Lab 1 - Simulink Introduction & Tutorial

Overview

This lab is intended for getting familiar with Simulink, learning to make block diagram models, and formatting figures prior to saving your results.

Resources Required:
MATLAB
Simulink

Resources:
The following are useful resources mentioned through this manual

- MXET375 - Lab 01 Part 2 - Simulink Tutorial
- Introduction to Simulink (6 min YouTube video)

Task1: Simulink Tutorials

1a: Simple Simulink Model

In this task, you will follow along and complete the simple model tutorial found in the provided file titled "MXET375 - Lab 01 Part 2 - Simulink Tutorial". Please follow the tutorial to completion and be sure to always save your Simulink files for your record.

NOTE:

- The amplitude text box does not automatically pop up. Double click on the sine wave block to change its parameters. This is true for all blocks going forward.
- The process to change the configuration parameters is wrong. Instead, navigate to the Modeling tab, then click the Settings wheel icon.
- The plot that is within the tutorial document is incorrect according to its own instructions. Have your plot look as it is in figure 1.

For good practice all your plots should be fully formatted with a white background, axes labels with units, legend, and title. However, for this lab, the models are not representative of an actual model and are just simple plots. Thus, the y-axis and what the lines represent are not defined. In these instances, just include a title, legend, and x-axis label. The "MXET 375 - Lab 01 Part 2 – Simulink Tutorial" file explains how to change the plot colors. The following process is for adding relevant information:

1. Open the plot.
2. Click the settings wheel icon in the top left.
3. In the Time tab, check the bottom box to display the x-axis.
4. Change the time units to seconds.
5. In the Display tab, change the title to an appropriate one for your task
6. Check the box to display the legend.

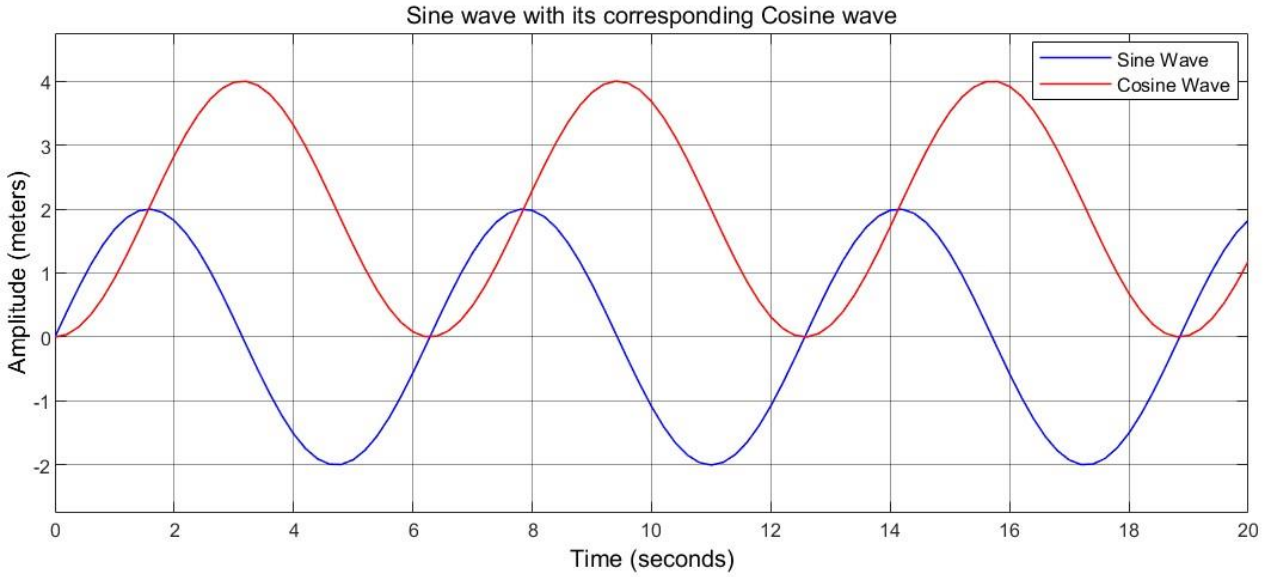

Figure 1: Sine wave integrated to form Cosine wave

Refrain from using a screenshot to capture and save an image of your plot. Unwanted clipping can occur, and it produces a poor result. The better way to save your plot is to do the following:

1. In your scope window, click on “File” in the top left corner.
2. Click “Print to Figure”. This will open a new window that allows you to do more sophisticated editing of your plots. Here we can save the figure as multiple different file types.
3. Click on “File” and then “Save as...”. This will allow you to save the image with your specified file name and to your specified directory.
4. Select the image format of your choice, .jpg or .png will be sufficient.

Save a screenshot of the tutorial block diagram and include it in your report. Be sure to have your block names shown with appropriate names in your block diagram. Showing block names can be done by the following procedure:

1. Highlight all the blocks in your block diagram.
2. Right click on one of the blocks.
3. Format
4. Show block name
5. On

1b: Simulink Intro Video Model

Next, follow along with the Introduction to Simulink video and create the same block diagram created in the video. Run, the simulation and open the scope to view the plot. It should appear as it is in the video. Format and save the block diagram and plot appropriately and include them in your report.

NOTE: It is best to create a new model file for each new system model. Do not have all your block diagram models in one file. This will cause problems in the future if you create this habit. Some settings will need to be made to correctly make a model work and they could impact the behavior of another model if they are in the same file.

To show completion of this task, save your formatted scope plots of the two plots from the tutorial and the "Introduction to Simulink" video and show the TA.

Task 2: Simple Signal Generation

Now that you are familiar with Simulink, you will create a couple of simple signals as an added exercise. The block diagrams are not going to be provided; you will need to configure the blocks per the instructions to achieve the outputs.

2a: Modified Sine Wave

The first signal will be a modified sine wave as shown in figure 2. Create the signal by using a sine wave, pulse generator, and a gain block.

Hint: Along with a scope block, there is an **additional block** you will need to produce the plot, it is up to you to try and figure it out. The scope should only receive one input. Also, DO NOT change the parameters of your sine wave.

Change the Title, Legend & Description from this figure and onwards.

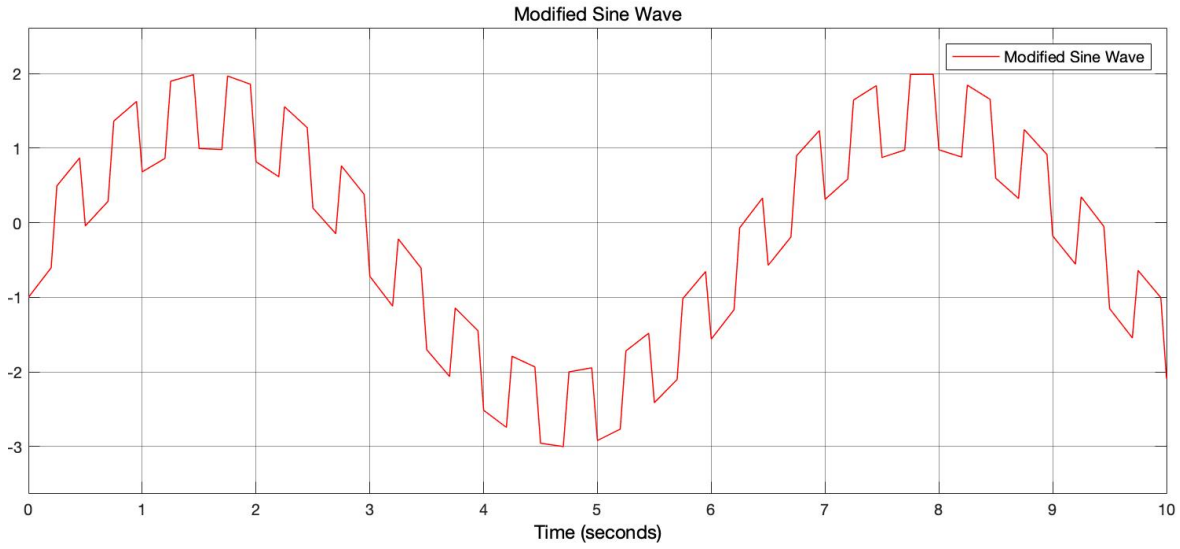

Figure 2: Modified Sine Wave

2b: Pyramid Signal
The second signal is a pyramid signal. Create the signal using two ramp functions, and an addition/subtraction function. Delay one ramp to achieve the shape. The signal should look as it is seen in figure 3.

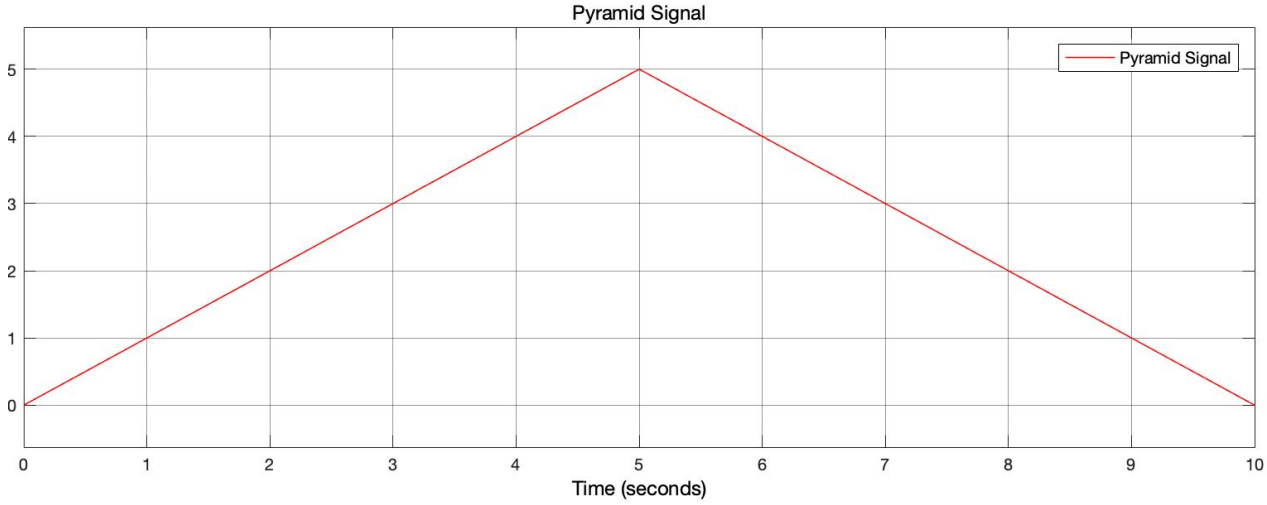

Figure 3: Pyramid Signal

Format and save the block diagrams and plots appropriately and include them in your report.

To show completion of this task, save your formatted scope plots of the two plots and show the TA.

Task 3: Simple Signal of a Car's path

Next you will create a simple signal of a car's path. To generate this diagram, create the following block diagram as shown in figure 3.

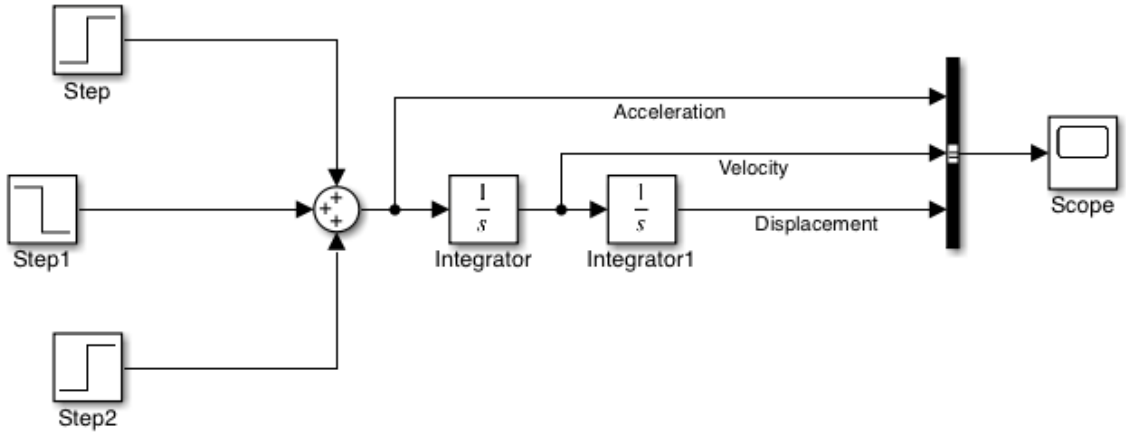

Figure 4: Car's Path Block Diagram

You will need to adjust the step functions appropriately to recreate the plot shown in figure 4.

NOTE: You will only need to look at the acceleration plot (the step plot) to know how to adjust the three step block functions. The velocity and displacement plots are created automatically

from the integrations of the acceleration plots. Look at your block diagram carefully, and this will make sense.

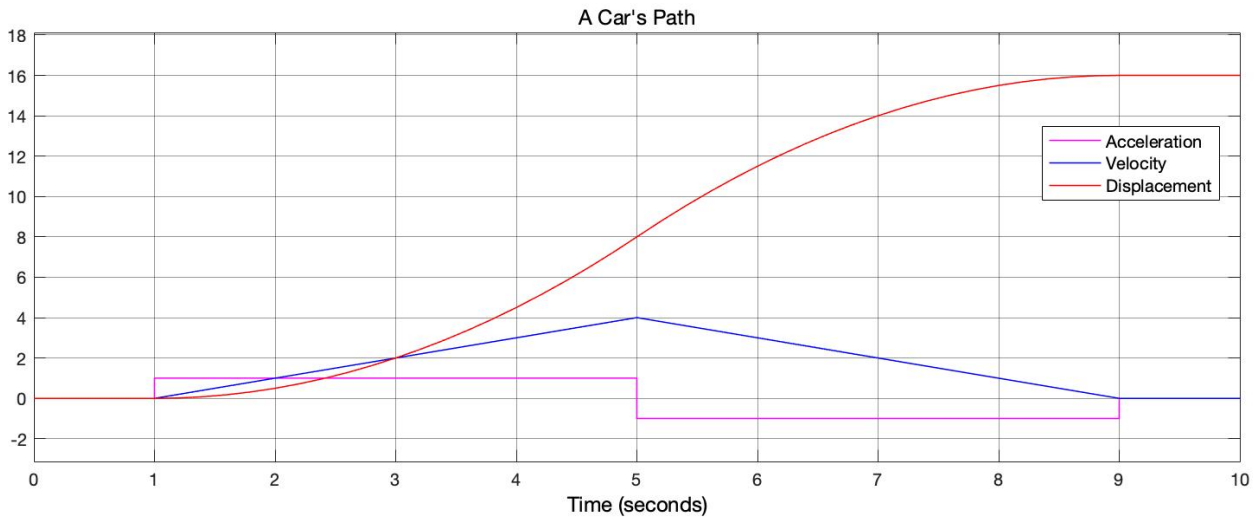

Figure 5: Car's Path Plot

After you have successfully recreated the plot, be sure to include the proper formatting to the block diagram and plot. They should look as they appear in the figures. The plot should have labels to the appropriate signal lines for "Displacement, Velocity, and Acceleration". Save and include these in your report.

To show completion of this task, save your formatted scope plot and show the TA.

NOTE: For completion of this lab, there should be a total of 5 models that you have created, thus you should have 5 block diagrams and 5 plots to show for check off and to include in your report.

Post-Lab Questions

1. From Task 3, If the resulting plots describe the path of a car, how would a driver generate this pattern? (When to accelerate/decelerate & stop?)
2. If we assume length is measured in meters, how far has the car traveled at 5 seconds?
3. Keeping the same assumption, what is the velocity of the car at 7 seconds?