

# Project Progress Report

## Implementation of Conventional and Neural Controllers Using Position and Velocity Feedback

**Week Ending: March 21, 2000**

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### Objective

This week's objective was to find the error in the program, why the command signal is not working right, to display the command signal, and to finish the feed-forward compensator and program it in C-code.

### Progress

Command Signal Error:

After looking through all programs before and running the CMAC program we found the error why the control signal was not displayed correctly. We always used the alternating step command signal and tried to adjust the slope of the step by typing in different ramp velocities. The problem is that with alternating step the slope is infinity and cannot be changed at all. The solution was to use the alternating ramp command signal. There we were able to adjust the ramp slope by using the ramp velocity input variable. To find this error took us about 5 hours.

The next step was to display the command signal on top of our display so we can see the output of the controller compared to the command signal. A minor problem is that the command signal is shown correctly with a straight line from the end of the plot to the beginning of the plot. The program always uses the line command to connect the last two points of the command signal and if a new screen is shown the old input is still there.(Fig.1) Right now this problem can not be fixed but we are still looking at different method to fix it.

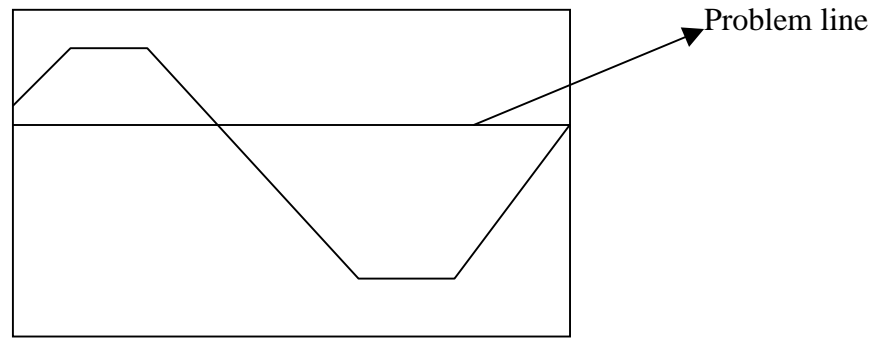


Fig. 1 Screen Shot of Command Signal

Feed Forward:

Using the configuration shown in Fig. 2, and the transfer function for the feed-forward is shown in (1)

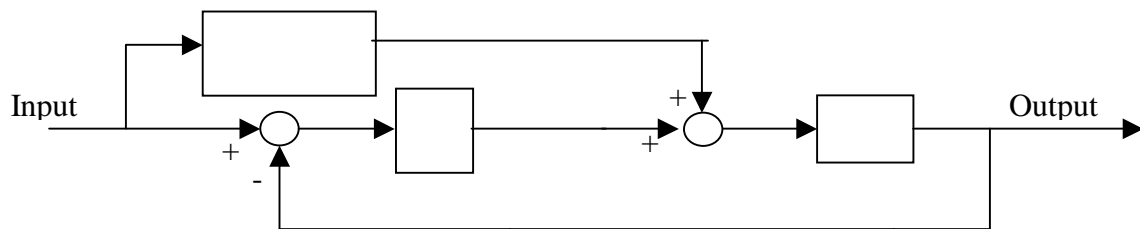


Fig. 2 Feed Forward K-Controller

$$G_{FF} = \frac{s}{s/10+1} \quad (1)$$

The tracking was great with a feed forward gain of 1. But the D/A volt is still to high. The final tuning was performed and found that the gain of the feed-forward compensator has to be reduced by a factor of 0.25. This gave us a voltage below 5v that the D/A converter can handle.

Using the transfer function(1) and MatLab we found the formula for the difference equation

$$Y = 0.002X - 0.002X_P - 0.998Y_P \quad (2)$$

The equation was programmed into the C-code so that you still can choose to have no controller, proportional controller, or the feed-forward controller with the proportional controller. Also the feed-forward compensator signal can be displayed now as well as the other basic ones. There is still room for other signals to be added to the graphing feature (eight maximum).

The first difference equation(2) did not work right because the gain reduction of 0.25 was not taken in account so a new difference equation was found by adding the gain reduction

$$Y = 0.750(0.002X - 0.002X_{-P}) - 0.998Y_{-P} \quad (3)$$

This difference equation was not working right so after trouble shooting I found that the past values were not being updated. So after entering the code to do that, it was tested again but still did not work right, the problem we think is in the C-code and not the design of the feed-forward. Next lab period this will be fixed and then the minor-loop will be implemented in C-code.