Lab 1, Sfwr Eng/TRON 3DX4

Introduction to Labview

First lab Week of: Jan. 20, 2014
Demo Due Week of: End of Lab Period, Jan 27, 2014
Assignment #1 posted: Thu Jan. 16, 2014

Announcements:

This lab has only a demonstration portion. To get your demonstration marks, every time the lab asks you to "show your work/output to your TA", show your TA that portion of the lab, fully working.

You will be working on the labs in groups of two. You should choose a partner before your first lab period.

Each lab has an attached assignment. Assignments are done individually, not in groups. Everyone hands in their own assignment. Assignment 1 will be posted Thu Jan. 16, 2014.

Goals:

- Learn about LabView software and its different components
- Introduction to graphical programming for creating user interface and implementing a given functionality
- Introduction to creating "Front Panels" and "Block Diagrams"
- Using simulated devices
- Simulating a plant by its transfer function
- Step input response

Introduction to Labview

- Labview is a product of National Instruments. A number of documents explaining different aspects of the software, including interactive tutorials, are available at their web site:

  `http:\\www.ni.com`

- Browse through the site at your convenience *BEFORE* your lab session, to get acquainted with the software

- Click on labview link, then "Technical Resources." Next, Select "Learn LabView basics."

  `http://www.ni.com/labview/technical-resources/`

Lab Part 1:

- Start Labview software. A splash screen appears.
- In the right half of the screen, under resources, click on "Getting started with LabView" to open a PDF document
- Labview provides some template VIs (virtual instruments) that can be configured to suit the requirements of an application. Go to chapter 1, page 1-1 of the document and perform all steps beginning at page 1-3 and ending at page 1-10. *Show your work to your TA before continuing.*
- Start "Modifying a Signal" at page 1-11 and continue all steps until page 1-18.
- Find "String Constant" on function pallette and insert it in your block diagram, then write the following information:

  ```
  Course Code, Lab #
  Your Names and ID numbers
  ```

- Your block diagram will be similar to that shown in Figure 1.
- *Show your work to your TA.*

Lab Part 2:

- This part of the lab deals with building VIs from scratch.
- Go to chapter 2 of the document page 2-1.
- Perform all steps from page 2-2 to page 2-11.
- Add a "String constant" to your block diagram to show information about the course, lab, your names and IDs, as done for part 1 of the lab.

  Show your work to your TA.

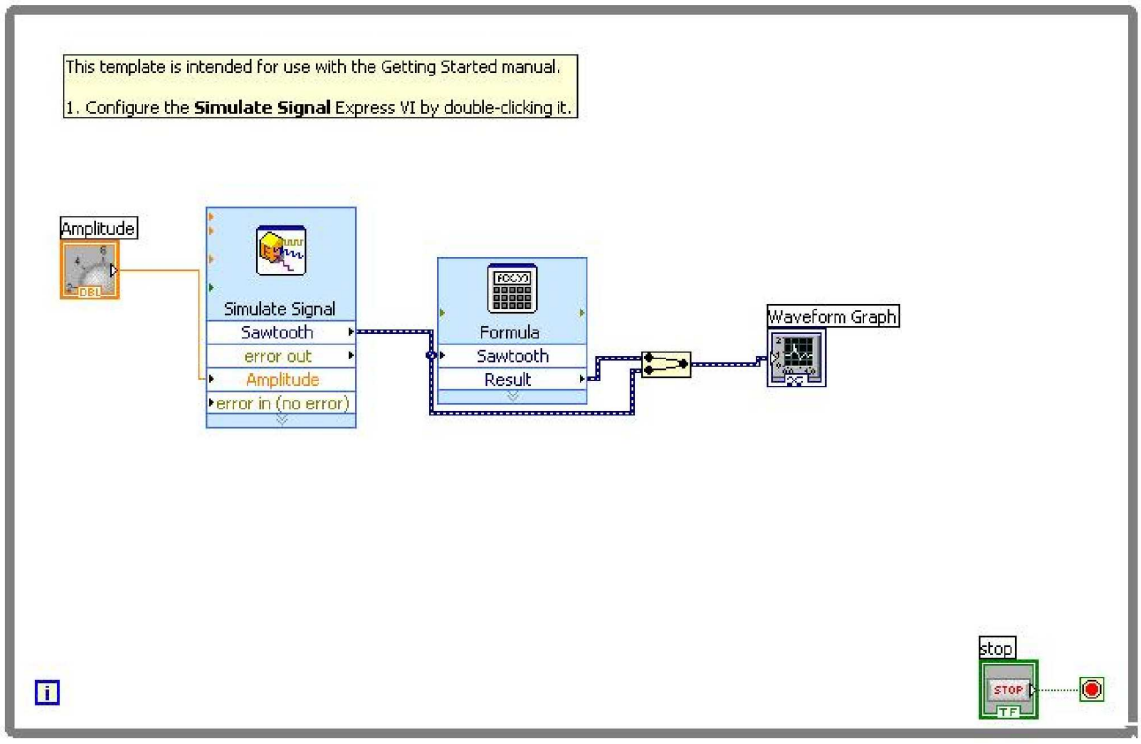

Figure 1:

Lab Part 3:

- Some of the basic concepts relating to analog controls can be demonstrated in labs by either building a physical controller and using it with physical plant or by simulating the plant in software and building the controller graphically using the LabView software.
- In this part of the lab you learn how to simulate a plant in software.
- Modeling of a dc motor is given by the following transfer function:

$$\frac{\theta}{V} = \frac{K}{s((Js+b)(Ls+R)+K^2)}$$

- Follow the steps below to create a VI in LabView that represents the above transfer function to simulate a dc motor then observe its response to a step input ($u(t)$).
  - Create a blank VI, then go to the model construction section of the control design palette and insert the CD Construct Transfer Function Model to your block diagram.
  - Choose "Single-Input Single-Output" (SISO) in the drop down box.
  - Right click on the "Symbolic Numerator Terminal and select Create $\gg$ Control

– Repeat the step above for the “Symbolic Denominator” and the “Variable” terminals

– The three controls will now appear on the front panel

– Now add the “CD Draw Transfer Function” VI to your block diagram.

– Connect the Transfer Function Model output from the CD Create Transfer Function Model VI to the Transfer Function Model input on the CD Draw Transfer Function VI.

– Right click on the “Equation Terminal” of the “CD Draw Transfer Function VI” and select Create ≫ Indicator.

– Go to Time Response section of the Control Design Palette and add the “CD Step Response VI” to your block diagram.

– Create a control for the Time Info input and an indicator for the Step Response Graph output.

– Surround the code in the block diagram with a While loop, right click on the loop condition terminal in the bottom right corner of the While loop and select Create ≫ Control.

– Your block diagram will be similar to that shown in Figure 2.

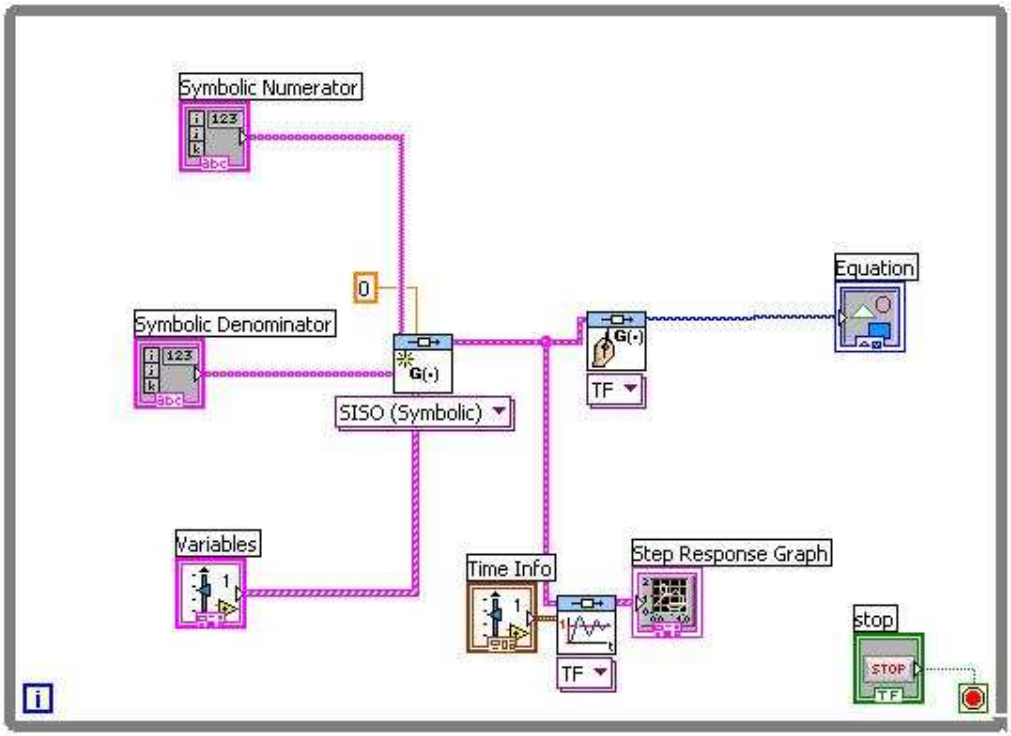

Figure 2:

- Go to the Front Panel of your VI and input the following variables with their values:

$$J = 3.2284E^{-6}; b = 3.5077E^{-6}; K = 0.0274; R = 4; L = 2.75E^{-6};$$

- In the "Symbolic Numerator" control, enter the numerator K and in the "Symbolic Denominator" control enter the denominator of the transfer function $= [(J * L) \quad ((J * R) + (L * b)) \quad ((b * R) + K^2) \quad 0]$ as shown in Figure 3.

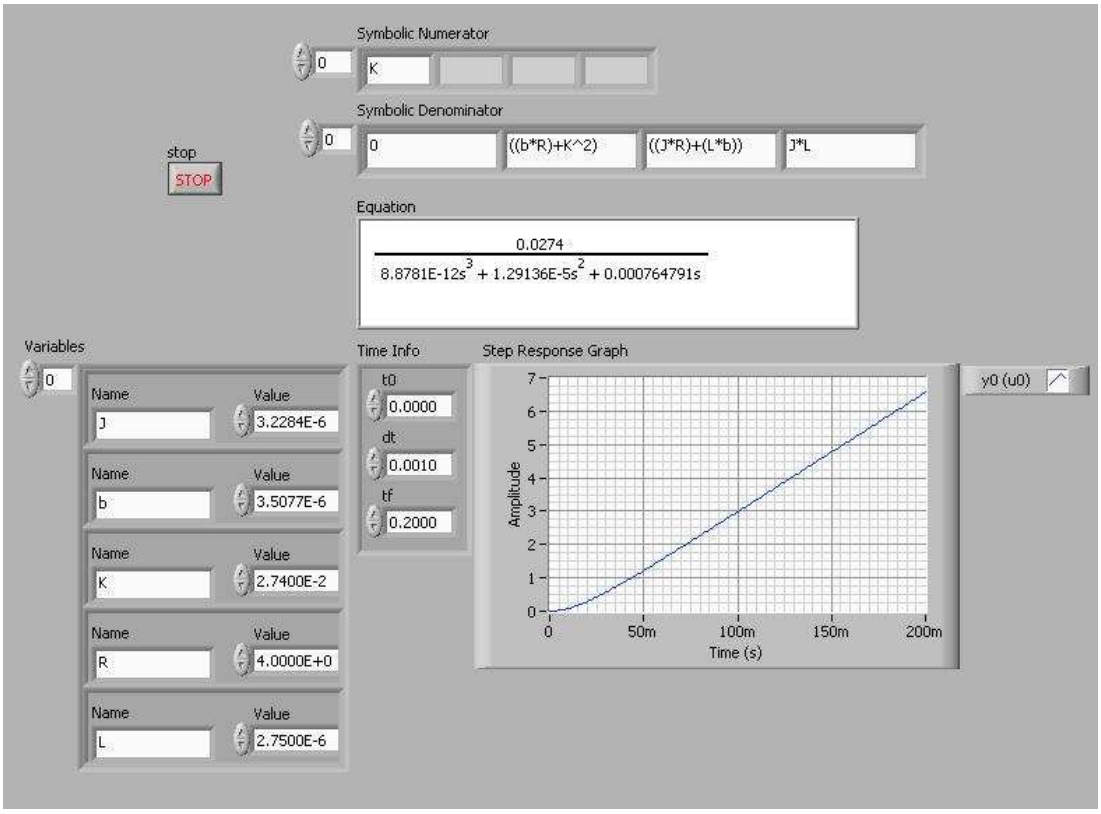

Figure 3:

- *Run the VI and show the output to your TA.*