Project Progress Report

Implementation of Conventional and Neural Controllers Using Position and Velocity Feedback

Week Ending: February 27, 2000

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Signature:________________________

Grade: _________________

Objective

This week's objective was to design a feed forward compensator for our robot arm system.

Progress

We started out with the plant model found in the previous week.

$$Gp = \frac{5.05 * e^{-0.025s}}{s(s/2+1)} \qquad (1)$$

The K-value for our proportional controller to give us 10% overshoot was found to be 0.256.

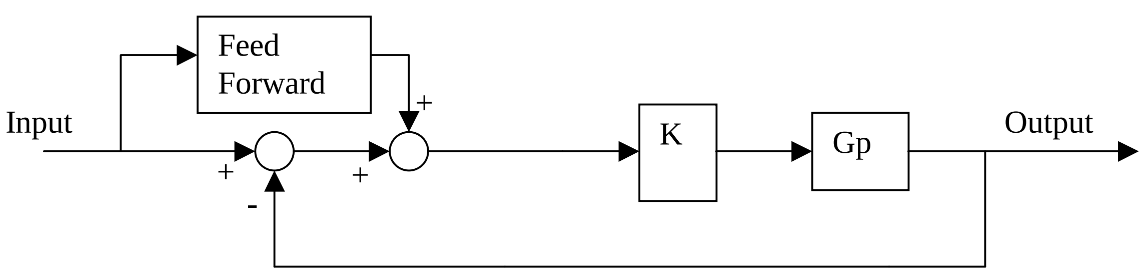

Fig. 1 Feed Forward K-Controller

We made a Bode plot of our KGp function to obtain the frequency where the phase is 135°. The following bode plot shows where it occurred:

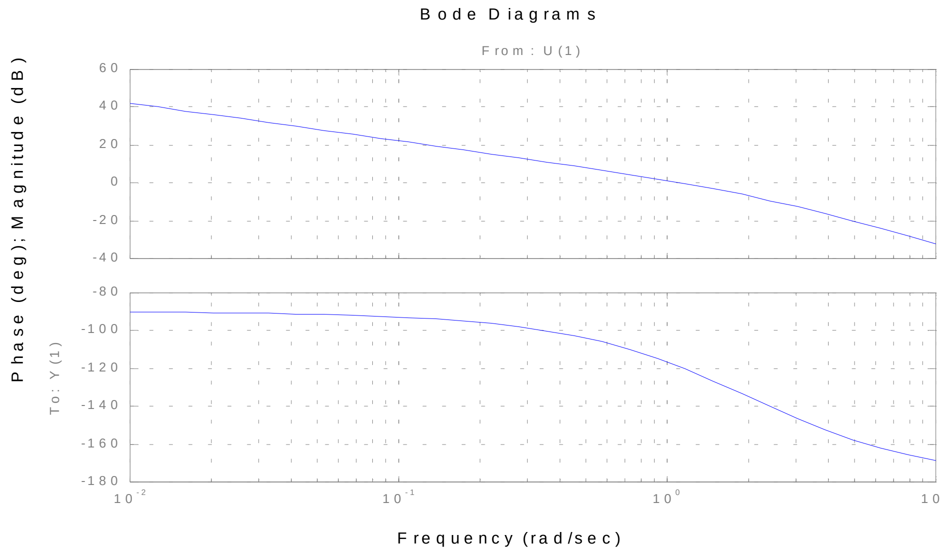

Fig. 2 Bode plot of System Model

It was found at 1.85 rad/sec by using the Pade function with an average time delay of 20 ms. From the Bode plot we found the model approximation,

$$KGp = \frac{1.2928}{s(s/1.85+1)} \tag{2}$$

Next take the inverse to get the feed forward controller.

$$KGp^{-1} = \frac{s(s/1.85+1)}{1.2928*(s/20+1)^2} \tag{3}$$

The double pole at 20 was chosen to be at least one decade away from our zero. Now we ran Matlab and Simulink to verify the result of our feed forward controller. The improvement through our feed forward controller was not quite as expected. The problem we observed came from the double integration in our controller. The next step was to switch to a first order controller which would not have such integration problems,

$$KGp^{-1} = \frac{s}{1.2928*(s/10+1)} \tag{4}$$

Now we could see a better improvement between the proportional controller and the feed forward added to it. We still ran into the problem of saturating the D/A converter. So we had to make sure that the maximum voltage for the D/A converter is below 4.5Volts to give us about 0.5 Volts of margin.

At the end it was found that the starting block diagram for the feed forward controller was wrong. Since we wanted to feed forward as close as we can towards the plant the feed forward block will now be changed in the following.

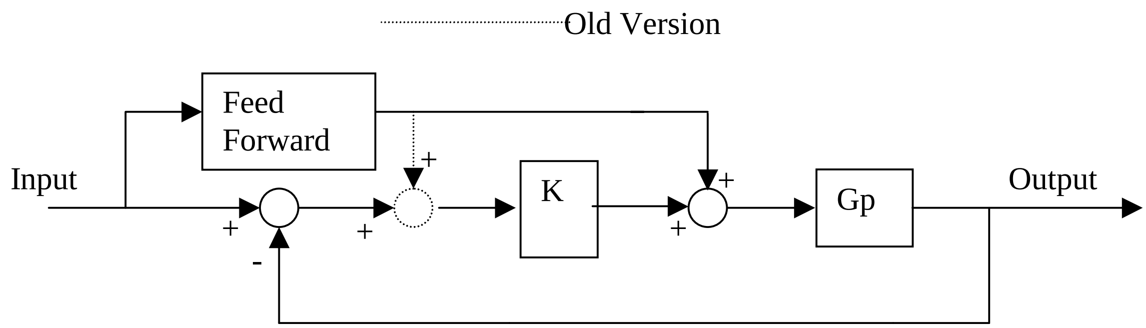

Fig. 3 Feed Forward K-Controller