



U5.1 The feedback loop

Feedback control · University · about 25 min

Name _____

Class _____

Date _____

What this lesson is about

Setpoint, error, controller, plant, measurement: the block diagram and the names.

- The first loop
- The sign
- What makes a good loop

Questions

6 marks in all

1. The first loop is run on a list of distances instead of the sensor. What does it print? [1 mark]

```
TARGET = 20.0
for d in (60, 45, 30, 22, 18):
    error = d - TARGET
    print(error, max(-50, min(50, 2.0 * error)))
```

2. With `error = distance() - TARGET`, positive `drive()` forwards, and the gain made negative by mistake, what happens? [1 mark]

- ☐ A The robot drives away from the target as fast as the gain allows
- ☐ B The robot approaches the target slowly
- ☐ C The robot oscillates around the target
- ☐ D Nothing, because the sign convention does not matter

3. When does open loop control work? [1 mark]

- ☐ A When the plant is perfectly known and nothing disturbs it
- ☐ B When the gain is small
- ☐ C When the sensor is noisy
- ☐ D When the actuator saturates

4. Follow a signal once round the feedback loop, starting at the comparison. [1 mark]

Number the lines 1 to 5 to put them in the right order.

- ___ plant
- ___ sensor
- ___ error = setpoint compared with measurement
- ___ controller
- ___ actuator

5. Raising the gain of this loop typically buys which two qualities?

[1 mark]

Tick every answer that is true.

- ☐ A Speed
- ☐ B Accuracy
- ☐ C Stability
- ☐ D Less actuator effort

6. In the lesson's table, what is the name for the robot and the mat, the thing being controlled?

[1 mark]

The task: close the loop

Settle 20 cm from the wall, plotting the `error` as you go. The wall's face is 150 cm up the mat and the robot starts at 60.

```
from bugbot import *  
connect()  
  
TARGET = 20.0
```

Plan your program here, then type it in and press Run.



Do it on the robot

www.bugbotlab.com/learn/u5-1-the-feedback-loop/

The simulator checks it and tells you when it passes. Nothing to install, no account.

Challenges

1. Reverse the sign of the gain and describe what happens, in one sentence, before you run it.
2. Start the robot closer than the target. Does the same loop push it back out?
3. Put a filter on `distance()` and see whether the loop is smoother, slower, or both.