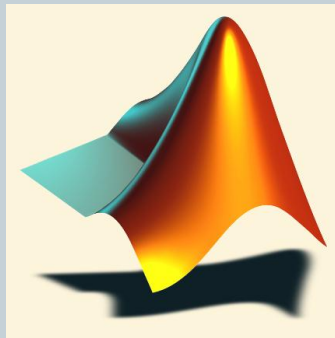


Lecture Series – 10

Solving RLC Series Parallel Circuits using SIMULINK

1



Shameer Koya

R L and C

2

Device	Current-voltage equation	Voltage-current equation
Resistor	$I_R(t) = \frac{V_R(t)}{R}$ <p>(Can change instantaneously <u>if</u> voltage can)</p>	$V_R(t) = I_R(t) * R$ <p>(Can change instantaneously <u>if</u> current can)</p>
Capacitor	$I_C(t) = C * \frac{dV_C(t)}{dt}$ <p>(Can change instantaneously)</p>	$V_C(t) = V_C(t=0) + \frac{1}{C} \int_0^t I_C(t) dt$ <p>(Can <u>not</u> change instantaneously)</p>
Inductor	$I_L(t) = I_L(t=0) + \frac{1}{L} \int_0^t V_L(t) dt$ <p>(Can <u>not</u> change instantaneously)</p>	$V_L(t) = L * \frac{dI_L(t)}{dt}$ <p>(Can change instantaneously)</p>

Series RLC Circuit

3

- Kirchoff's voltage law

$$v_R + v_L + v_C = v(t)$$

- Substituting the voltage equations

$$Ri(t) + L \frac{di}{dt} + \frac{1}{C} \int_{-\infty}^{\tau=t} i(\tau) d\tau = v(t)$$

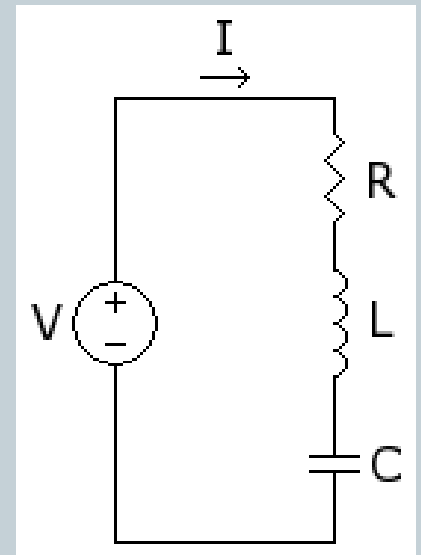
- differentiating and dividing by L

$$\frac{d^2i(t)}{dt^2} + \frac{R}{L} \frac{di(t)}{dt} + \frac{1}{LC} i(t) = 0$$

- Can be expressed in the general form

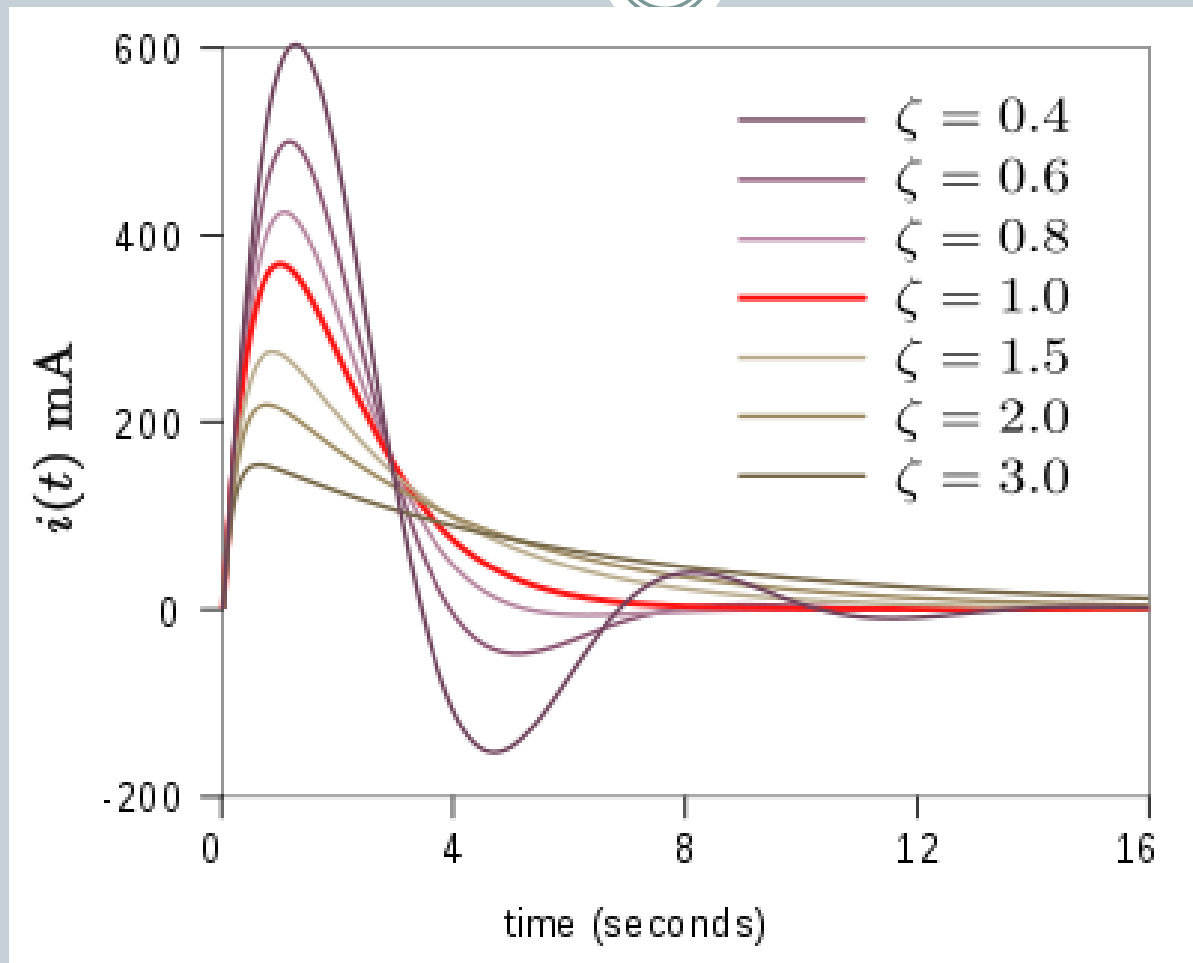
$$\frac{d^2i(t)}{dt^2} + 2\alpha \frac{di(t)}{dt} + \omega_0^2 i(t) = 0$$

$$\alpha = \frac{R}{2L} \quad \text{attenuation} \quad \omega_0 = \frac{1}{\sqrt{LC}} \quad \text{angular resonance frequency}$$



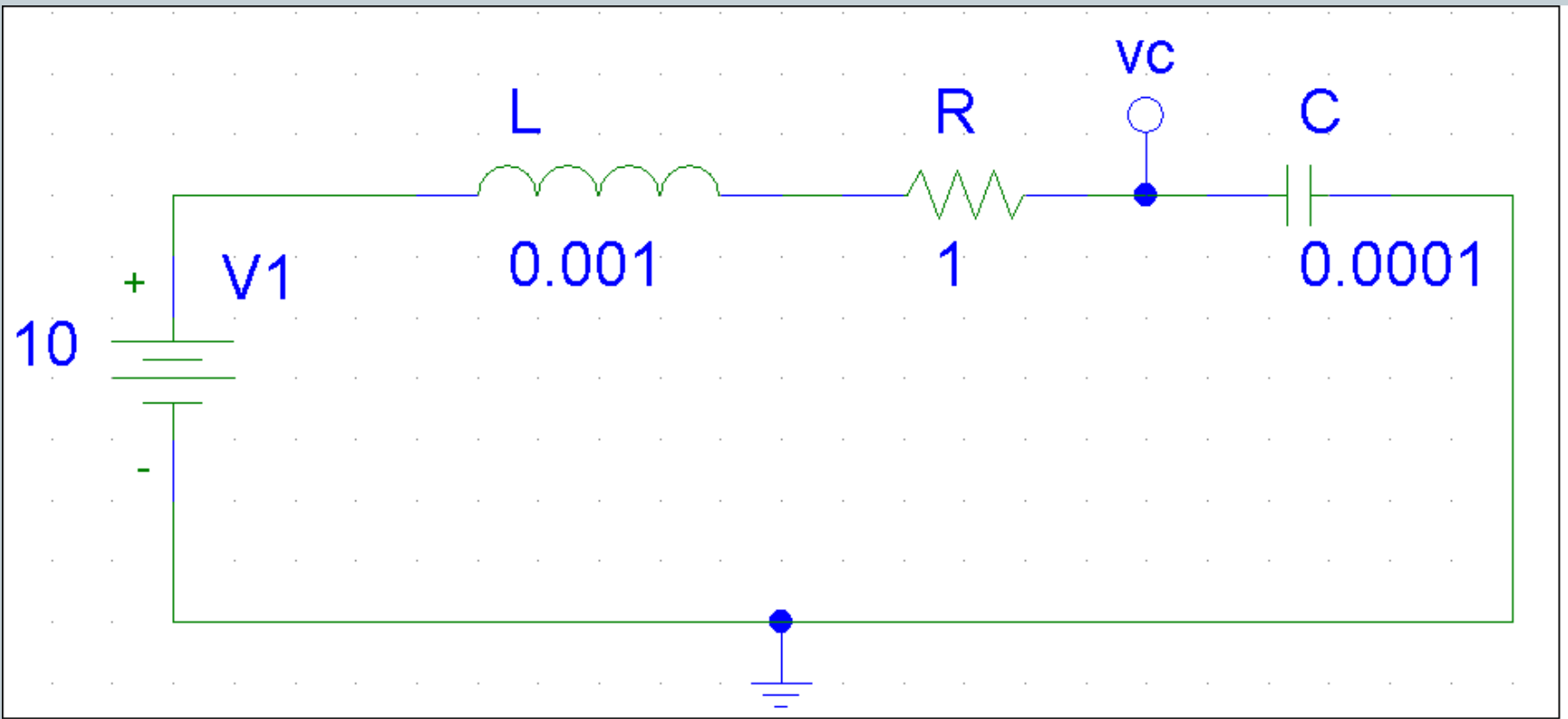
RLC Response

4



Series RLC Using Simulink

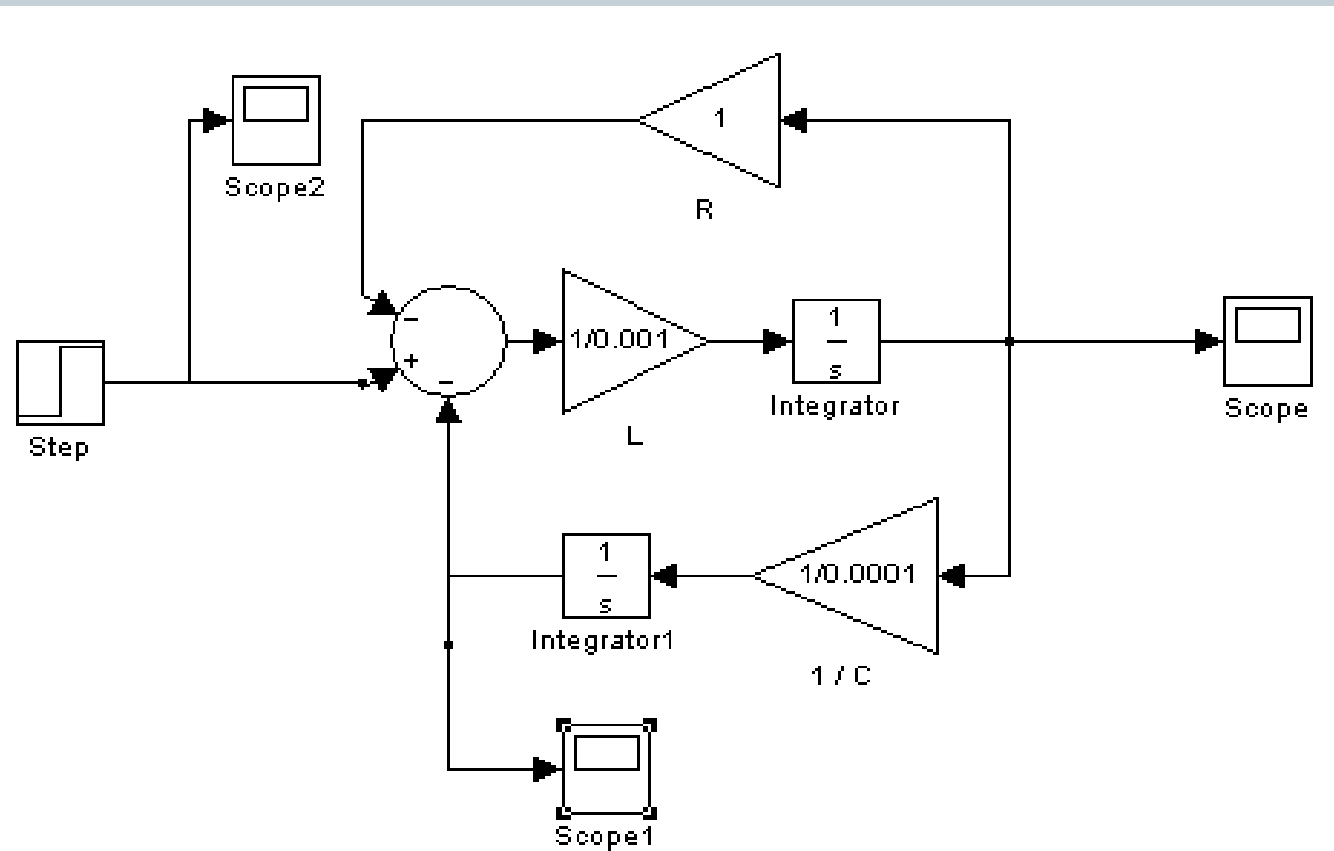
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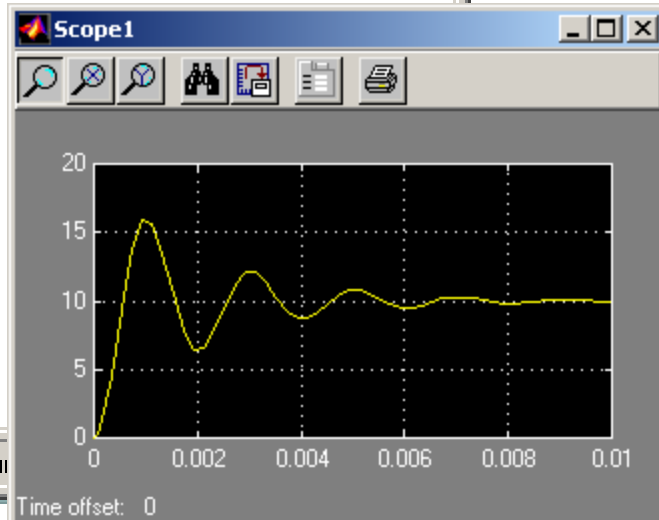
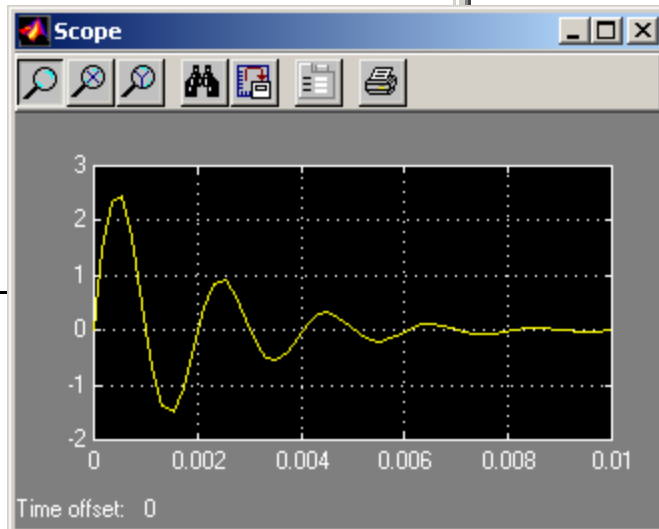
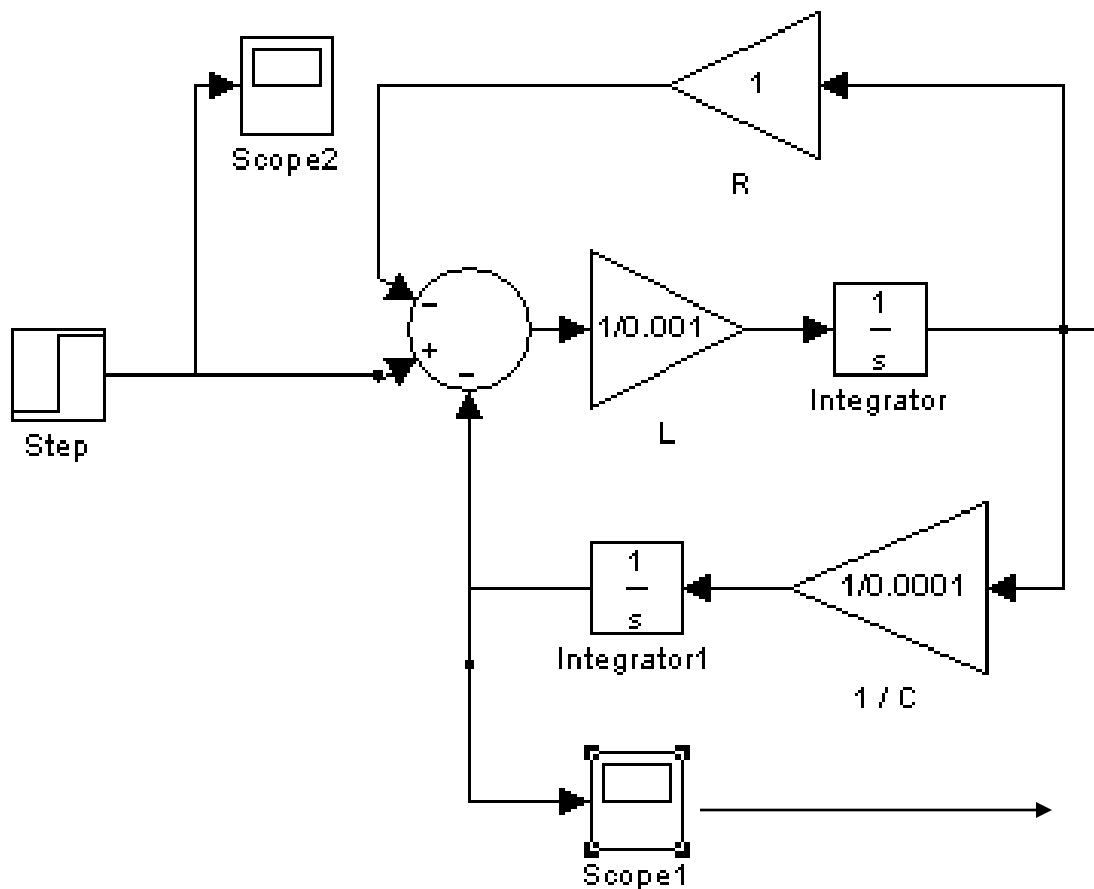


Simulink model

6

$$Ri(t) + L \frac{di}{dt} + \frac{1}{C} \int_{-\infty}^{\tau=t} i(\tau) d\tau = v(t)$$



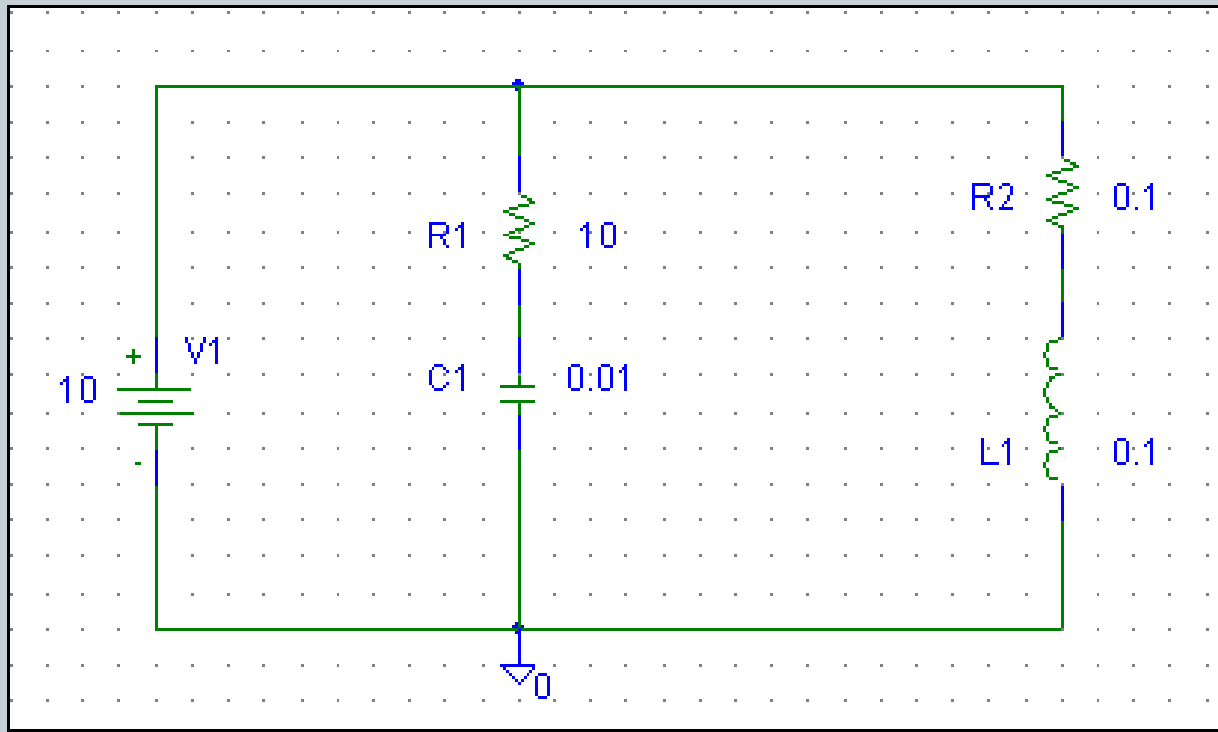


- Change the R values and check the change in result.
- Make a simulink model of RLC Parallel circuit

Series parallel Circuit

9

- RL and RC circuits in parallel
- $I = I_1 + I_2$



Simulink model

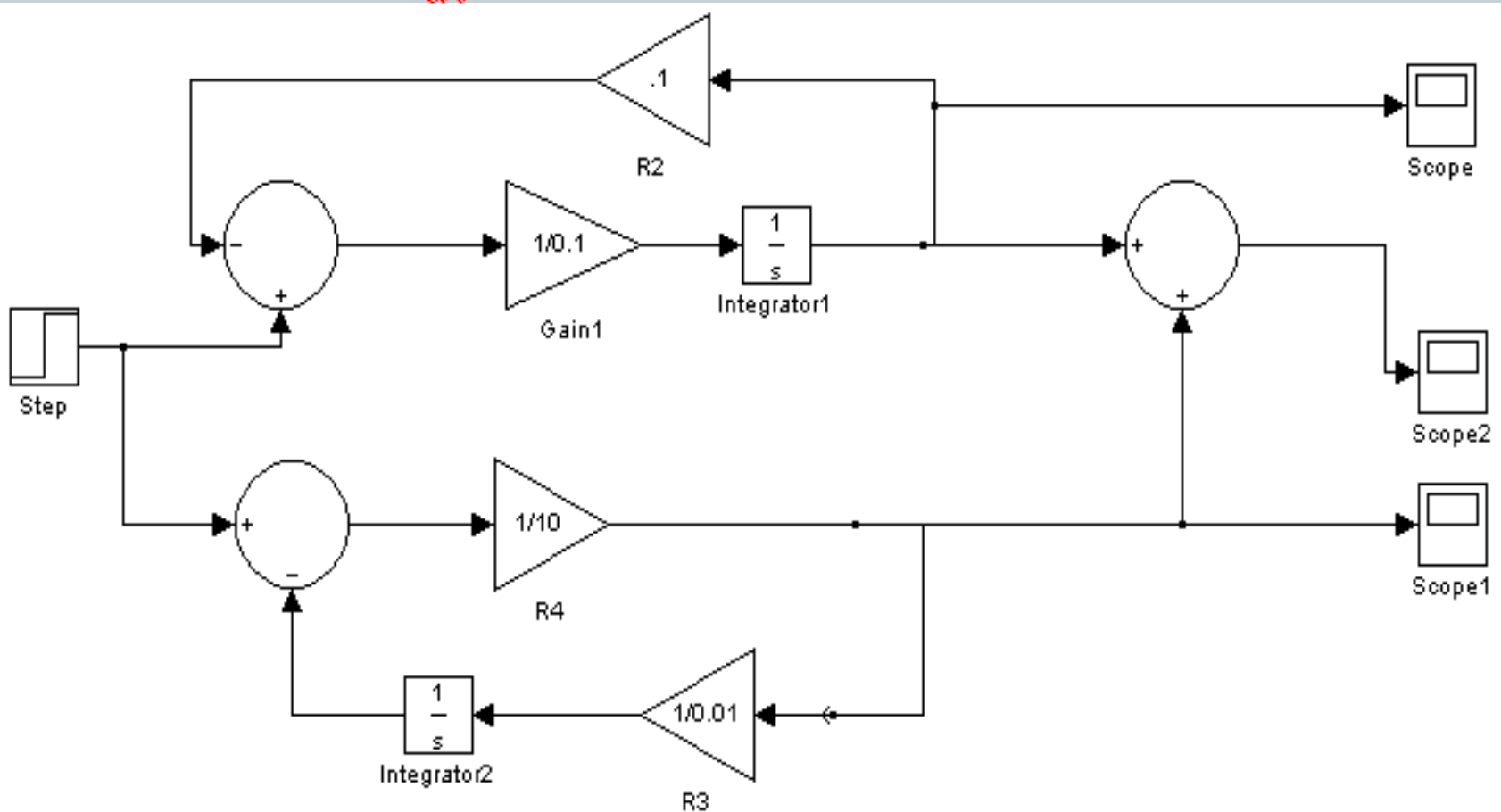
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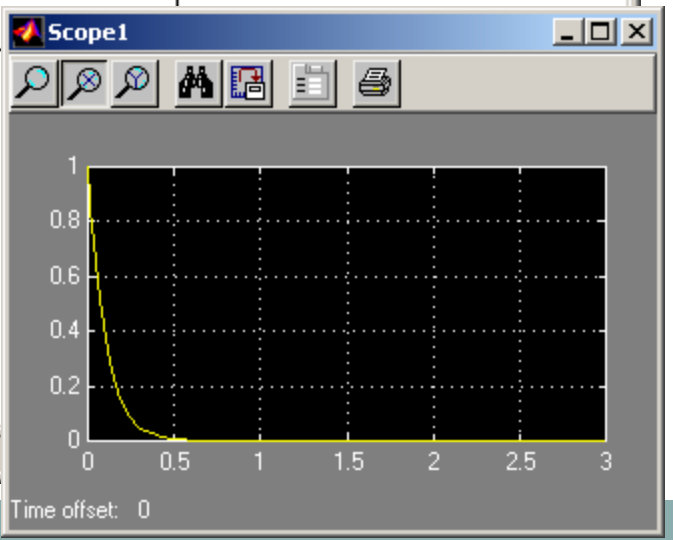
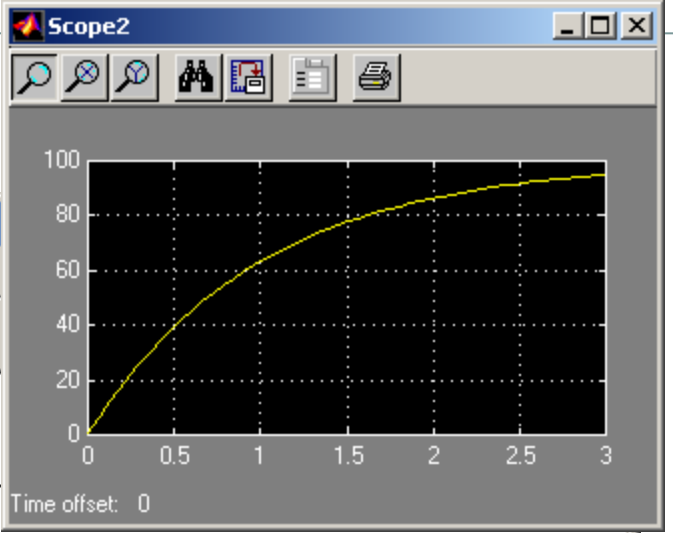
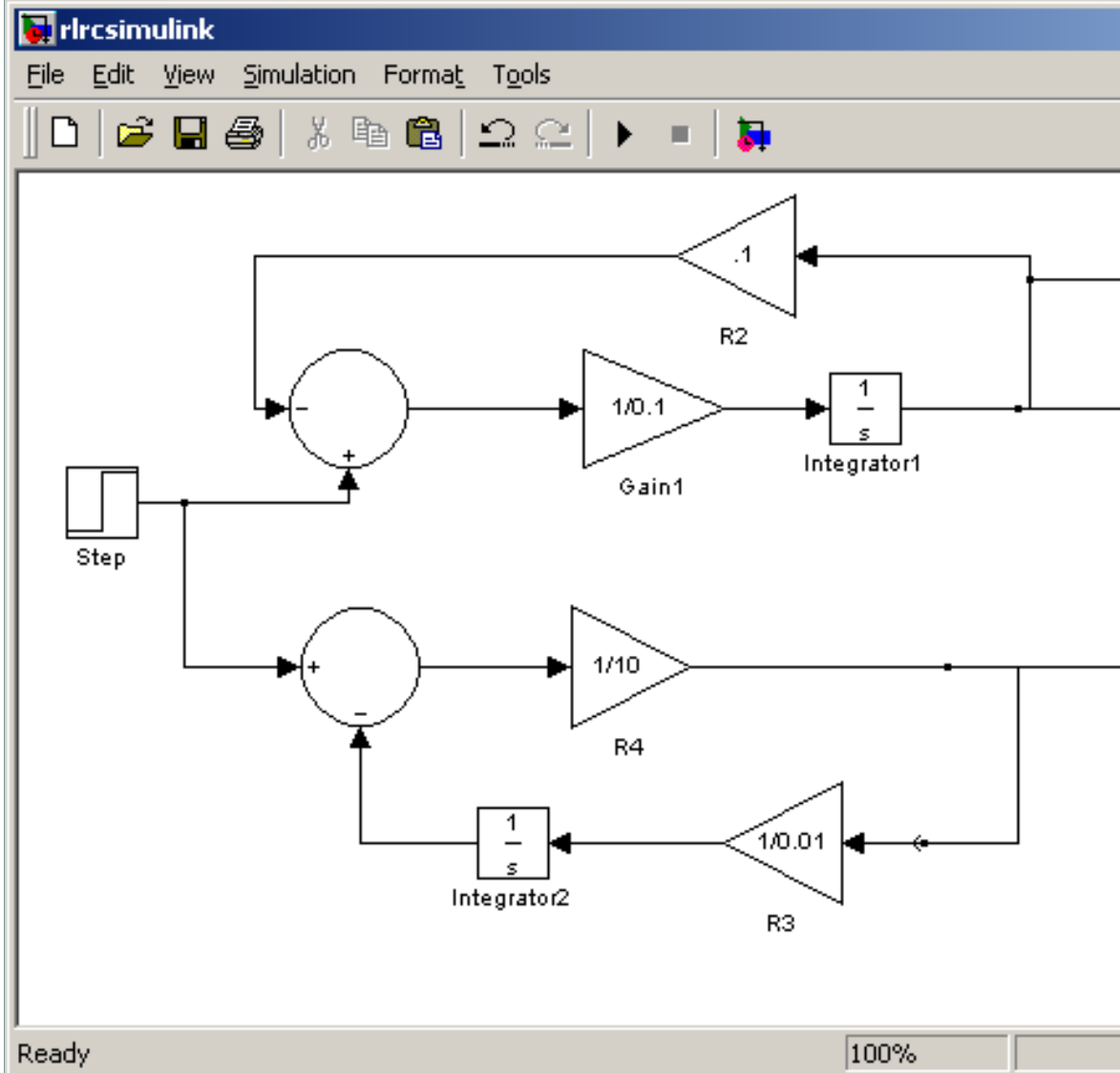
RL circuit

$$V(t) = L \frac{di(t)}{dt} + Ri(t)$$

RC circuit

$$V = \frac{1}{C} \int_{-\infty}^t i dt + iR$$





Simpowersystem

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- SimPowerSystems is physical modeling tools for MATLAB Simulink to model electrical systems.

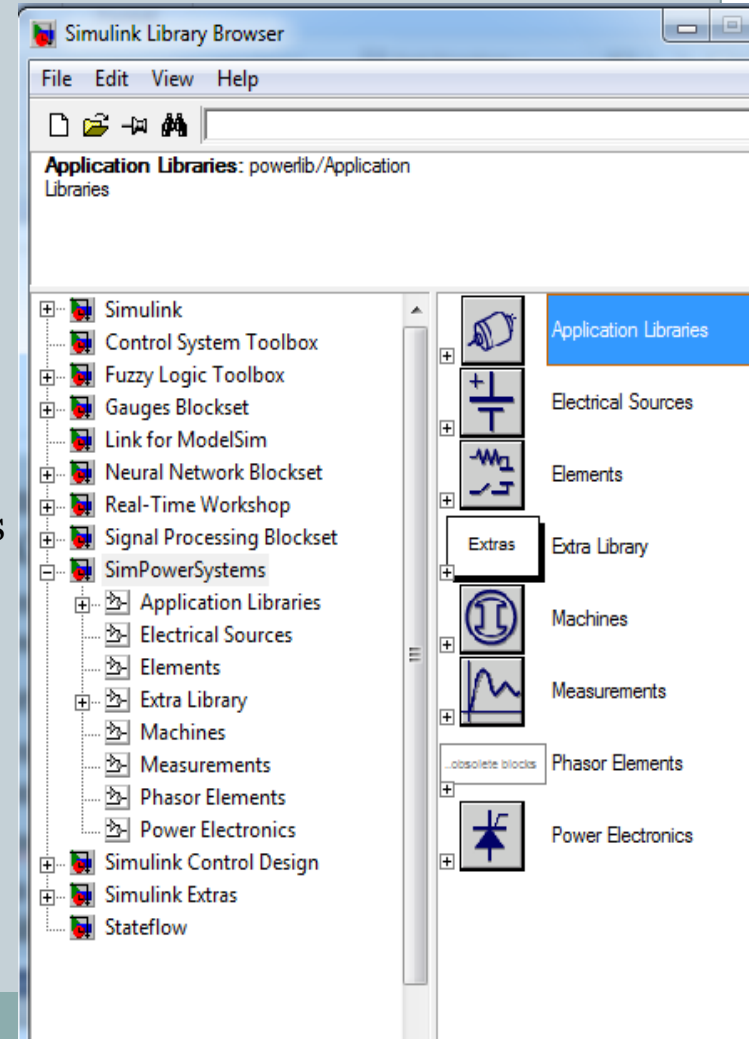
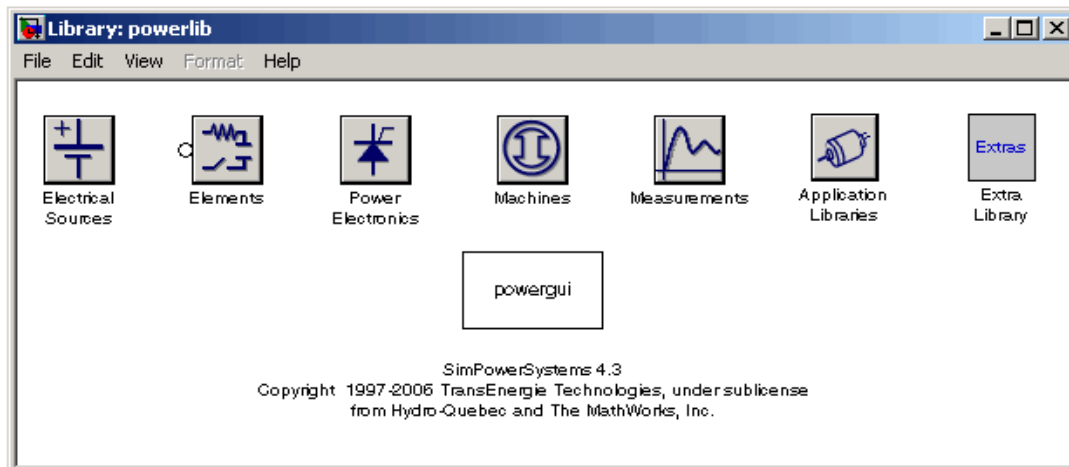
- Library for simpowersystem is available in Simulink Library Browser

- Alternate method:

- by entering the following command at the MATLAB® prompt.

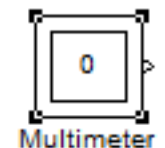
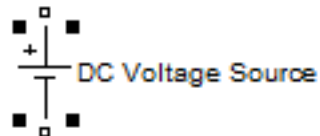
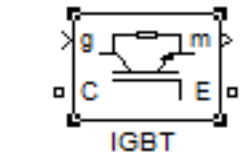
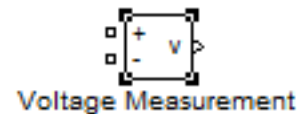
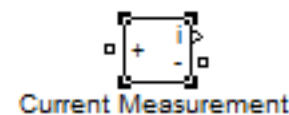
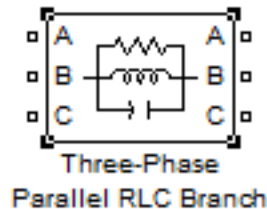
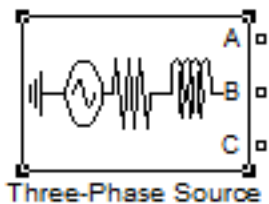
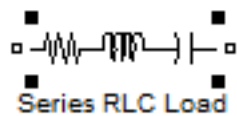
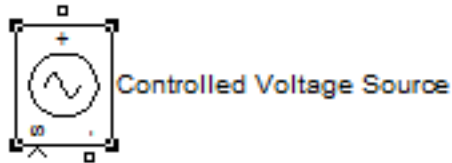
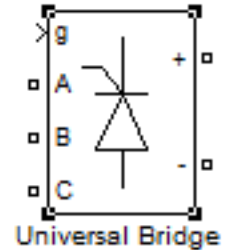
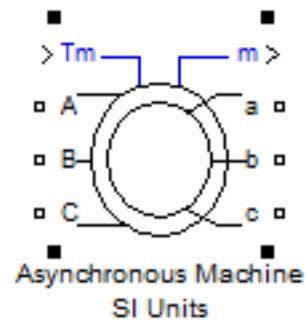
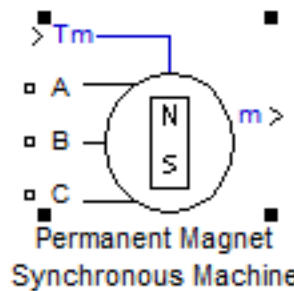
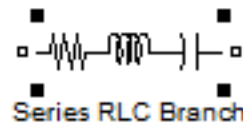
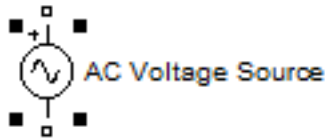
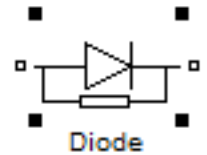
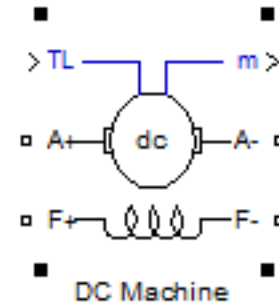
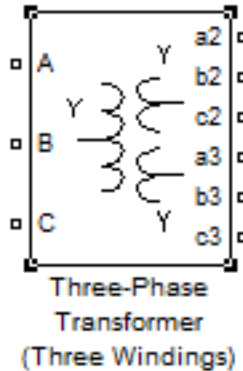
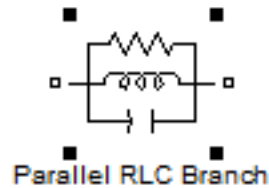
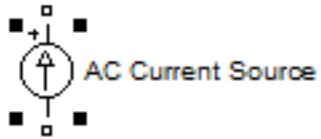
```
>>powerlib
```

- This command displays a Simulink window showing icons of different block libraries.



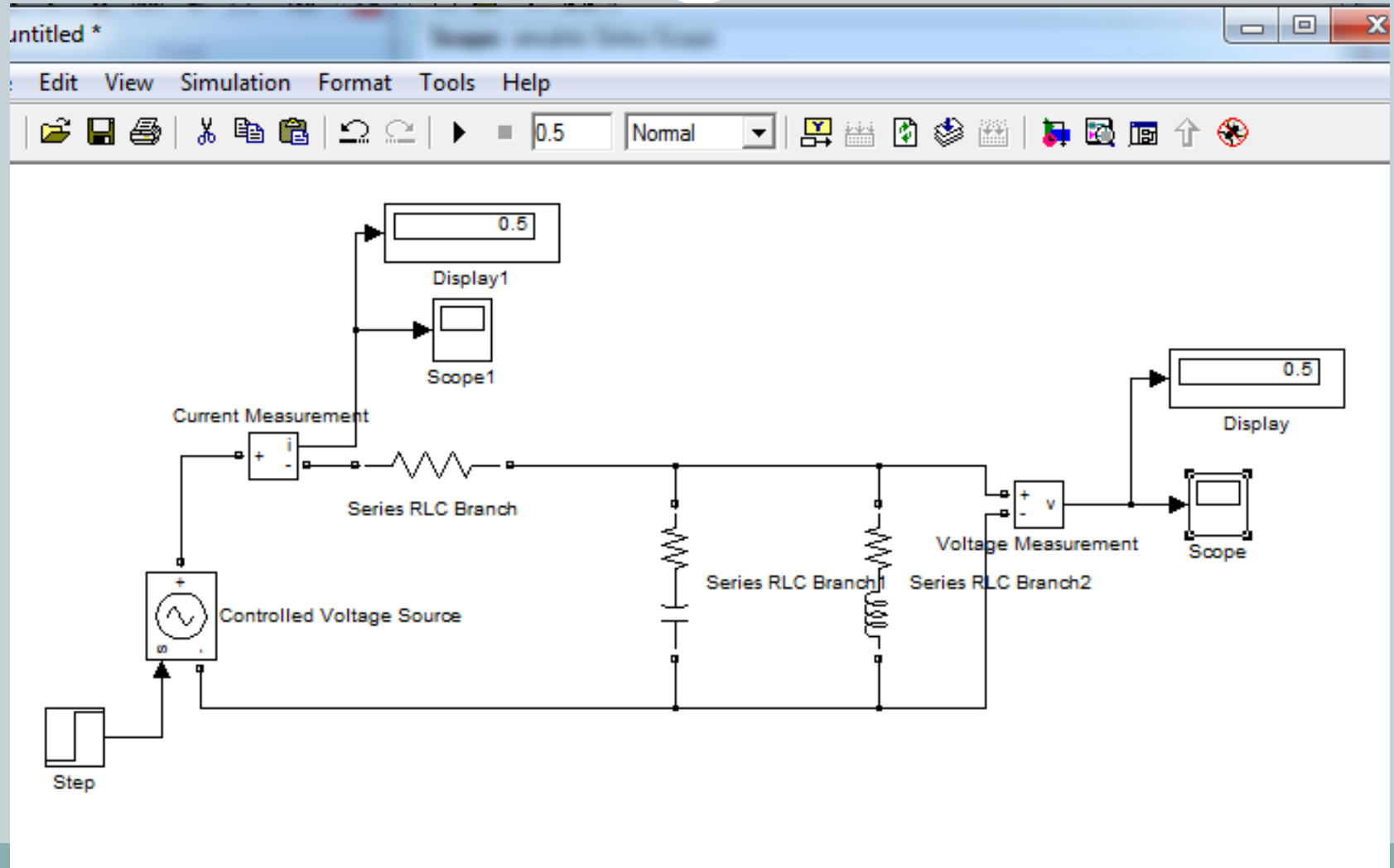
Some commonly used blocks

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Example

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Thanks

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Questions ??

