FL. 2018 ESE 447.02 Robotics Lab

Lab Journal 3

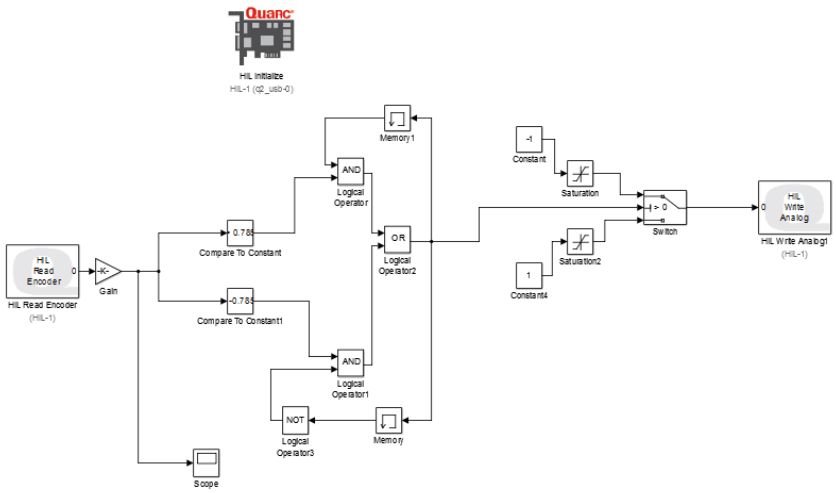
9/15/2018

1. Building the Simulink continued from Lab2.

   At the beginning we tried to build the system simply using two inputs, one positive and one negative, and switch between the two inputs based on the current angle of the link. However this was not feasible because when we used the switch block, it did not work out as we desired. The switch could not stay on for either positive or negative input, and it just kept being turned on off when the angle reached the threshold value. Therefore the link kept oscillating around the threshold value.

   Then we figured we need to use the logic gates and the memory block to make a more complex model.

   The final Simulink model built is shown below.



   The initial value in the upper memory block was 1, and it was used as the initial input.

   (1) The initial position of the link is at angle 0, so the upper compare block output 1, thus the upper and gate output 1. The signal 1 passes through the or gate and the switch block activates input 1, causing the link to turn negative since the input is -1.
   (2) Once the link has passed the threshold value of -0.785 (45 degree in radiance), the lower compare to constant block outputs 1, and the upper compare block outputs 0. The lower memory block has an initial value of 0, and it changes to 1 as the in first stage. When the signal 1 passes the not block, it changes to 0, so the or gate will output 0, causing the switch block to activate input 2. Input 2 is positive, so the link rotates positively, which means the angle of the link increases.

(3) When the angle reaches positive 45 degree (0.785), the or gate outputs 1 again and thus the switch block activates the input 1 causing the link to rotate negatively. The above processes happens repeatedly so that the link rotates between angles of -45° and 45°.
(4) Note that a gain block was added for the output signal from the HIL Read Encoder, the gain is 2*pi/4096 to convert the signal unit to angle unit with radiance. The signal counts 4096 as the link rotates 2*pi.

2. Answers for questions
   (1) Could you use this system as a position control device?
   Yes. This device can be used to control the position of the end effector to points between a specified range of angles. However it is not able to make the end effector stop at a particular position.
   (2) What is the shape of the motion when looking at the position using the scope?
   The graph shows on the scope is the angle of the link in radiance. It ranges from -0.785 to +0.785, and it increases or decreases with constant speed, so it looks like a triangle wave.
   (3) Can you control the shape of the motion while oscillating?
   Yes. The shape can be controlled by changing the speed at the inputs for the switch block. This will change the frequency of the triangle wave. If we use two speed values with different magnitudes, the shape will also change since the slope will change.
   (4) What can you say about the speed of the link throughout the entire oscillating region?
   The speed alternates between a positive value and a negative value.
   (5) Can you predict the shape of the motion if the SRV-02 unit would be tipped on its side?
   The frequency will change.
   (6) Does this controller have any predictive nature?
   If the mass of the link increases, the respond will be delayed to some extent, and the position control will become less accurate because of inertia.