PROGRAMMING WITH MATLAB

WEEK 12

SIMULINK

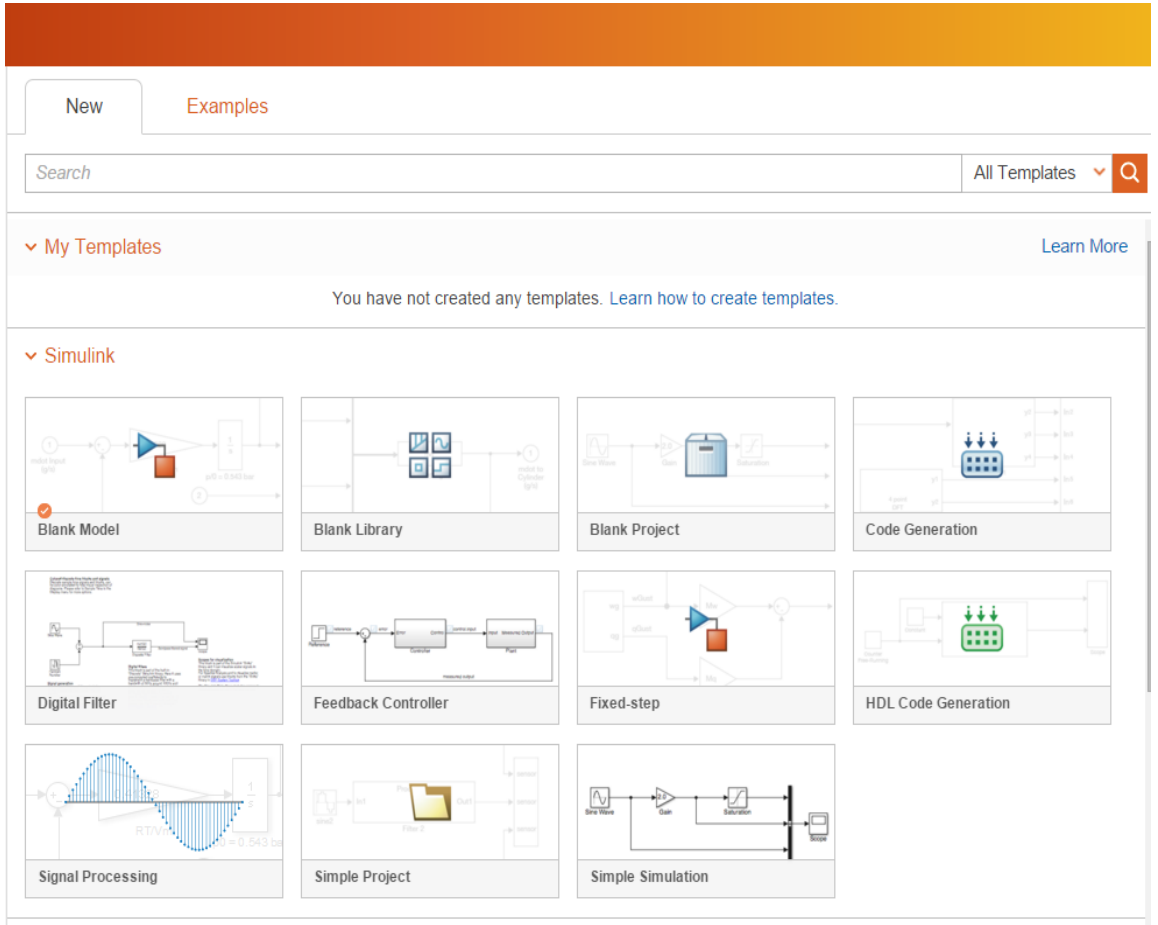
SIMULINK

- Simulink is a toolbox for modeling, simulating, and analyzing dynamic systems.
- With Simulink you can easily build a system model, modify it, and observe the behavior of the system.

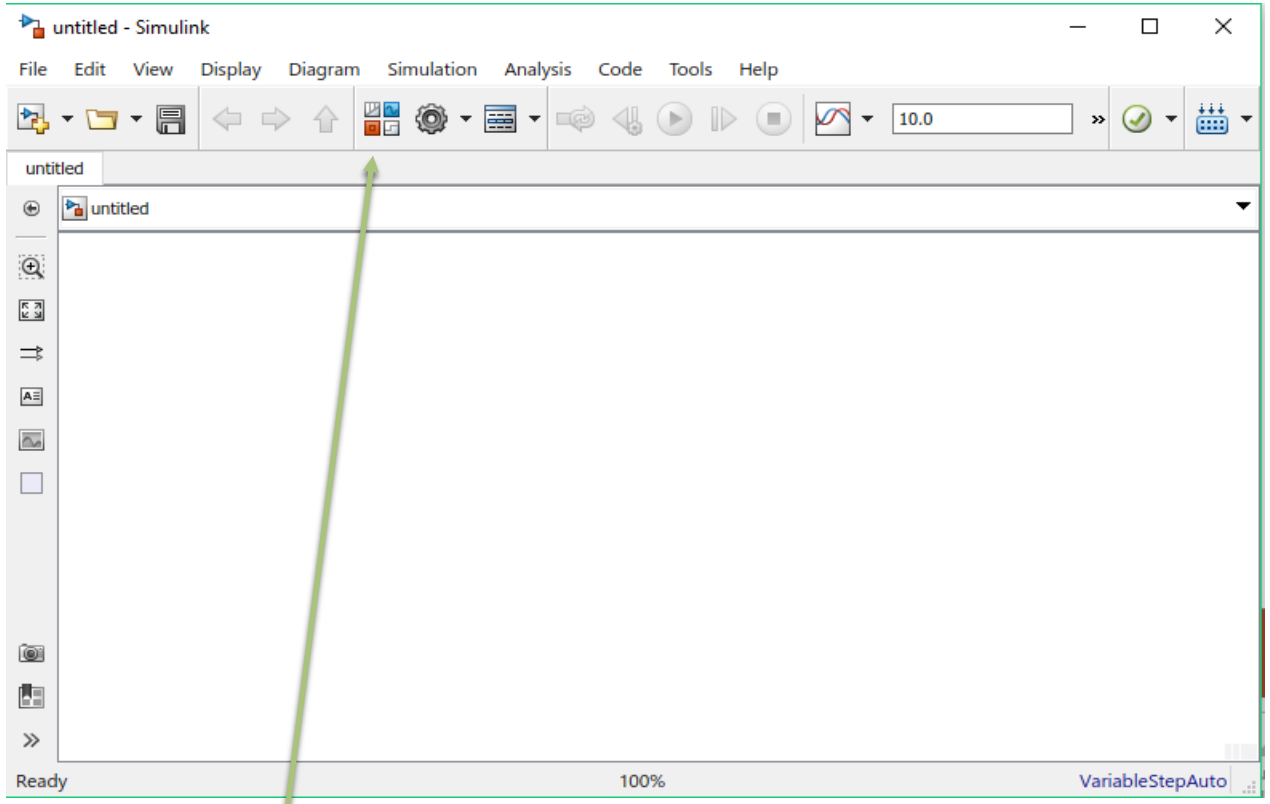
>> simulink

This command opens the Simulink Start Window

Click on the Blank Model pain

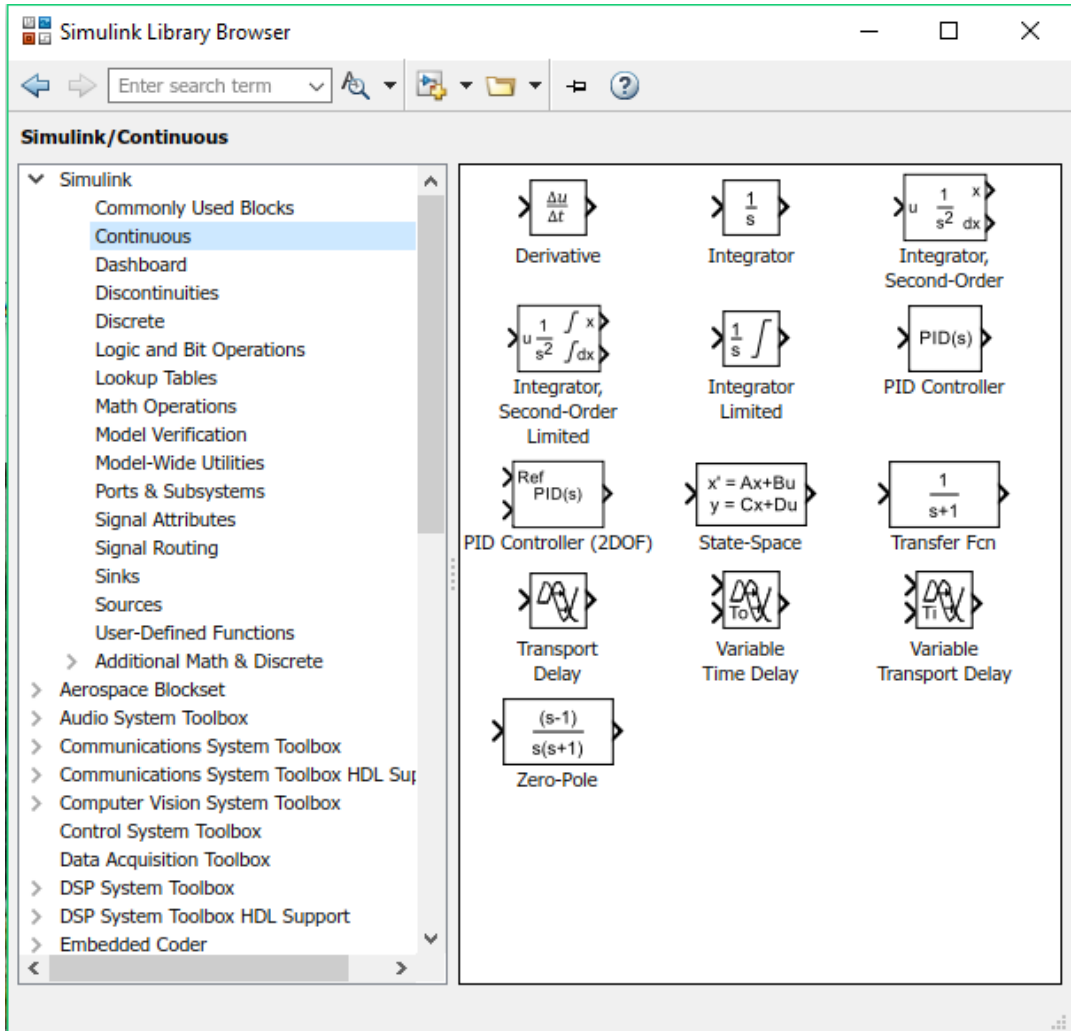


SIMULINK



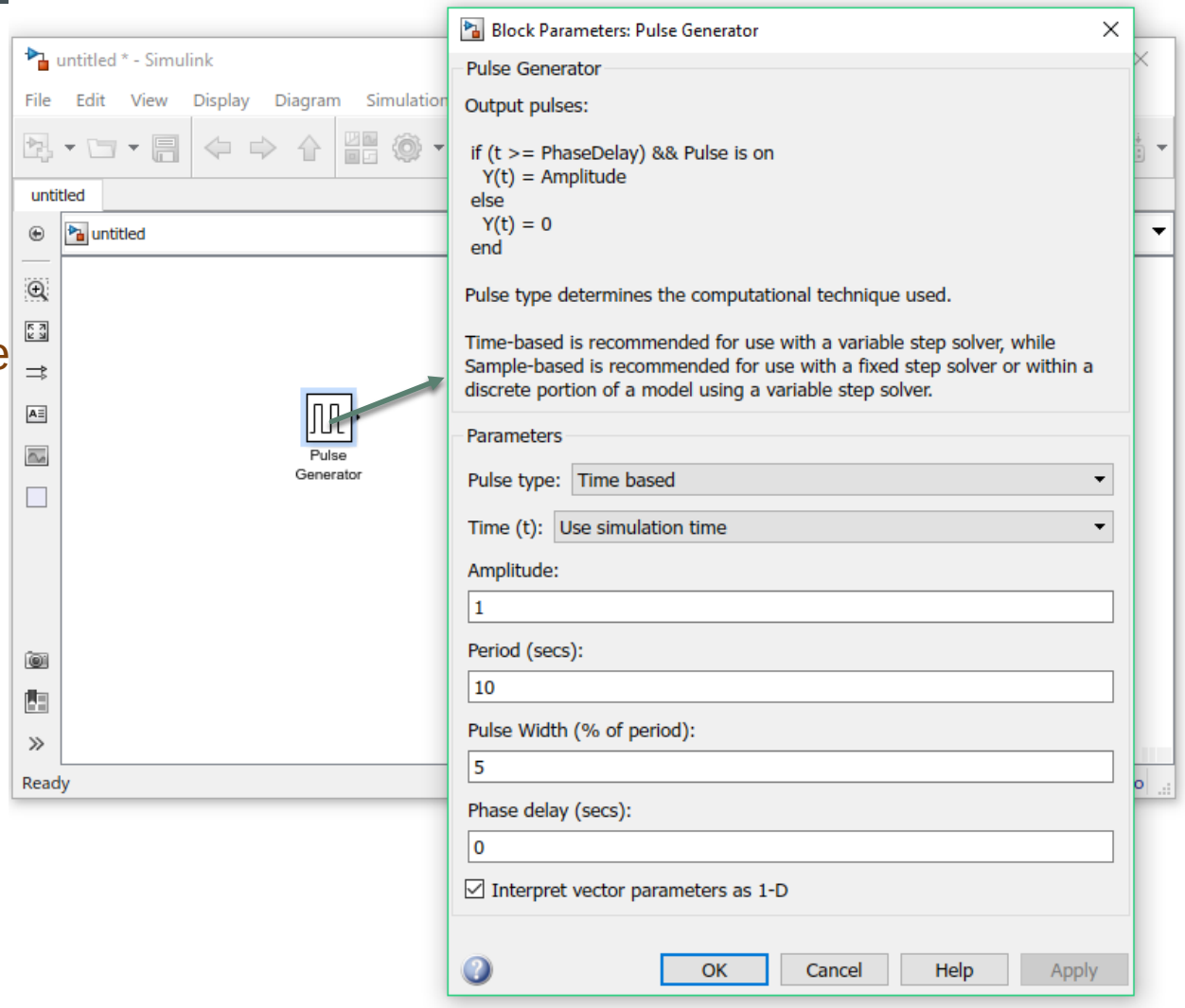
- Click the icon in the toolbar to open the library browser.

The Simulink Library Browser



SIMULINK

- The necessary items for the system model in the Simulink Library browser are clicked and dragged to the new model window.
- Then the connections between the ports of the items are again done with the help of the mouse.
- Blocks have a Block Parameters window that opens when you double-click on the block.



SIMULINK

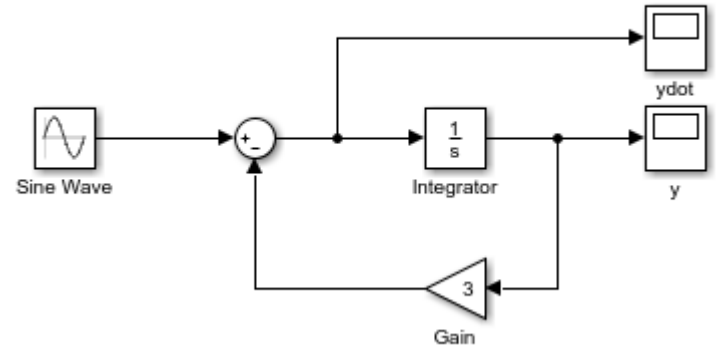
Let's construct a Simulink model to solve the following equation:

$$\dot{y} + 3y - cos3t = 0, \quad 0 \leq t \ll 5 \; and \; y(0) = 1$$

or

$$\dot{y} = -3y + cos3t$$

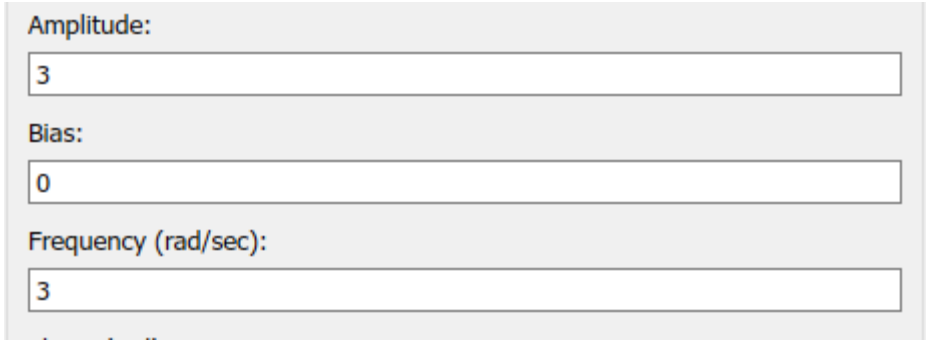
- Select and place in your new model window the Sine Wave block from the Sources library
- Select and place the Gain block from the Math Operations library
- Select and place the Integrator block from the Continuous library
- Select and place the Scope block from the Sinks library
- Connect these blocks as shown in the figure



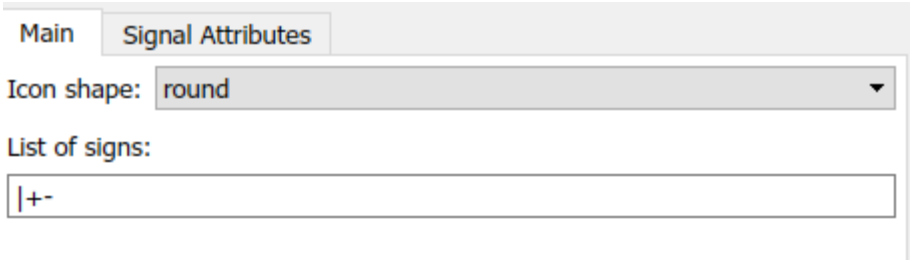
SIMULINK

Change the block parameters according to our equation:

Sine Wave

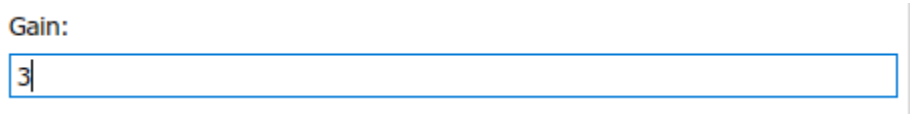


Sum



Integrator

Gain

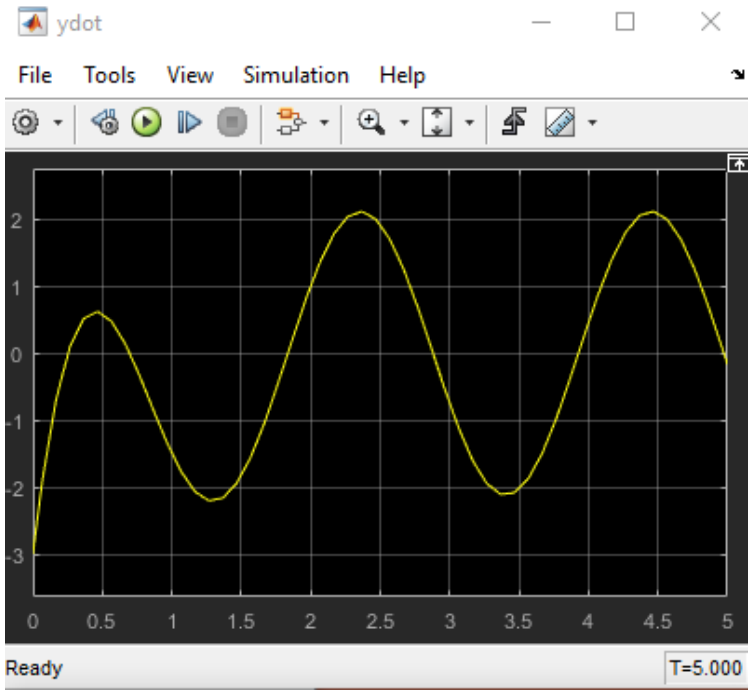


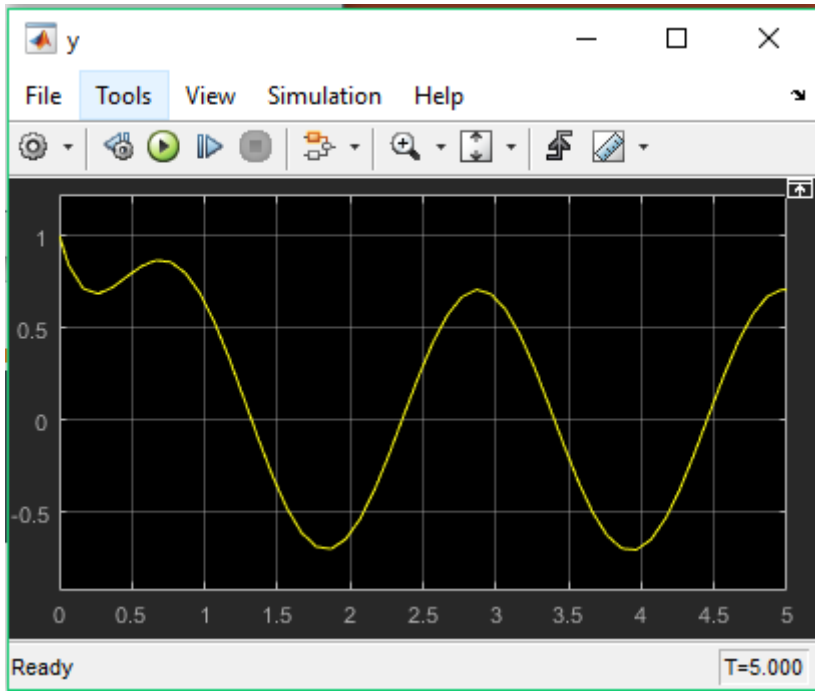
SIMULINK

Enter 5 for the Stop time.

Run the simulation by clicking on the Start Simulation icon on the toolbar.

Then double-click on the Scope blocks to observe the results.





SIMULINK

Now let's implement low-pass and high-pass filter applications in Simulink:

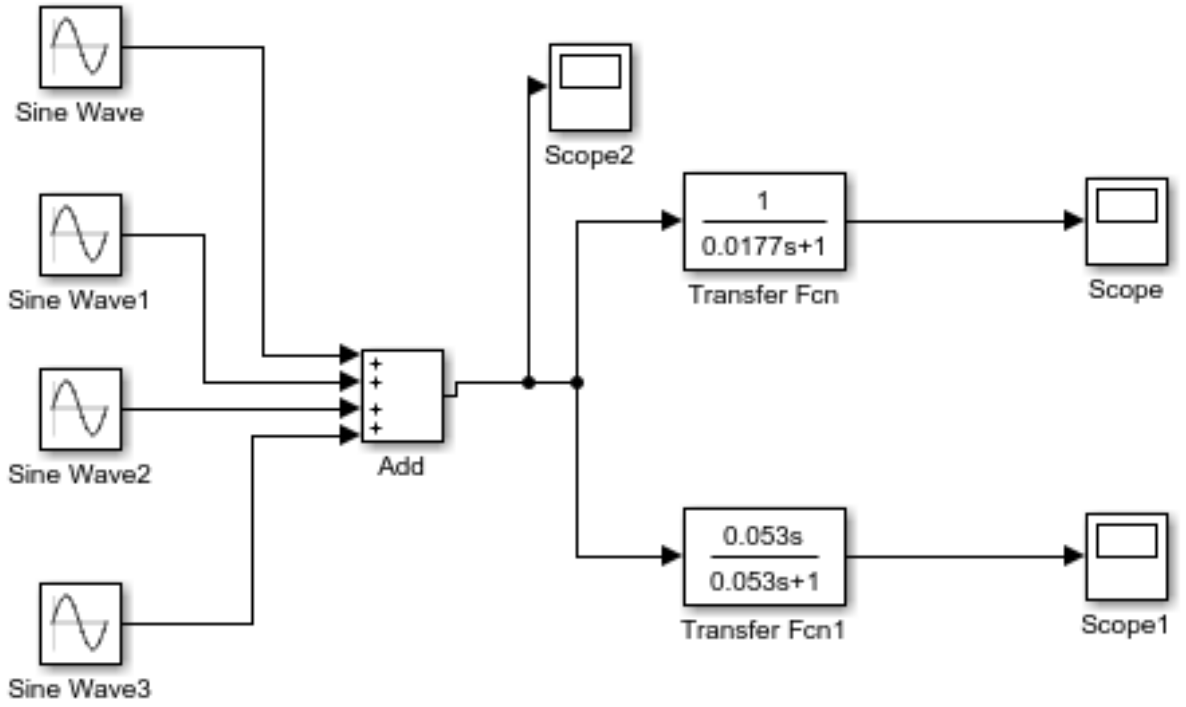
The transfer function of a first order low-pass filter is as follows

$$H(s) = \frac{1}{1 + Ts}$$

The transfer function of a first order high-pass filter is:

$$H(s) = \frac{Ts}{1 + Ts}$$

SIMULINK


Sine Wave
Sine Wave1
Sine Wave2
Sine Wave3
Add
Scope2
1
0.0177s+1
Transfer Fcn
Scope
0.053s
0.053s+1
Transfer Fcn1
Scope1

SIMULINK

Set the frequencies of the sinusoids as follows:

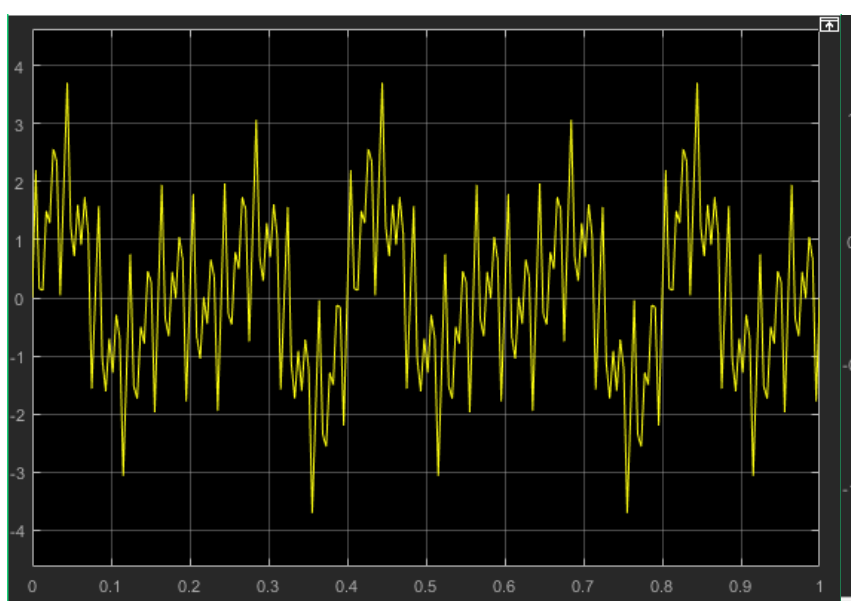
Sine Wave : 31.4159 rad/s

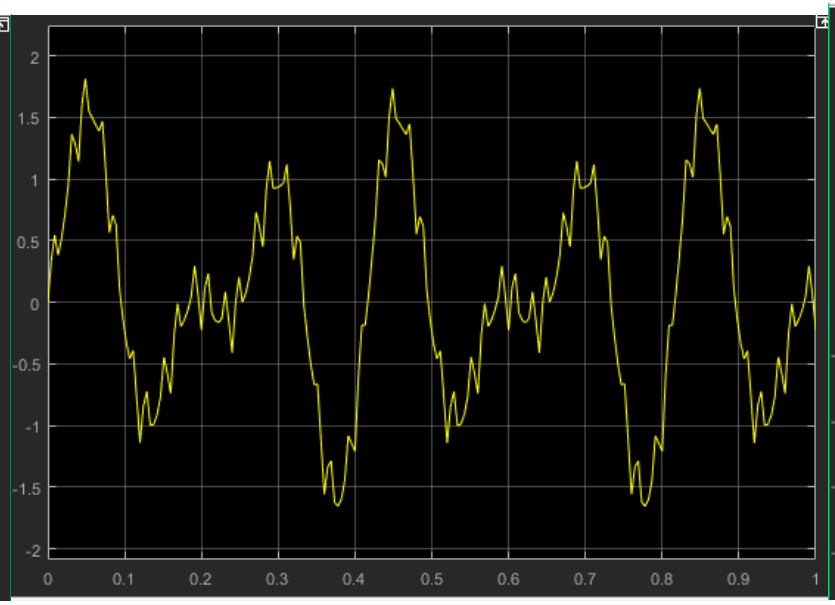
Sine Wave1 = 47.1239 rad/s

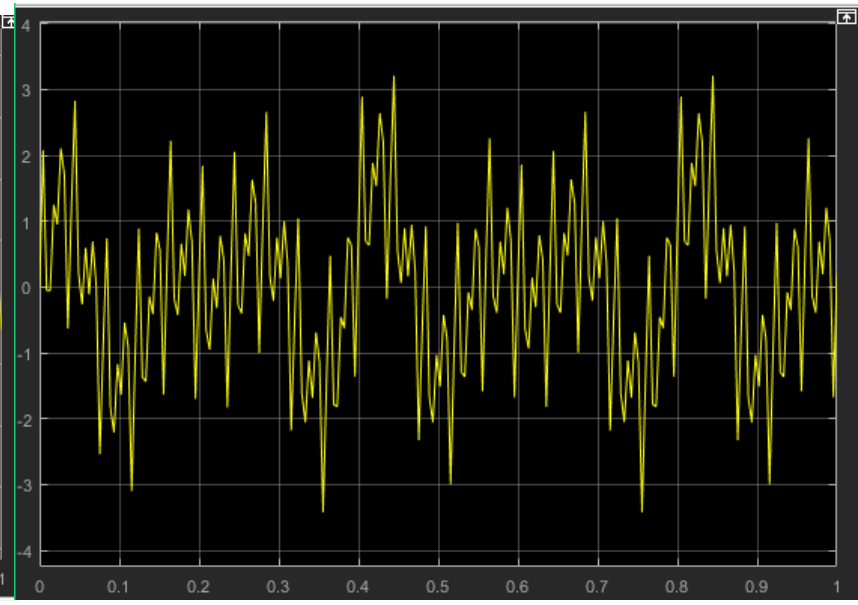
Sine Wave2 = 314.1593 rad/s

Sine Wave3 = 471.2389 rad/s

SIMULINK


4
3
2
1
0
-1
-2
-3
-4
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1


2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1


4
3
2
1
0
-1
-2
-3
-4
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1

SIMULINK

- Toolboxes

Math Operations: Takes the signal and performs a math operation

Abs, Add, Gain, Product, Sign, Trigonometric Function …

Continuous: Adds differential equations to the system

Derivative, Integrator, Transfer Function, State-Space …

Discrete: Simulates discrete difference equations

Delay, Difference, Discrete Derivative, First-Order Hold …

SIMULINK

- Toolboxes

Sources: Provides input to your system

White Noise, Clock, Constant, Pulse generator, Random Number, Sine Wave, Signal Generator …

Sinks: Allows signals to be observed and analyzed

Scope, Display, To File, To Workspace …