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CS122A Hw3

1. PID control: Experiment with the PID controller simulator in PES 11.5. Recall goals include minimizing rise time, overshoot, oscillation, and steady-state error. Start with the default fan power and ball weight (0.5 and 0.03g respectively).

(a) Starting with all 0s for P, I, and D, set P to a "good" value. Then set D. Continue modifying P and D. Report your final "best" PD values.

P = 0.043
D = 2.2

(b) Try reducing the fan power to represent the motor aging after deployment. Report how your PD controller responds. When done, set the fan power back to default.

Set fan power from 0.5 => 0.3
There's not enough power to get to the desired value in the first place, and the ball levels out at a place lower than desired.

(c) Now find a good I value to reduce steady-state error. Adding I may increase oscillation and overshoot, so you may want to adjust your P and D values. Report your PID values.

P = 0.043
I = 0.0004
D = 2.2

(d) Try reducing the fan power again. How does the response differ from (b) above?

As opposed to the previous reduced fan power where the ball levels out, the ball continues to oscillate near the desired values.

2. Pattern recognition: Using the 3-part PES embedded-system pattern recognition framework in PES 14, set B0 to 1 for at least 3 seconds whenever a "big" box is detected. A2..A0 represent a box's height, A5..A3 its width, and A7..A6 its weight. A box is "big" if its height or width exceeds 4, if its height plus width exceeds 7, if its weight exceeds 2, or if its weight times (height+width) exceeds 10. Your feature extractor will simply extract the height, width, and weight values from input A, and set global variables with those names. Your actuator will simply read a global and set B0 to 1 for as long as the box is detected (if the box appears for less than 3 seconds, B0 stays 1 for 3 seconds).

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3. Pattern recognition: Using the 3-part PES framework, blink B0 (500 ms on, 500 ms off) for 5 seconds whenever a "panic situation" is detected, defined as three distinct "loud noises" within 10 seconds heard via input A. Input A represents a digitized sound level. 0: no sound, 255: extremely loud sound. A "loud noise" (the feature to extract) is defined as a sound of level 99 or higher for at least 1 second. The feature extractor should set a global "loudNoise". The pattern recognizer should detect three loud noises and set a global variable "panicSituation". The actuator should blink B0 in response.