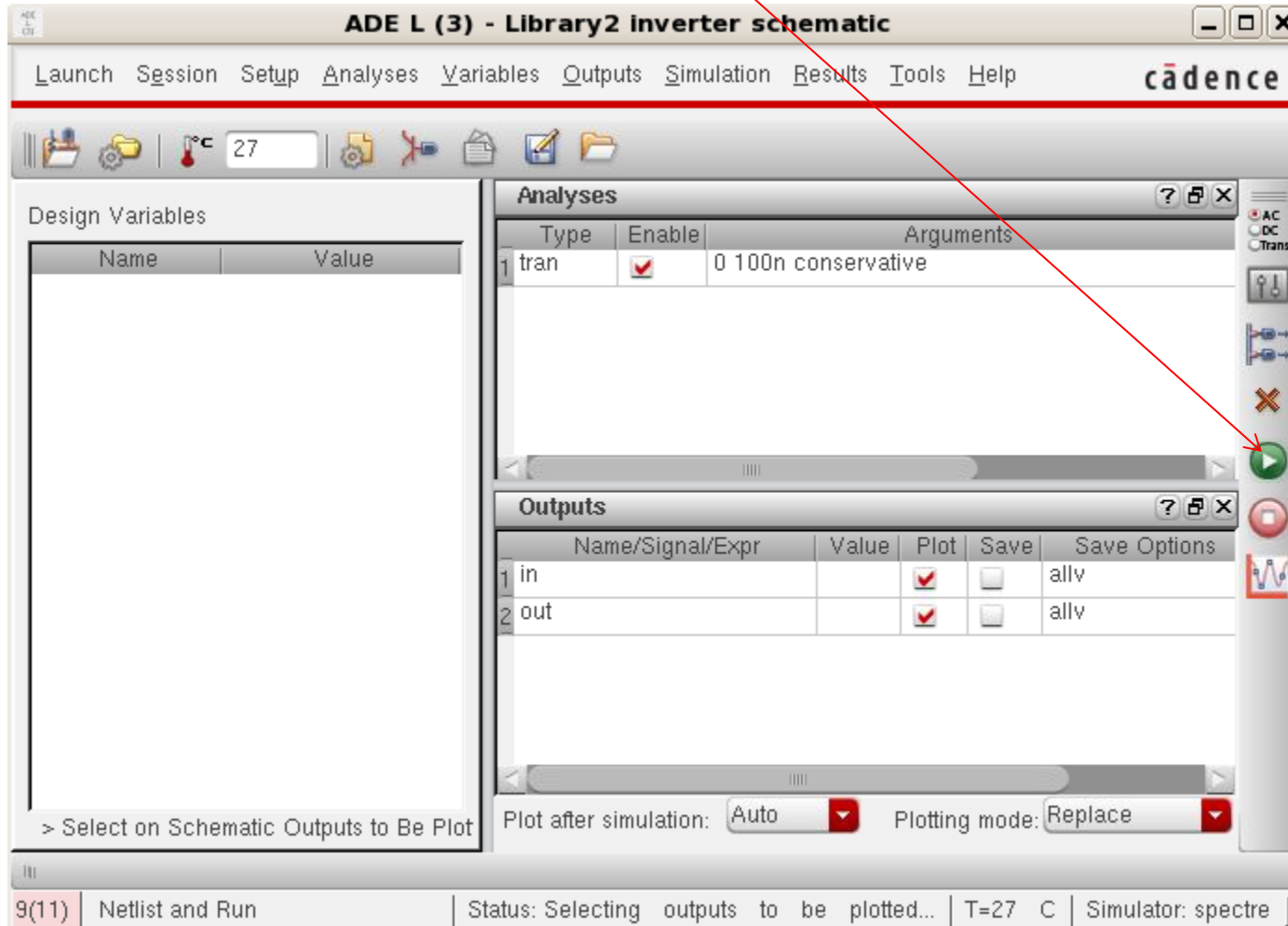
Outputs Tab - To be Plotted – Select on Schematic

Then choose the wires: in and out in the schematic window



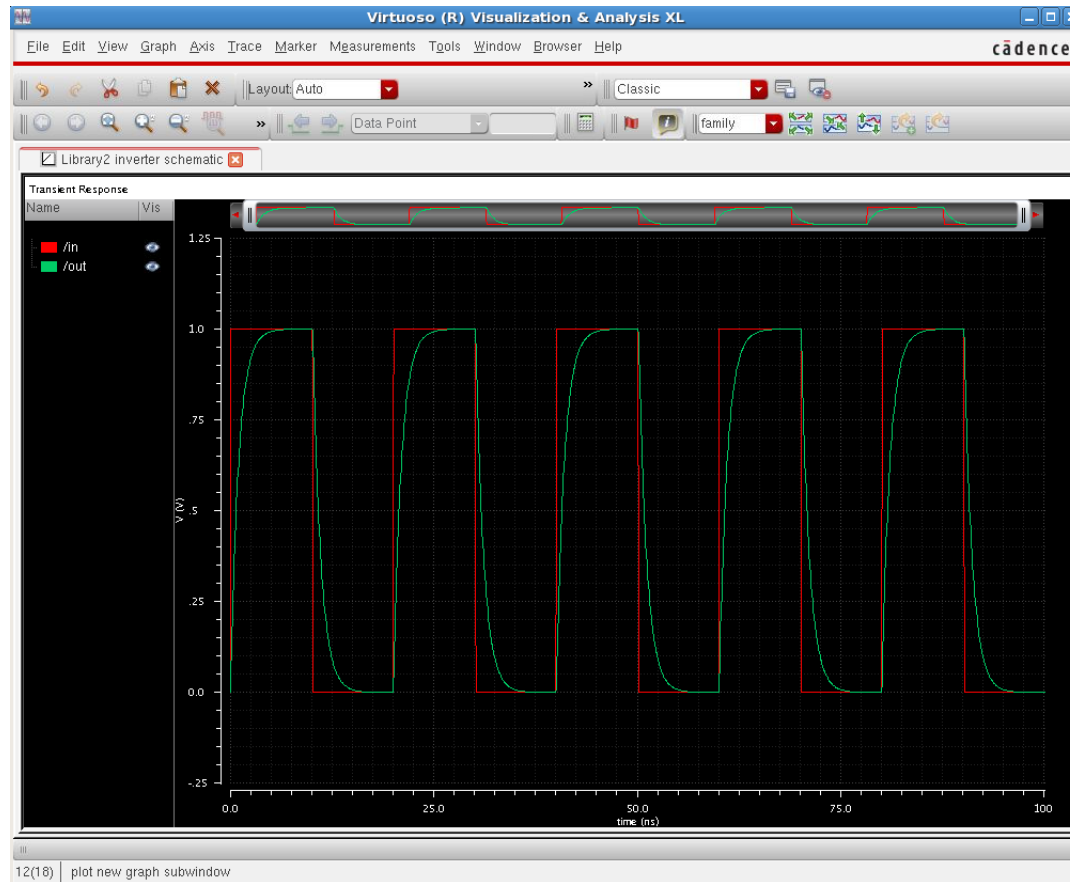
Simulate

- Than click Netlist and Run Tap to simulate



Simulate

- You should be able to see the simulation results plotted



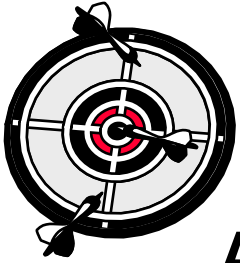
- You can now close the simulation window and the schematic view of your cell

re-opening the schematic

- From the library manager, find your schematic cell view
- Right Click on the selected cell view
- Choose the “Open” option
- Composer will open your schematic for editing



Learning Outcomes



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How does Cadence Know about Libraries?

- **Cadence uses a file called `cds.lib` to establish the libraries**
- **It looks first in the current working directory, then your home directory for this**
- **It also has a default `cds.lib` if none exists**

- **This is an ASCII file that has the library name and actual location**
- **environmental variables are often used in these path definitions to make them general and portable**



Which cds.lib file?

- It is good practice to set up your working directories with custom design kit settings AND libraries
- Keeping projects separate makes administration and management of files MUCH easier.
- Therefore, each project directory should have its own cds.lib



How can I reference someone else's design?

- **Given that the definition of a library is done using a name and pathname, can we use this to reference other libraries not in our design space?**
 - Yes, but remember that the technology **MUST** be compatible
 - This is how the design kits work – we simply reference the libraries in the design kit location
 - You may also not have edit rights – perhaps read only
- **You need to know, therefore:**
 - The library **NAME**
 - The library **LOCATION**



An example

- There is an examples library which has the name `library_lab1`
- It is in the location `/home/bh9/lab1/library_lab1`
- How can we link to that existing library?
- First load up the library manager and select :
 - Edit->Library Path



Edit Library Path

- Type in the library name you need
- Then type in the absolute path name to the directory, including the library name itself
- Close the editor and save the cds.lib file

Library	Path
1 analogLib	\$CDSDIR/tools/dfl/etc/cdslib/artist/analogLib
2 functional	\$CDSDIR/tools/dfl/etc/cdslib/artist/functional
3 basic	\$CDSDIR/tools/dfl/etc/cdslib/basic
4 US_8ths	\$CDSDIR/tools/dfl/etc/cdslib/sheets/US_8ths
5 ahdLib	\$CDSDIR/tools/dfl/samples/artist/ahdLib
6 bmslib	\$CDSDIR/tools/dfl/samples/artist/bmslib
7 TECH_C35B3	\$AMS_DIR/cds/HK_C35/TECH_C35B3
8 PRIMLIB	\$AMS_DIR/cds/HK_C35/PRIMLIB
9 IOLIB_4M	\$AMS_DIR/cds/HK_C35/IOLIB_4M
10 IOLIBV5_4M	\$AMS_DIR/cds/HK_C35/IOLIBV5_4M
11 IOLIB_ANA_4M	\$AMS_DIR/cds/HK_C35/IOLIB_ANA_4M
12 CORELIB	\$AMS_DIR/cds/HK_C35/CORELIB
13 GATES	\$AMS_DIR/cds/HK_C35/GATES
14 GATES_3B	\$AMS_DIR/cds/HK_C35/GATES_3B
15 sbaLib	\$CDSDIR/tools/dfl/etc/cdslib/artist/sbaLib
16 LEADFRAMES	\$AMS_DIR/cds/HK_ALL/LEADFRAMES
17 A_CELLS	\$AMS_DIR/cds/HK_C35/A_CELLS
18 PACKAGES	\$AMS_DIR/cds/HK_ALL/PACKAGES
19 PRIMLIBRF	\$AMS_DIR/cds/HK_C35/PRIMLIBRF
20 CORELIB_3B	\$AMS_DIR/cds/HK_C35/CORELIB_3B
21 IOLIB_ANA_3B_4M	\$AMS_DIR/cds/HK_C35/IOLIB_ANA_3B_4M
22 IOLIBC_3B_4M	\$AMS_DIR/cds/HK_C35/IOLIBC_3B_4M
23 IOLIBC_ANA_3B_4M	\$AMS_DIR/cds/HK_C35/IOLIBC_ANA_3B_4M
24 BORDERS	\$AMS_DIR/cds/HK_ALL/BORDERS
25 TECH_C35B4	\$AMS_DIR/cds/HK_C35/TECH_C35B4
26 IOLIB_3B_4M	\$AMS_DIR/cds/HK_C35/IOLIB_3B_4M
27 SPIRALS_4M	\$AMS_DIR/cds/HK_C35/SPIRALS_4M
28 avTech	/home/esdcad/software/cadence/linux/assura410/tools/assura/etc/avtech/avTech
29 Library1	/home/tz1g12/6097/zty_demo_new_cadence/Library1
30 Library2	/home/tz1g12/6097/zty_demo_new_cadence/Library2
31 lib1	/home/tz1g12/6097/zty_demo_new_cadence/lib1
32 library_lab1	/home/bh9/lab1/library_lab1
33 Library3	/home/tz1g12/6097/zty_demo_new_cadence/Library3
34	

Library library_lab1 is defined locally.

New Library....

- Now the new library is available in the library manager



Summary

- You can now create and edit your own libraries
- You can see how to link and share other directories into your Cadence library manager
- In the library_lab1 library you will find a basic RC circuit

