

EEE 352 Automatic Control Systems Laboratory

Week 3 : Experiment #2

Proportional Control of a Positional System

1. Preliminary Work

- 1.1. Give brief description of proportional control action.
- 1.2. Write down the major advantages and disadvantages of proportional control when it is employed alone.
- 1.3. Define “dead band” that occurs in control systems.

Do not forget to include a list of your references!

2. Experimental Work

Connect the system given in Figure 1.

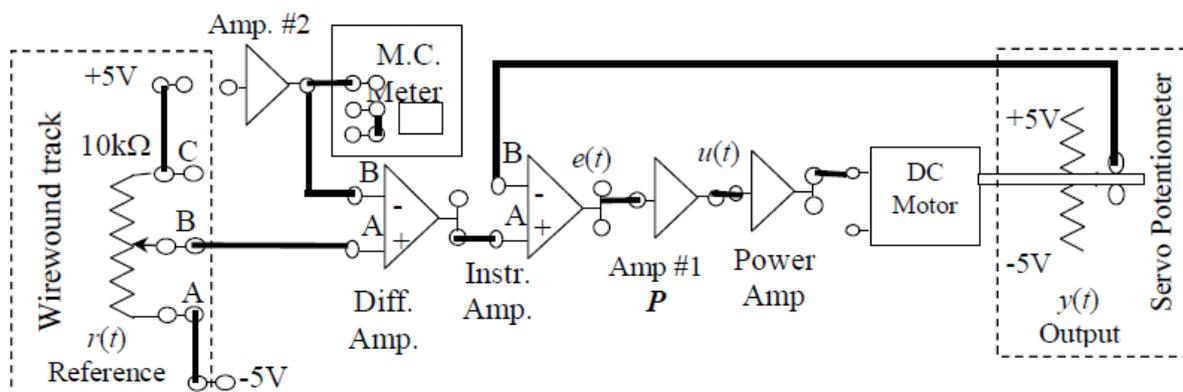


Figure 1. Experiment connections of P (Proportional) control of a positional system

- 2.1.1. Set amp. #2 coarse and fine gain controls to 1 and 1.0, respectively. Set 10K resistor control to its central position. Set amp. #1 coarse and fine gain controls to 10 and 0.1, respectively. Switch the power on. Rotate the resistor control fully clockwise and fully counter clockwise. Record the servo travel.
- 2.1.2. Repeat 2.1.1 for amp. #1 fine gain settings 0.5 and 1.0. Rotate the input control very slowly when near the end of the travel or the drive shaft may rotate continuously. Record the servo travel.
- 2.1.3. With the amp. #1 gain controls set to 10 and 0.1, adjust the input control so that the servo potentiometer dial indicates 0 degree. Now offset the dial by rotating the shaft by hand and note the total range over which the dial can be moved without the servo responding and moving the dial back. This value represents a “dead band” over which the system does not respond. Repeat the procedure for amp. #1 fine gain settings 0.5 and 1.0 respectively. Record the dead band values.
- 2.1.4. Disconnect the motor. Set amp. #2 gain controls to 1 and 1.0 and adjust offset control for an output 0V. Then set the coarse gain to 100 and adjust the offset control for an output of 3V. This control will be used to introduce step input to the system.

- 2.1.5. Set amp. #1 gain controls to 10 and 0.1. Change the coarse gain control of amp. #2 from 1 to 100 and note the effect on the shaft position. Return the control to 1 and note the effect on shaft position. Return the control to 1 and note the effect.
- 2.1.6. Repeat 2.1.5 for amp. #1 fine control 0.5 and 1.0. note the following points: was the operation faster? Was there any overshoot? Record if any.

3. Results and Conclusions

- 3.1. Draw a block diagram representing the system above. Indicate the major signals and blocks with their names in control systems terminology.
- 3.2. Depending on the results obtained at 2.1.1 and 2.1.2, comment on the effect of higher proportional gain on steady-state error.
- 3.3. Depending on the results obtained at 2.1.3, comment on the effect of higher proportional gain on the dead band.
- 3.4. Depending on the results obtained at 2.1.5 and 2.1.6, comment on the effect of higher proportional gain on the oscillatory behaviour of the response. (overdamped, underdamped, or critically damped).