FL. 2018 ESE 447.02 Robotics Lab

Lab Journal 19

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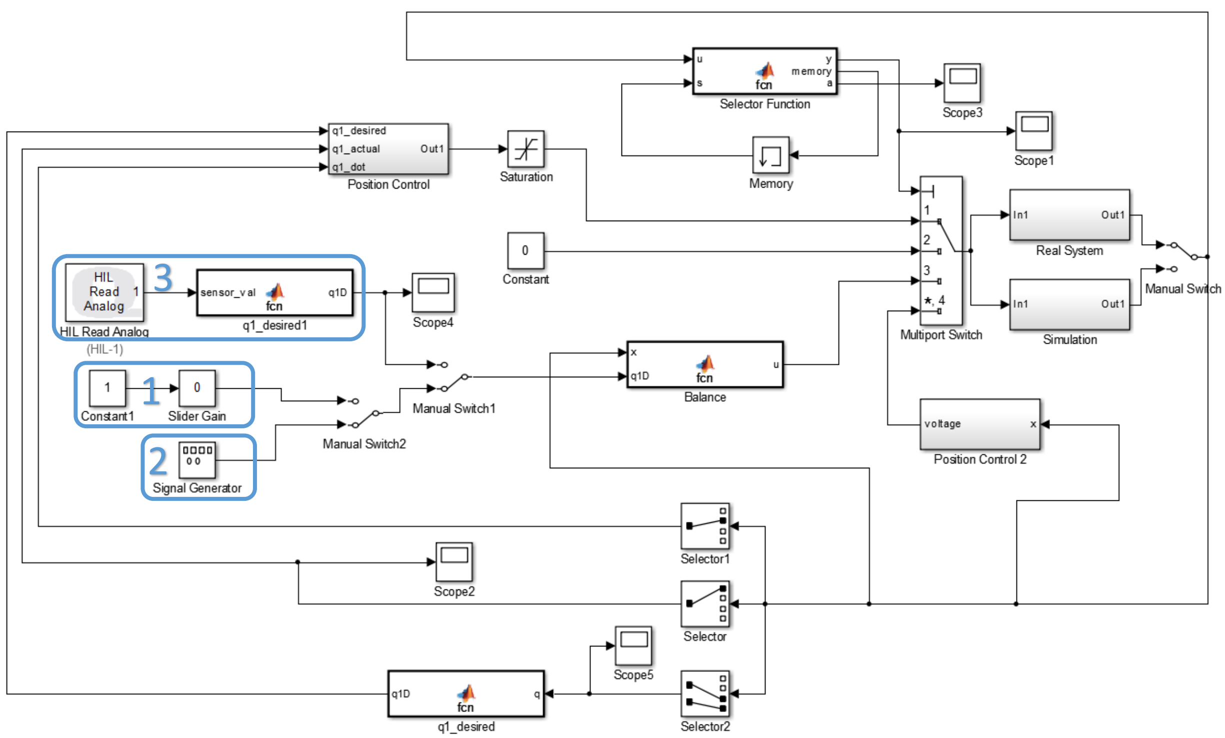
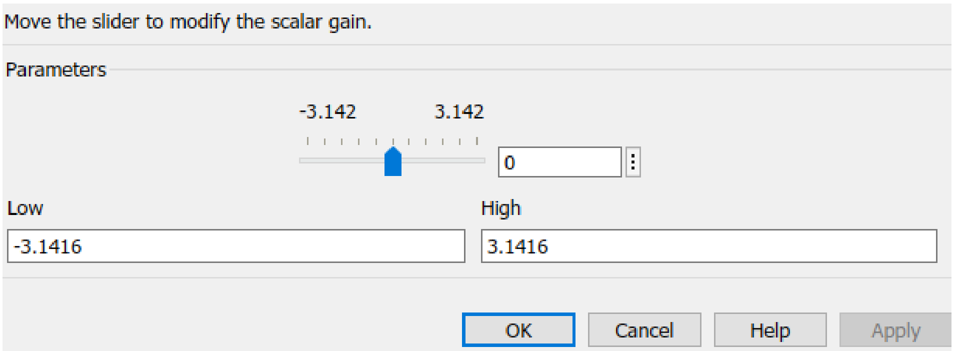
1. Minor modification on swing up controller.
   When we tried to swing up link2 by rotating link1, it did not work well because link1 had too large range in which it could rotate. We actually wanted it to oscillate in a smaller range so that link2 can be swung up more efficiently. Therefore we added a saturation block to the input signal for link1, thus it oscillates with a smaller amplitude. The range was set between –pi/7 and pi/7.
2. Modify the Selector function.
   We noticed that the balance function did not work well because when link2 hits region 3, it was kind of difficult for it to balance so it only balances occasionally. After making sure there is nothing wrong with our balance function, we went to the selector function and realized we used wrong region range for region 3 and region 1. We corrected the range of region 3 from ± 10 to ± 25 degrees so that the balance function could be activated in a larger region.
3. Desired position of q1 while balancing.
   As mentioned in the previous lab, there were extra inputs to the balance function in order to control the position of link1. The position control of link1 was achieved by using the difference between the desired q1 and the actual q1 as the first element in the state variable vector instead of using the actual q1. Since the controller was trying to control this factor to 0, link1 would try to balance link 2 with itself around the input desired position.



We used three types of inputs as the desired q1.

The first one used a slider gain block and a constant block. The desired q1 then equals the multiplication of the constant and the slide gain. By dragging the slide gain bar, the desired q1 can be adjusted manually while keeping the model running. The slider gain menu is shown below and the gain range was set between –pi to pi so that link1 can rotate a full circle.



The second type of input is a time-based function provided by a signal generator. A typical signal can be generated by this generator is a sine wave signal, and by changing the values of frequency and amplitude of the sine wave, we were able to make link2 dance in the balance state without falling.

The third input is a signal from the analog sensor. The sensor senses the position of a metal ball on a pair of parallel tracks. By moving the ball on the track, the desired q1 can be generated in a normalized range. Here we normalized the range of q1 desired to –pi to pi by using a normalizing function.

Several manual switches were used to switch between different q1 desired inputs.