Project Progress Report

Implementation of Conventional and Neural Controllers
Using Position and Velocity Feedback

Week Ending: April 11, 2000

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Objective

This week's objective was to implement the minor loop controller in C-code to prove that the noise does cause problems in the minor loop, test the neural network to make sure that it works right, compare the feed-forward and p-controllers, and make some functional changes to the program.

Progress

Implementation of Minor Loop in C-Code:

The minor loop controller was implemented in C-code. To do this the programming equation had to be found by using Matlab with Tustin's method. This programming equation was the same for the minor loop and feed-forward, except the gain. The gain for the minor loop was 0.212, feed-forward was 0.3, and the p gain was 0.42. When this was ran the arm oscillated. We determined this was because of noise by looking at the output of the minor loop and seeing that it was really noisy and so we concluded to use the neural network curve fit to lower the noise level.

Testing of Neural Network:

The Matlab code for the neural network was converted into C-code by hand and then added to the program. We added in a separate controller listing for the neural network. Now we have a choice to use a P-controller, Feed-Forward, Minor loop without ANN, and Minor Loop with ANN. Also the output of the ANN can be graphed with the input signal to show the curve fitting. The output of the ANN is shown in Fig. 1.
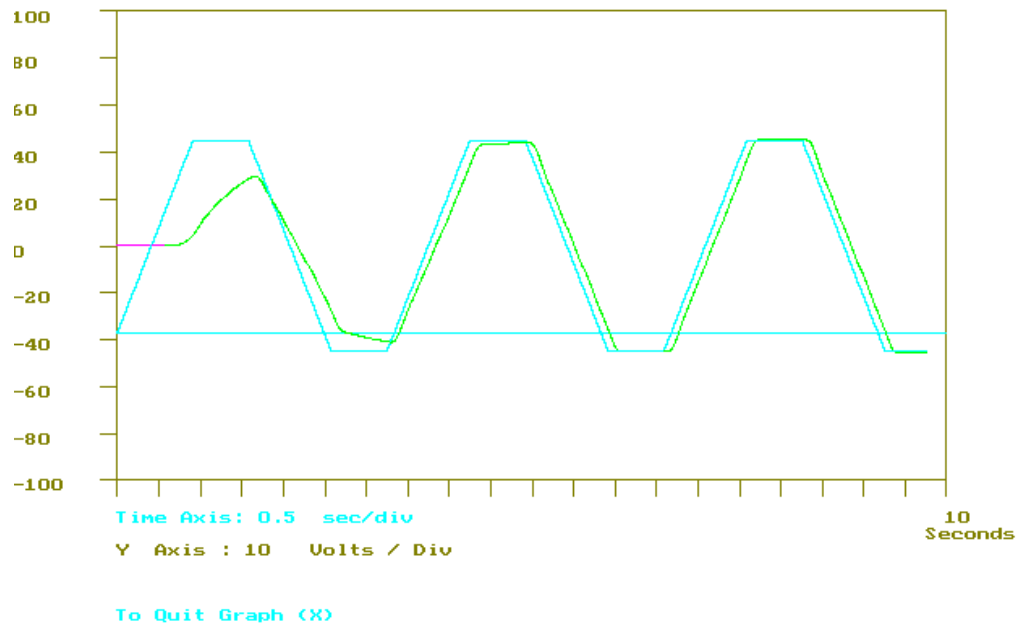
Fig. 1. ANN Output

This figure shows the learning curve and how it follows the input.

Comparison of P-controller and Feed-forward-controller:

The P-controller shows no overshoot and bad tracking (Fig.2), while the feed-forward controller shows almost perfect tracking and a little bit of overshoot (Fig. 3).
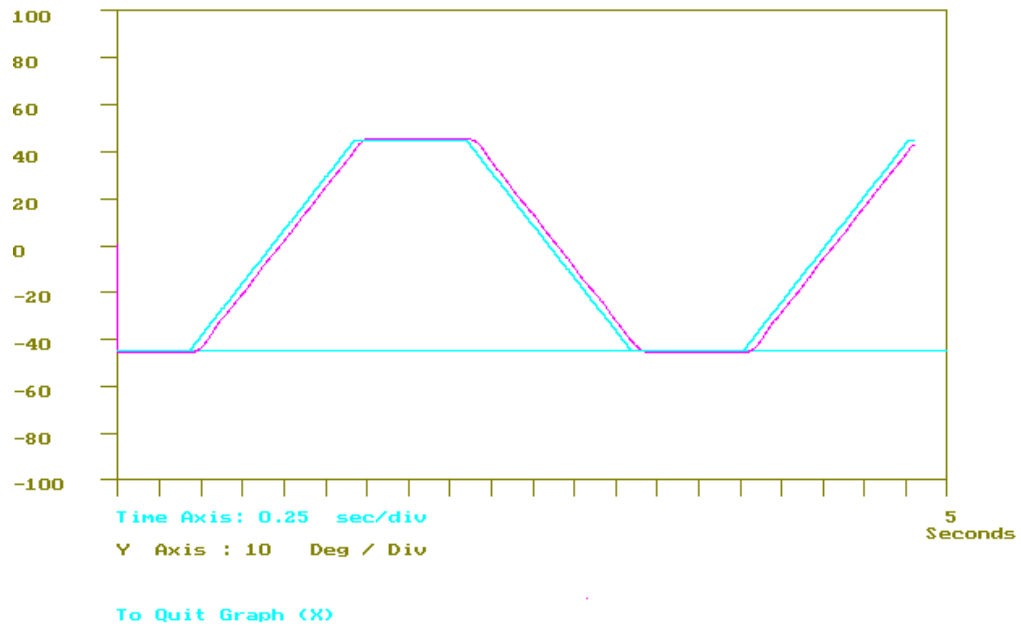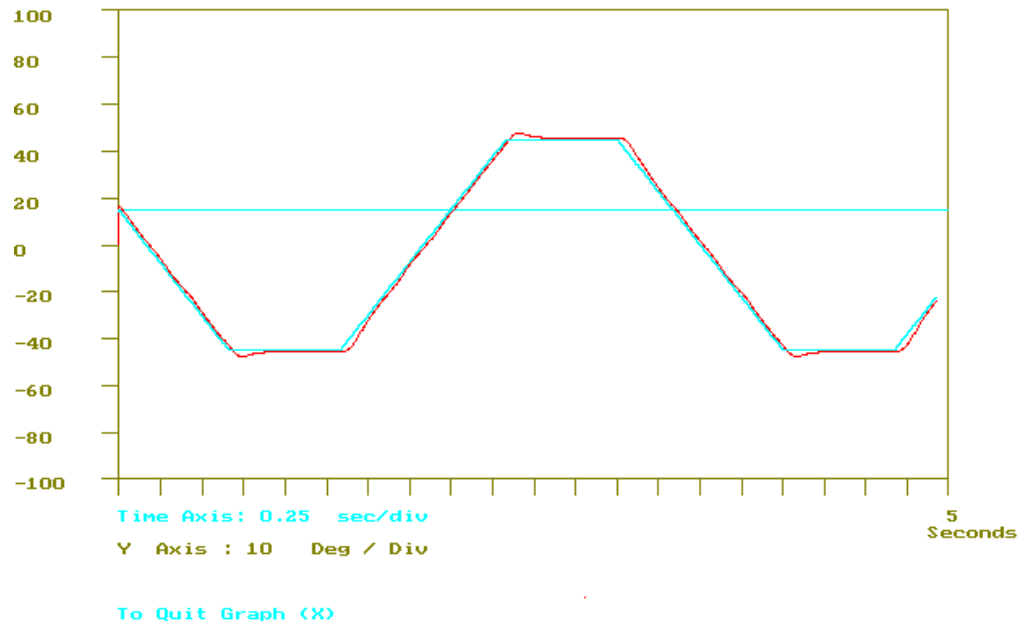

Fig.2 P-Controller output

Fig.3 Feed-Forward Controller output

C-Code improvements:
The program was rewritten in the manner that the motor turns automatically off if the program is exited. All the gains for the controller are now preset. The major change was that now when the program is started the input signal is set to alternating ramp. Also if you switch to the minor loop controller the gains adjust themselves for the minor loop, since the proportional and the feed-forward gains are changes.