Lab 1

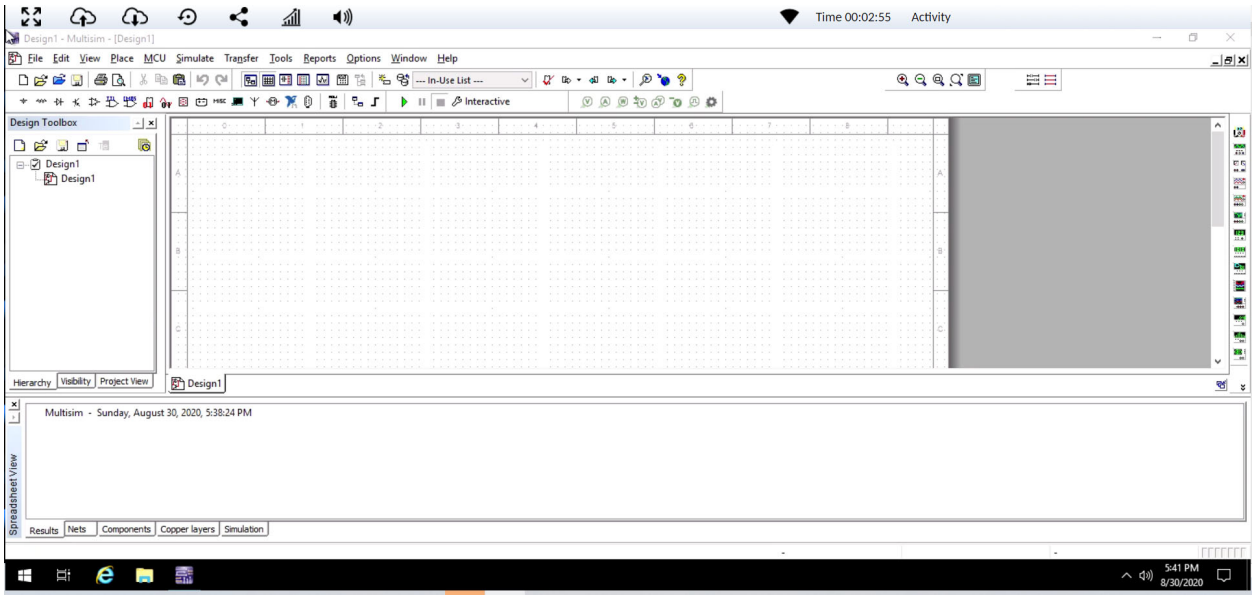
How to use Multisim

Learning outcomes

1) Learn how to open Multisim software
2) Learn how to include basic elements (resistors, voltage source, multimeters, oscilloscope)
3) Learn 2 techniques to verify Ohm's law

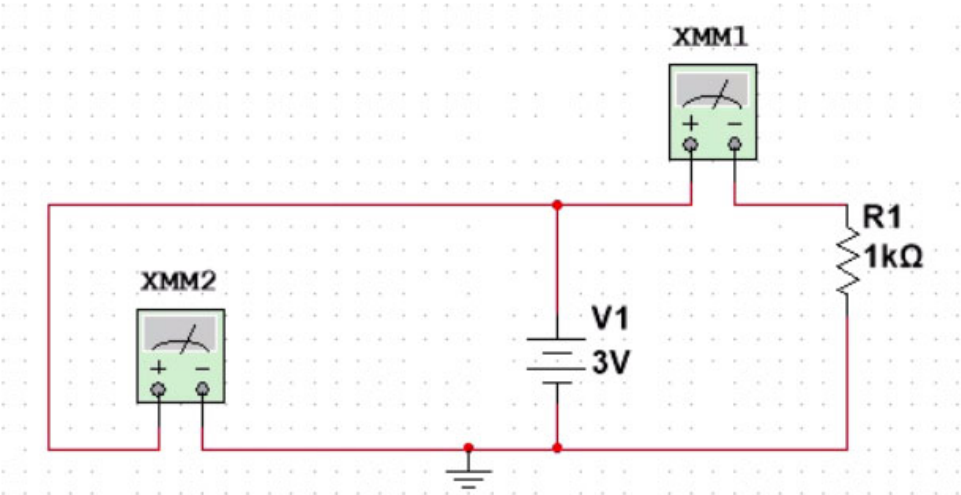
Experiment 1) Verifying Ohm's law using step by step measurements

A) Opening Multisim
   1. Go to https://its.csub.edu/VCL
   2. Click on "**Virtual Computer Lab here**"
   3. A list of software tools will appear, from which choose NI Multisim 14.1 by clicking the Launch button
   4. Wait for few seconds until the Multisim environment appears similar to the figure bellow



B) Insert and connect the required components
   1. click **Place** tab and choose **components**
   2. On the **Family** list on the left-hand side scroll down to **RESISTOR** and click it
   3. From the **component:** list in the middle choose any value then press **OK**
   4. Then click anywhere in the workspace to place the resistor
   5. Double click on the resistor and adjust the value to 1k
   6. Right-click on the symbol and choose **Rotate 90 clockwise**
   7. Insert a DC power source using the same steps as resistor although this time you will choose POWER_SOURCES from **Family:** list and DC_POWER from the **component:** list

8. From the same list insert a **Ground**
9. Insert 2 multimeters from the rightmost list (the first icon is the Multimeter)
10. Connect the circuit as shown bellow



11. Double click the voltage source and change the voltage value to 3V

C) Run experiment

1. Run the circuit simulation by choosing **Simulate** dropdown list and click the **Run**
2. Double click on the multimeter connected to V1 and choose **V**. Be sure it reads 3V
3. Double click on the multimeter connected to R1 and choose **A**. Be sure it reads 3 mA
4. Stop the simulation by choosing **Simulate** dropdown list and click the **Stop**
5. Change V1 to 6V, 9V, 12V, 15V and run the simulation in each time and record the value of the current through the resistor
6. Plot V vs I and check the slope
7. Repeat the same experiment after changing the resistor value to 1Ω and 2kΩ

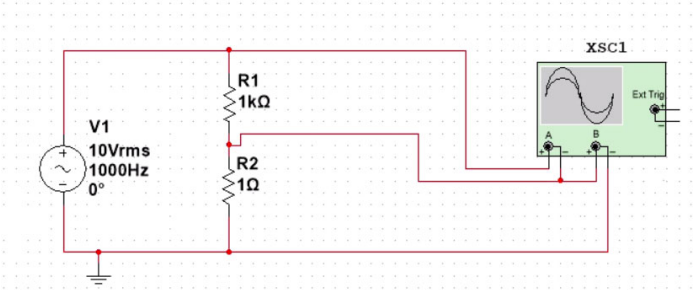
D) Save the current project with a proper name, e.g. Ohm's law step by step

Note: to help find your projects in the future, create a folder in \\apporto.com\dfs\CSUB\Users\mabdelrehim_csub\Documents\National Instruments\Circuit Design Suite 14.1
And name it with your name and before doing the 2nd experiment save the project to that folder giving it the name Lab1_1

Experiment 2) Verifying Ohm's law automatically using AC source and oscilloscope

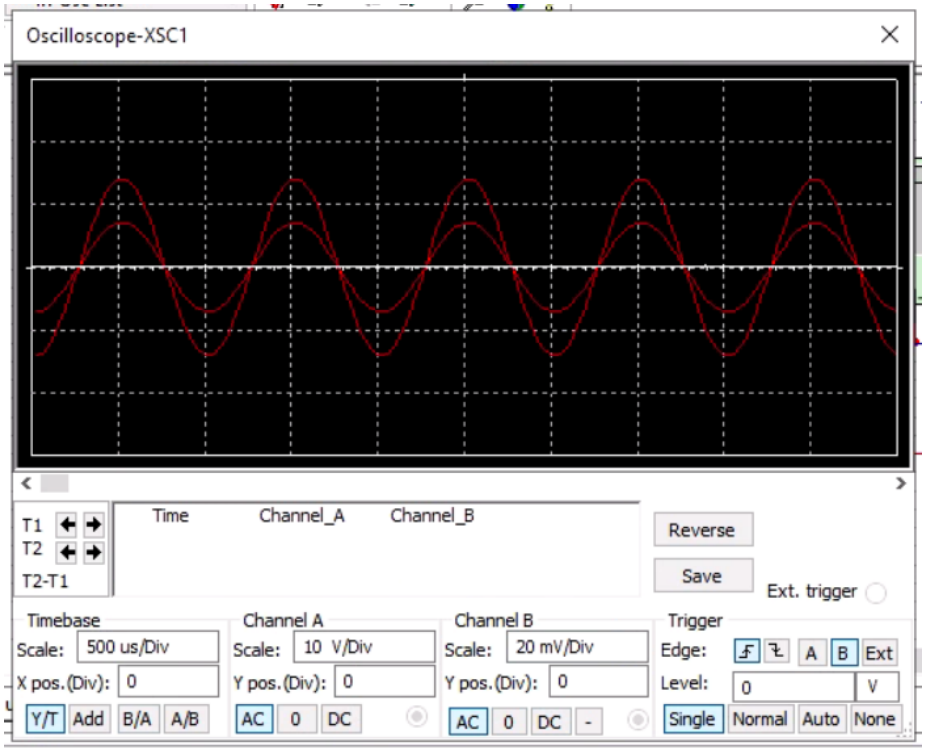
A) Insert and connect the required components

1. Insert 2 resistors and set their values to 1Ω and 1kΩ
2. Insert an AC power source using the same steps as resistor although this time you will choose POWER_SOURCES from **Family:** list and AC_POWER from the **component:** list
3. Insert from the same list a ground
4. Insert an oscilloscope from the rightmost list (the fourth icon is the oscilloscope)
5. Change the value of V1 to 10V RMS (≈28Vpp)
6. Connect the circuit as shown bellow

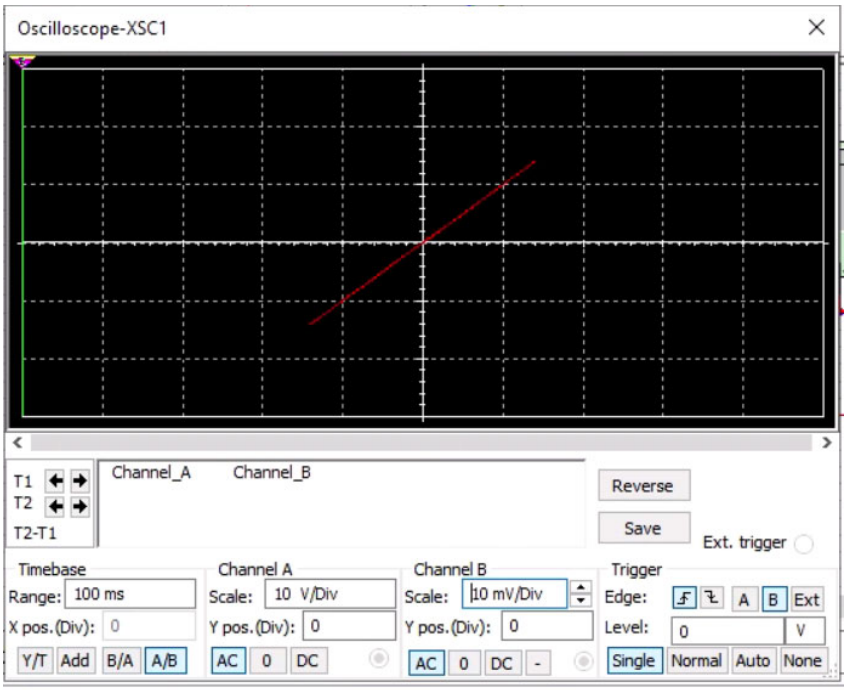


B) Running the simulation

1. From Simulate click Run
2. Double on the oscilloscope
3. Set the front panel knobs of the oscilloscope as shown bellow



4. Follow the instructor on how to measure Vpp of either signal
5. Set the oscilloscope as shown bellow in A/B mode



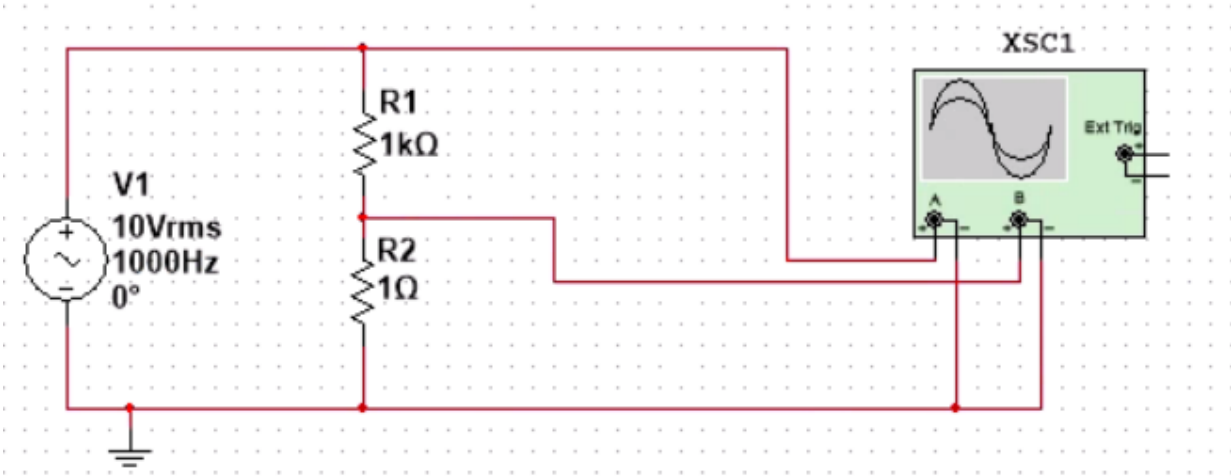
6. Measure the slope of the line
7. What do you notice?
8. Repeat the procedure after changing the R1 value to 0.1Ω

C) Save the current project with a proper name, e.g. Ohm's law automatic characteristic measurements

Experiment 3) Verifying Ohm's law automatically using AC source and oscilloscope (using realistic oscilloscope connection)

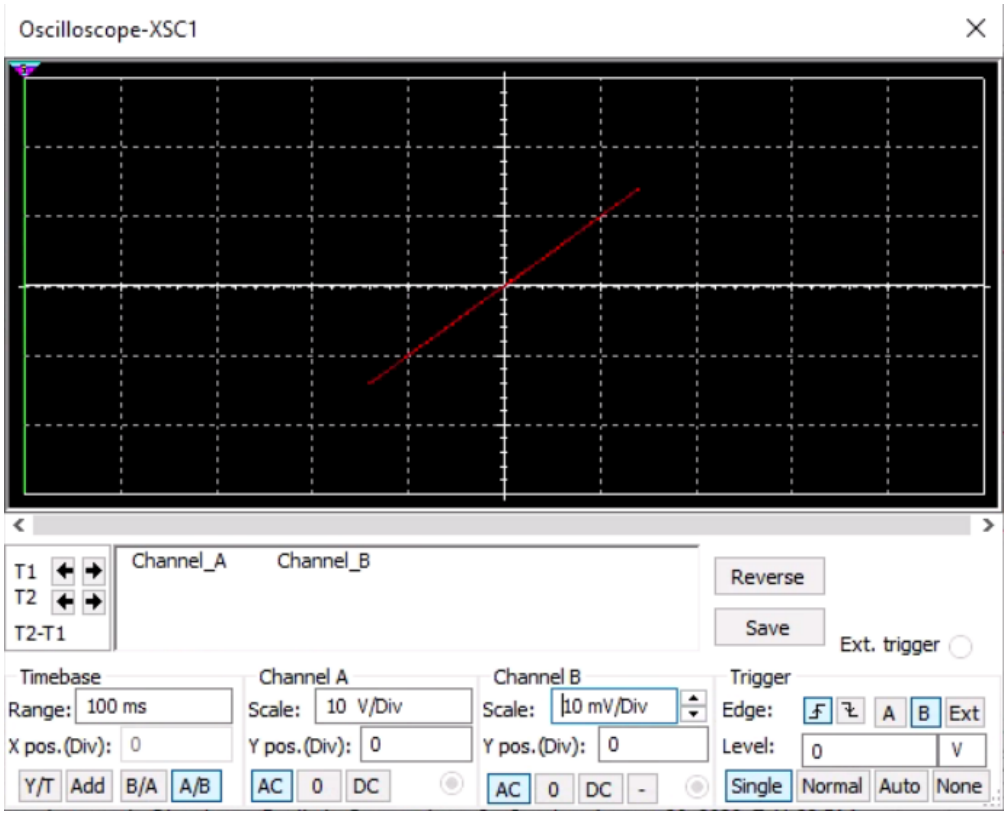
In reality, practical lab oscilloscope has a common ground for both A and B channels so the precious connection in Exp 2 is not realistic and will cause a short circuit on R2

A) Insert and connect the required components as shown bellow



B) Running the simulation

1. Run the simulation and double click the oscilloscope
2. Set the oscilloscope settings shown bellow and measure the slope



3. **Repeat at R1=10k and R1=0.1 what do you notice?**

C) Save the current project with a proper name, e.g. Ohm's law automatic characteristic measurements - realistic