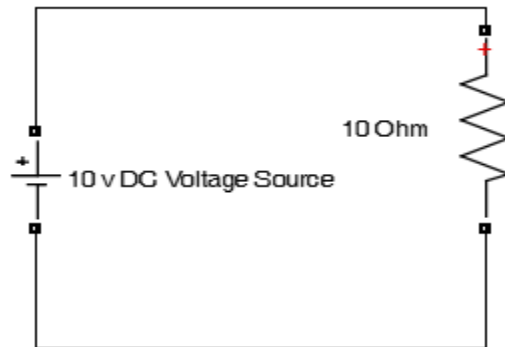


Lab # 02

Simulation of Circuit with Modeling Method

In this lab we will learn about the simulation as well as mathematical modeling of the circuit.

A circuit with a dc battery source of 10 volt and a resistor of 10 ohm is shown below.



To create kvl or kcl equation. We use ohm's law i.e.

$$V = IR$$

Because of only one circuit element with a voltage source is used in the circuit. To find current

$$I = V/R$$

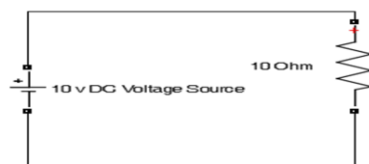
And for Power we have

$$P = V^2/R$$

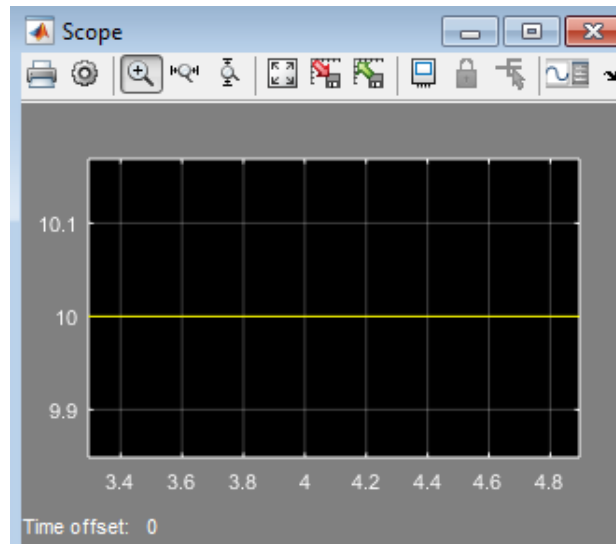
Or
$$P = I^2R$$

Now let us simulate this circuit with the set of these equations. Now let us go to MATLAB.

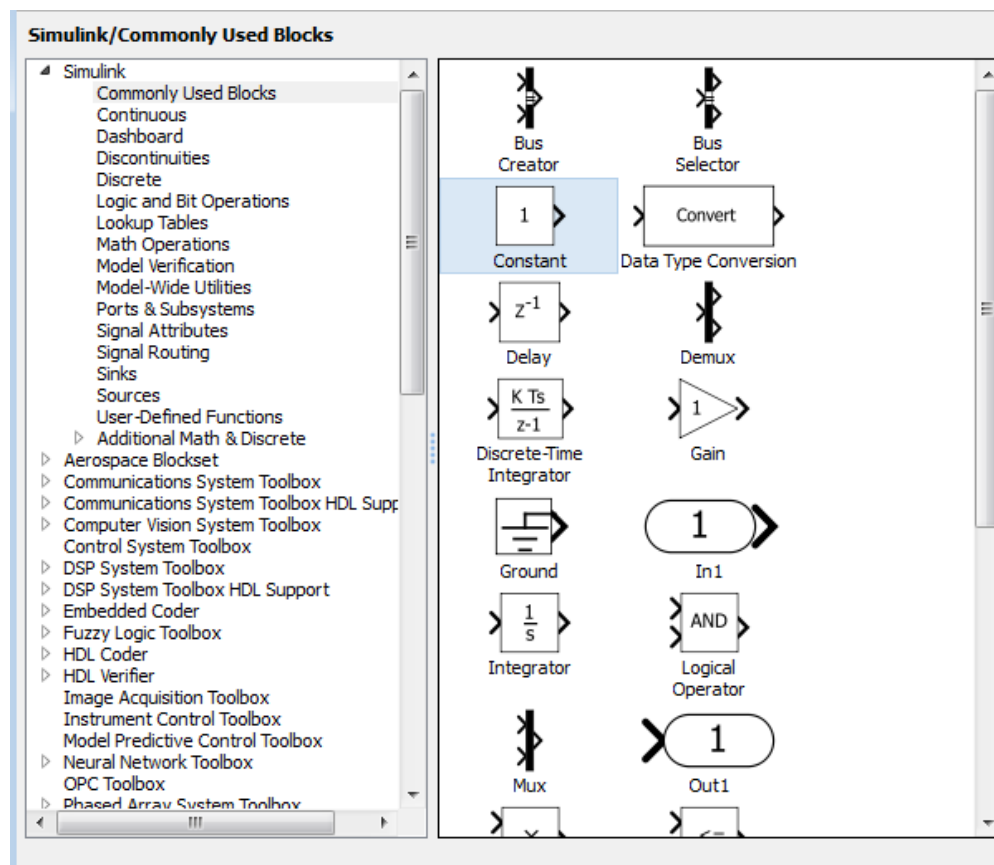
When we are about to do modeling we are not needed to take the elements from Simpowersystem only Simulink is necessary to do the modeling no other components is needed like simscape or simpowersys etc. for modeling purpose. For mathematical modeling of a circuit we only needed the element from the Simulink because these components are enough for mathematical modeling of a circuit. Now we have a circuit which is shown below as,



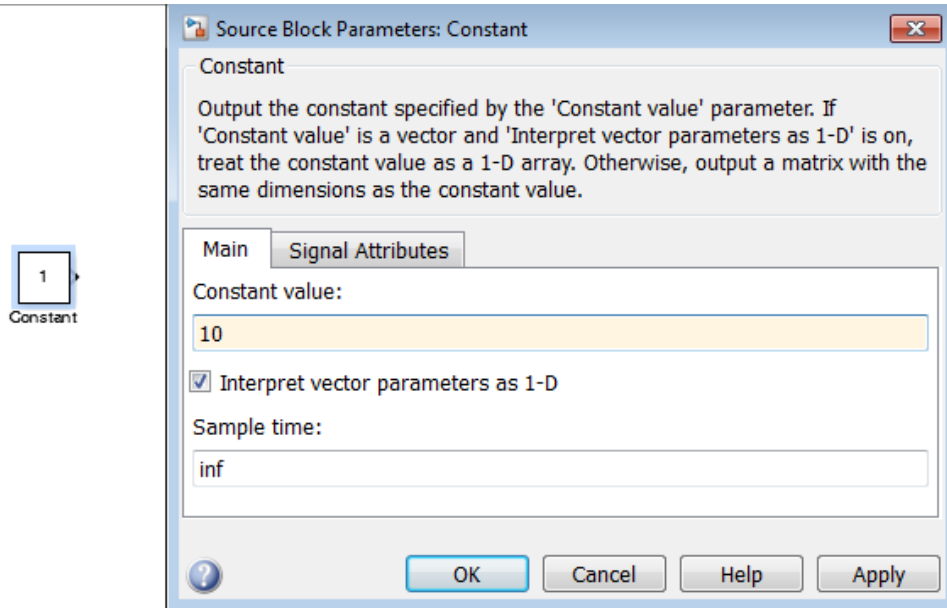
As we have a Dc voltage source. To see the characteristics of Dc source we have a constant waveform like that for a steady state,



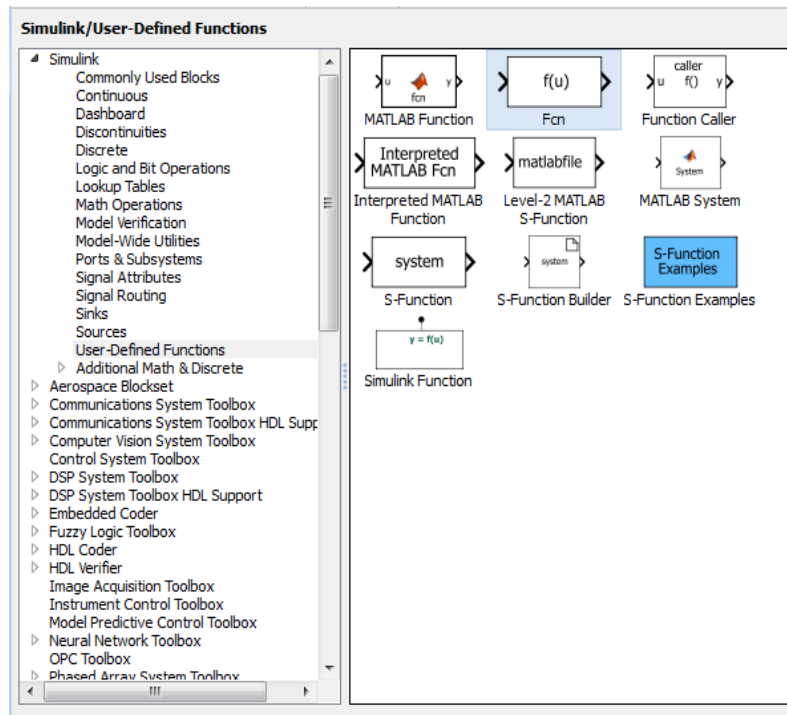
So we can take a constant value for Dc. So from Simulink go to commonly used block and pick out constant block and drag it to your workspace.



Now give the value by double clicking on the constant block and give it to the value of 10v.



Now once again open the Simulink library browser and go to Simulink and then go to user define function and then select Fcn. It is represented by $f(u)$ function.

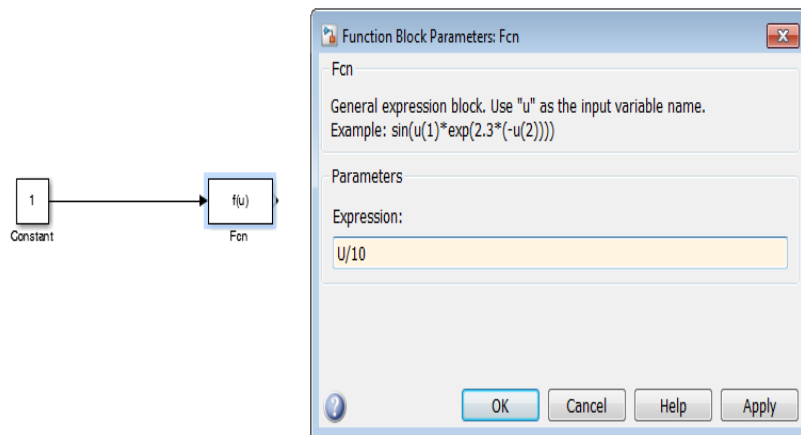


Now see the equation if you want the value of current we have

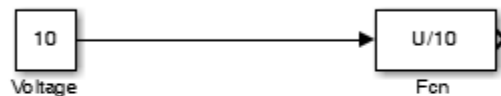
$$I=V/R$$

There are two parameters one is voltage and one is resistor. We have entered the value of voltage by a constant block. Now double click the fcn function and clear the pre-define expression and simply type $u/10$. This $u/10$ is nothing but this function has input as well as output the input is taken as u . while the divided by 10 is nothing but the value of resistor. So, the output from the function block will be current because the voltage is divided by the resistance i.e.

$$u/10 \text{ or } V/R$$



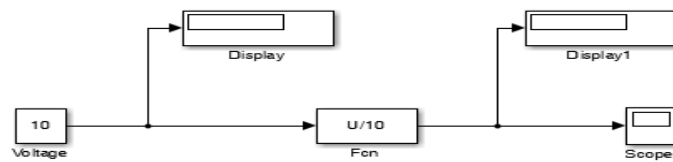
Enter the voltage at the constant block. And this value of voltage is entering into the function block.



Now take the scope and connect it to the output of the function block. So, that you will find the value of current flowing through the circuit.



Also take the display element and connect it after the constant block it will show you the voltage and also after the function block so it will show you the current.



If you want to enter the value of R from the beginning type R=10 in the MATLAB command window and then use R instead of its value in the blocks you will get the same result.

```
Command Window
New to MATLAB? See resources for Getting Started.

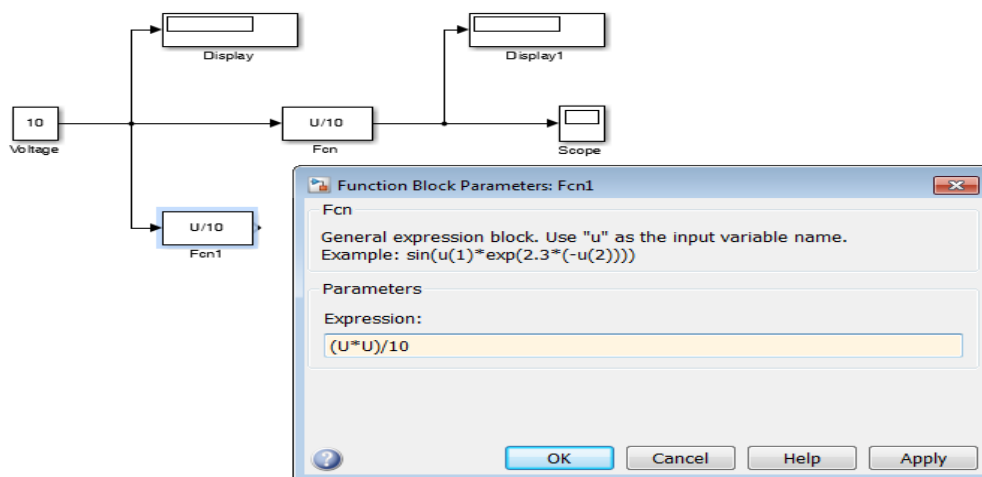
>> R=10

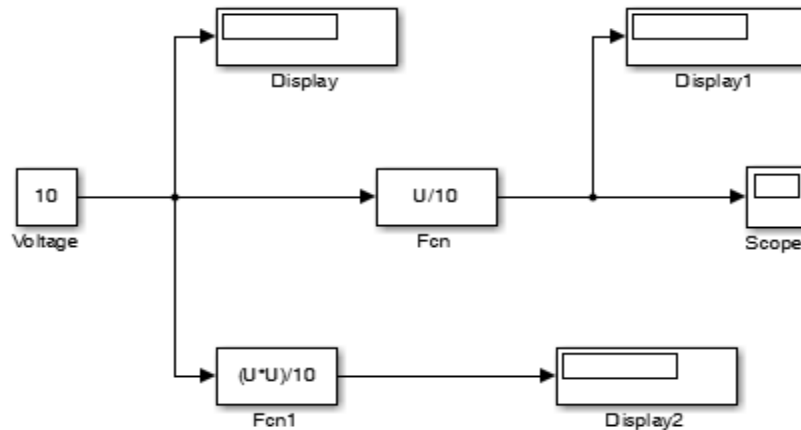
R =

    10

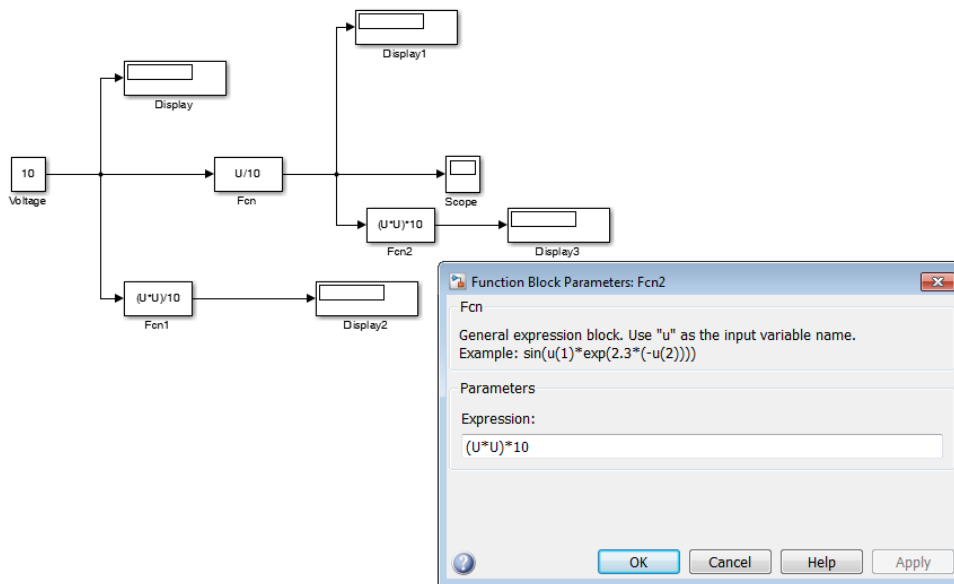
fx >>
```

Also we need to find the power. For that we simply copy the function block and double click on it and write in the expression block $(u*u)/10$ or V^2/R . Connect it after the constant block. Also connect the display block after that function block.



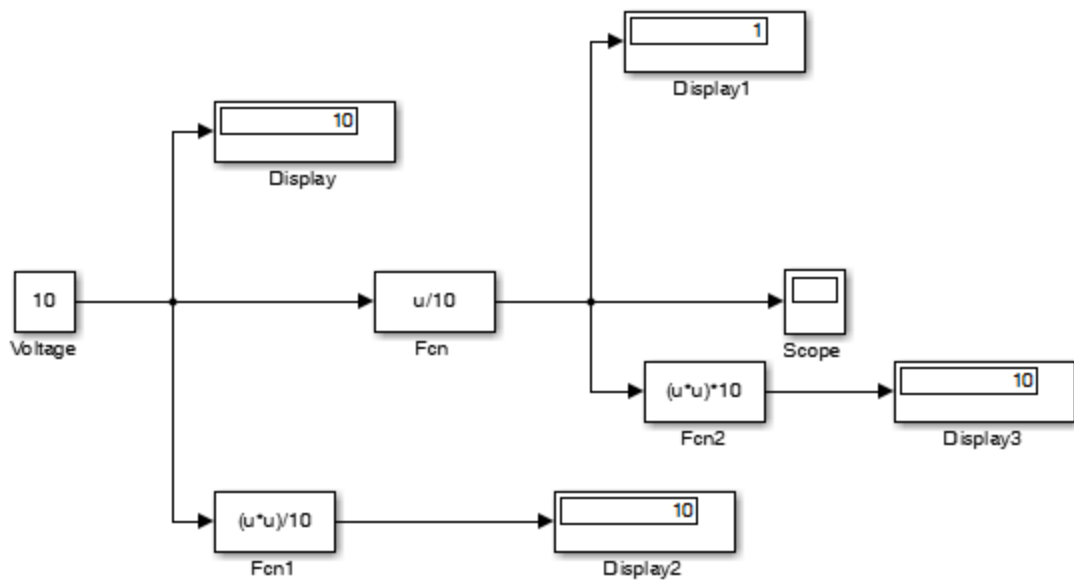


We have one more relation i.e. I^2R . So copy the function block and place it before the scope and after the function block because the output of this block is the value of current. So you get the same result by connecting the display block after that block. Change the value of u^2/R to $(u*u)*R$.



One important thing to note is that if you use the element in the Simpowersystem we should have powergui in our workspace. Now here we are using the elements from the Simulink. So if you use element from pure Simulink element not the mixture of other elements powergui is not necessary.

Now run the circuit simulation. We got the value of voltage, current and power.



Lab Task:

1. What does the waveform of a DC source show? Why do we use constant block for representing DC source?
2. What are the important components of "Sink" library.(used in Lab)
3. What is 'scope' used for during simulation?
4. What is function block? Explain with example.

Marks Obtained:

Remarks: