# Lab 03

# Wall Following: Feedback PD Control Worksheet

Robot Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Team Member Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Team Member name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

## Purpose

1. In your own words, state the purpose of lab 02 in the following space.

## Part 1 – Follow Wall (Layer 1)

### Bang-Bang Control

1. Did you decide to drive your robot forward or backward, how did you decide? What were the pros and cons?
2. How far and how long was the robot able to follow the wall between 4 and 6 inches without losing it?

### Proportional Control

1. What proportional gain did you use so that the robot followed the wall with regular oscillations?
2. How far and how long was the robot able to follow the wall without losing it?

### Proportional-Derivative Control

1. What derivative gain did you use so that the robot followed the wall with minimal oscillations and limited hitting?
2. How far and how long was the robot able to follow the wall without losing it?
3. How did you modify the code so that the robot could detect and outside corner or doorway?

## Part 2 – Avoid Obstacle (Layer 0)

1. How did you integrate avoid obstacle into the previous part?
2. How does your robot handle a stuck situation? Did the robot ever get stuck?

## Part 3 – Random Wander (Layer 3)

1. Describe how the robot’s random wander behavior worked and how you integrated it with wall following and avoid obstacle.

## Part 4 – Follow Center (Layer 2)

1. Describe how you add the follow center layer to the subsumption architecture that you’re already built?

## Conclusions

1. How does what you implemented on the robot compare to what you planned to based upon your software design plan?
2. What did the robot do when it encountered a corner while wall following?
3. What did the robot do when it encountered doorways and/or corners?
4. When tuning the proportional controller and/or derivative controller, did the robot exhibit any oscillating, damping, overshoot or offset error? If so, how much?
5. What were the results of the different P and D controller gains? How did you decide which one to use?
6. How accurate was the robot at maintaining a distance between 4 and 6 inches?
7. Did the robot ever lose the wall?
8. Compare and contrast the performance of the *Wander* and *Avoid* behaviors compared to last week’s lab.
9. What was the general plan to implement the feedback control and subsumption architecture on the robot?
10. How could you improve the control architecture and/or wall following/follow center behaviors?
11. What does the overall subsumption architecture diagram with all 4 layers look like?
12. What was the pseudocode and flow chart for the program design?
13. How did you implement the finite state machine to integrate the various behaviors? Did you use any inhibition and suppression to create layers in this behavior?
14. How did you keep track of the robot’s state and as it switched between behaviors?
15. What did you learn?
16. What questions do you still have?

### Upload Details:

You must submit your properly commented code and prelab simulation to Moodle DropBox. Submit the prelab software design plan & worksheet to GradeScope. Check the course calendar for the lab demonstration due date.