Running Rotary Flexible Link Experiment

Contents

Purpose

The rotary flexible link depicted in Figure 1, consists of a strain gauge which is mounted at the clamped end of a thin stainless steel flexible link. The system is designed to mount on a Quanser SRV02 plant resulting in a horizontally rotating flexible link that can be used to perform flexible link control experiments. The motor end of the link is instrumented with a strain gauge that can detect the deflection of the tip. The final system output is an analog signal proportional to the deflection of the link.

Figure 1. Rotary Flexible Link System.

The rotary flexible link is an ideal experiment intended to model a flexible link on a robot or spacecraft. This experiment is also useful in the study of vibration analysis and resonance.

The goal of this experiment is to design, implement and test a state-feedback control system to control the position of the servo while minimizing the motions of the flexible rotary link.

For a detailed explanation of the device, motion equations that model the apparatus, or additional information, please refer to the Instructor Manual, or User Manual for this experiment (see the Reference section).

Physical Setup

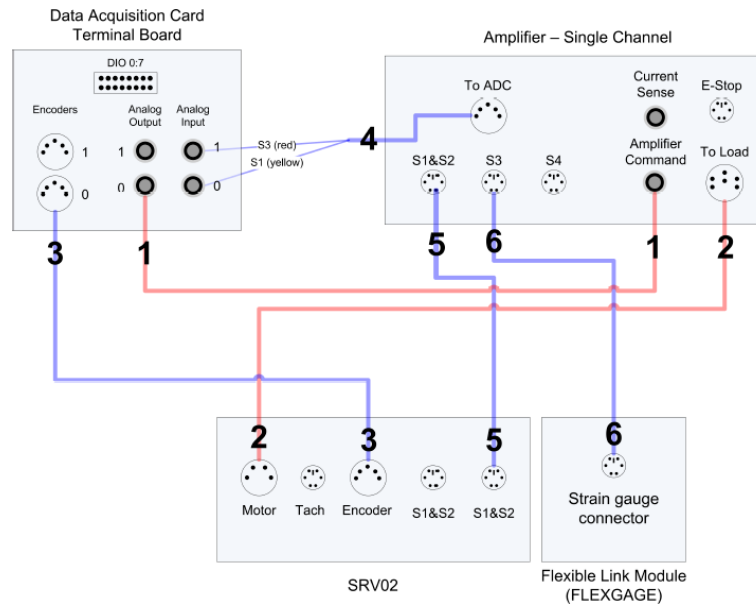Figure 2 presents the schematic of how the wiring should be set up.

Figure 2. Wiring diagram.

Procedures

Step 1: Setting Up MATLAB Environment

1. Open MATLAB
2. If the user logged in has never used QUARC before, type the following into the command prompt:

```
>> mex –setup
>> y
>> 2
>> y
```

3. Ensure that all necessary cords are attached and unit is powered ON.
4. Change the Current Folder to:

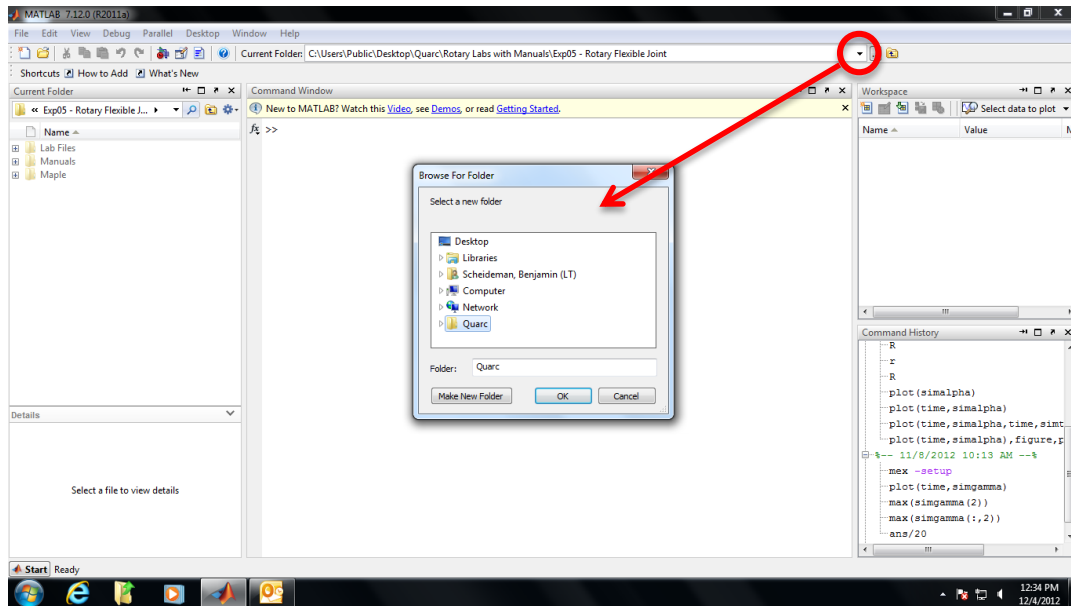   *Desktop\Quarc\Rotary Labs with Manuals\Exp05 – Rotary Flexible Joint\Lab Files*

Figure 3. MATLAB Desktop with Current Folder line at top.

5. Right Click setup_srv02_exp06_flexgage.m, click 'Run' (In Current Folder panel to left)

Step 2: Running Simulink Model
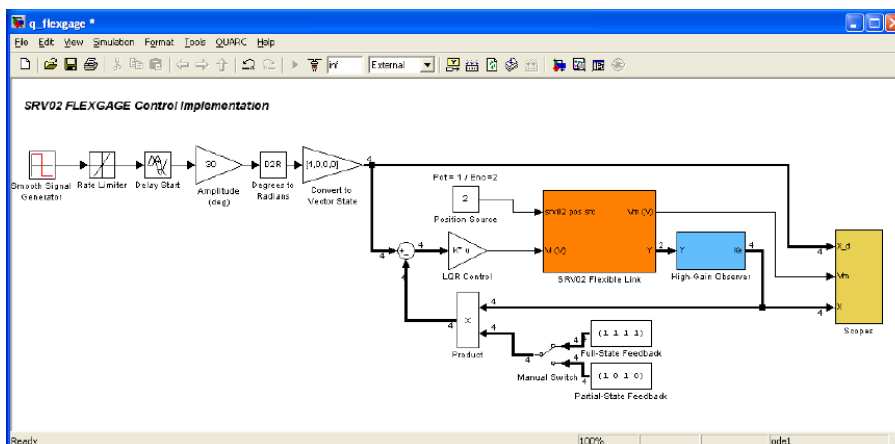
1. Open Simulink q_flexgage.mdl (Fig.4).

Figure 4. Simulink block diagram q_flexgage.mdl.

2. Confirm the Simulink model is configured for the proper OS. Select: QUARC > Options. Under the Code Generation options, confirm the operating system matches the computer's OS. These lab settings are Win64 for HP and Win32 for Dell computers.
3. Ensure that the Simulink model is configured for the proper data acquisition board. Double-click the Orange SRV02 Flexible Link block in the model and then double-click the HIL Initialize icon in the top right corner of the model that just opened. From the drop down menu, choose the correct data acquisition board (Q8) and connection mode (USB).
4. Four Scopes should immediately pop up if not:
   a. Double Click large yellow Scopes block on diagram

      b. Double click each desired scope output

5. If data point collection is necessary modify the scope block diagram as follows:

      c. Connect a Simout (Simulink Library > Sinks) to each desired variable

      d. Double click the Simout

      e. Rename it to a meaningful name

      f. Change the data type to array

      g. Create a clock (Simulink Library > Sources), place it anywhere

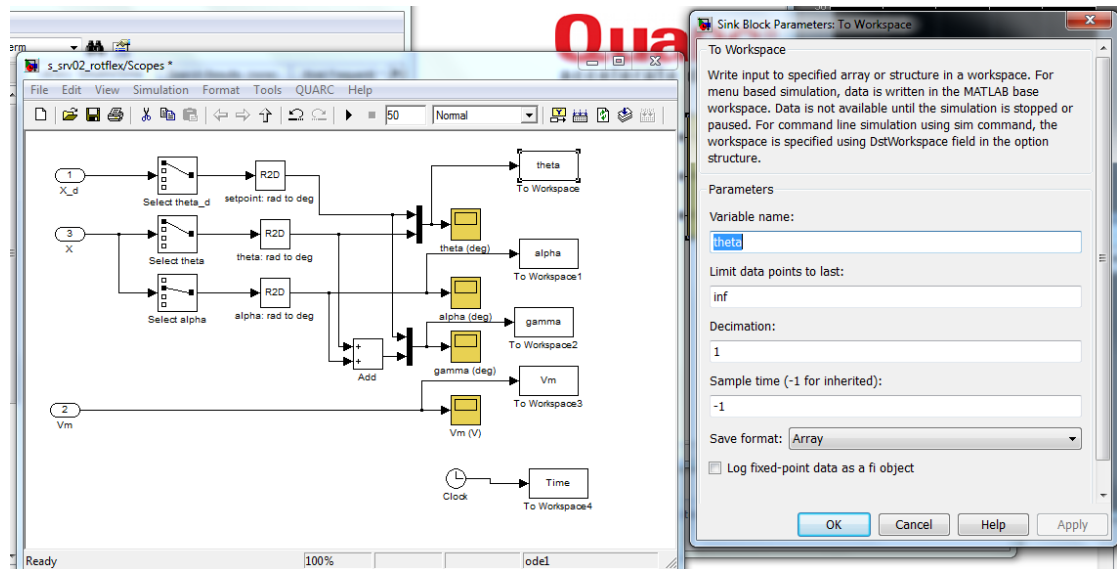   h. Connect a Simout to the clock and modify its characteristics as above

Figure 5. Scopes Block Diagram with Simouts attached (Simout Block Parameters window opened).

6. In overall block diagram window: Click "Connect to Target" icon

7. Click the Build icon

8. Click the Start button

References

[1] Quanser Inc., *SRV02 QUARC Integration*, 2008.
[2] Quanser Inc., *QUARC User Manual*, 2009 (type `doc quarc` in MATLAB to access).
[3] Quanser Inc., *QUARC Installation Guide*, 2009.
[4] Quanser Inc., *SRV02 User Manual*, 2009.
[5] Quanser Inc., *QUARC Compatibility Table*, 2010.
[6] Quanser Inc., *SRV02 Lab Manual*, 2011.
[7] Quanser Inc., *SRV02 Rotary Flexible Link User Manual*, 2011.
[8] Norman S. Nise, *Control Systems Engineering*, John Wiley & Sons Inc., 2008.