Lab 0b: Introduction to Simulink

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Introduction and Background

This lab introduces you to the Simulink software environment. One main advantage of using Simulink is that it helps a DSP engineering better integrate the design phase (in software) and implementation phase (in hardware) steps of DSP system development resulting in more effective algorithms for a given application. As you will learn, the Simulink environment is user-friendly and provides a nice graphical user interface (GUI) to provide better intuition to a DSP designer.

Lab Instructions

Go online to:

http://www.mathworks.com/academia/student_center/tutorials/simulink-launchpad.html

and select the "Interactive Simulink Tutorial". You will need to register for this tutorial, which will take approximately 2.5 hours to complete.

Deliverables

You must be present and conducting the interactive tutorial assigned to you during the scheduled lab session. You must provide answers to the following questions. Please write directly on the sheets and hand in your solutions by the end of the lab.

You must *each separately* answer the following questions on these lab sheets to be submitted (to the TA) at the end of the lab. You may use the back of the sheets if necessary.

Lab Questions:

1. Match the appropriate actions to the descriptions below (there is an enumerated action pool for your reference). Please write the appropriate number from the action pool just left of each description below:

   a. Drag a block to the model window using the left mouse button OR select COPY and PASTE from EDIT menu.

   b. Hold down the CTRL key and select a block using the left mouse button, drag the block to a new location.

   c. Double mouse click on a block.

   d. CTRL-F.

   e. CTRL-R.

   f. Mouse click on block's label and position the cursor to desired place.

   g. Hold down the SHIFT key and drag a block to a new location.

   h. Hold down the SHIFT key while dragging a block using the left mouse button.

   i. Move the cursor to the line to where you want to create a vertex and use the left mouse button to drag the line while holding down the SHIFT key

Action pool:

1. Flip a block
2. Duplicating blocks in a model
3. Dividing a line
4. Rotate a block (clockwise 90 deg @ each keystroke)
5. Copying a block from a library
6. Display block's parameters
7. Changing blocks' names
8. Disconnecting a block
9. Drawing a diagonal line

2. Find the following blocks from the Simulink library browser and write down the specific library names corresponding to each:

    a. Step

    b. Gain

    c. Sum

    d. Integrator

    e. Scope

    f. To workspace

    g. Ramp

    h. Constant

    i. Product

    j. Trigonometry Function

    k. Mux

3. Consider the following sinusoid: $x(t)=A\cos(\omega t+\phi)$ where the radian frequency is 5 rad/s, the phase is $\pi/2$ and A = 2.

    a. Use Simulink to generate/model this signal. Please quickly sketch the Simulink block diagram below.

    b. What is the corresponding MATLAB code to obtain the same output?

Multiple Choice Section

Please circle the best answer for each of the next three questions.

4. To use MATLAB variables as Simulink block parameters, where do you need to define their values?

   A. Simulink library browser

   B. Simulink model editor

   C. MATLAB current directory

   D. MATLAB workspace

5. Given a discrete multirate system using the fixed step solver, what would the fundamental sample time be if the blocks in the model were sampled at 0.5 and 0.8?

   A. 0.1

   B. 0.3

   C. 0.5

   D. 1.2

6. What MATLAB command configures the Simulink environment prior to creating any Signal Processing Systems?

   A. >>sim

   B. >>simulink

   C. >>dspstartup

   D. >>commstartup

Please circle all appropriate answers for each of the next two questions.

7. What are the advantages of importing inputs from MATLAB and exporting outputs to the MATLAB workspace? (Select all that apply)

   A. Simulation results can be visualized with a wide variety of MATLAB plotting functions.

   B. You can import actual physical data into your model.

   C. Simulation results can be analyzed further in MATLAB.

   D. You can drag blocks from the Simulink Library Browser into the MATLAB workspace.

8. What are the possible ways to create a subsystem? (Select all that apply)

   A. Select blocks in a model and group them into a subsystem.

   B. Select blocks in a model and type "subsystem" in the command window.

   C. Drag a subsystem block into a model, and add blocks to the subsystem window.

   D. Drag variables from MATLAB workspace as a group into a Simulink model

9. Consider the transfer function:

$$\frac{1}{2s^2 + 0.7s + 1}.$$

Build a Simulink block of the above system where the input signal is a unit step function.

   a. Display the output from 0 to 10.0 time units and sketch your results.

   b. Repeat above for an output from 0 to 50.0 time units.