**PID Control Project**

The Parameters I first set by intuition and trial and error. I changed the P [ 1 ] ( the proportional factor) so that the car turned enough to take the corner, and I adjusted P [3 ] ( the differential factor) to combat the wobbling. P [ 2 ] (the integral factor) I left at first at zero. Playing around with these parameters, I found a set that got me around the track without crashing: P[ -.175 -0.01 -0.9].

I decided to the ‘Twiddle’ algorithm manually (I figured it would be fun to play with the simulator); I added all the absolute values of the cte’s, and printed out this sum. When the car came around the first right corner, I stopped the program by pressing the escape button. The last printed sum of cte’s would be my indicator of the ‘Goodness’, and I adjusted the P[ i ], accordingly. My starting delta vector:

dP [ 0.005 0.005 0.005 ]. And the adjustment I would make (like in the lessons) with a factor of 1.1 or 0.9

I input the parameters each time with the help of the commented out line for the main() function, where I could alter, and input the parameters without having to run ‘make’ each time.

I kept track of the P[ i ] ‘s, and dP [ i ]’s by penciling them into a spread-sheet.

Below is a part of that spreadsheet.

The 34th run produced the best result. I did another 74 run’s but no improvement in parameters.

The sum of the dP[ i ] at that time was 0.0122, not as low as I had hoped for, but the car stayed in the lane for multiple laps with minimal wobbling.

I changed back the main() function, and hard coded the final results: P[ -.1715756 -.0013914 -0.85459]

Finally I reduced the throttle (from 0.3 to 0.2) for an even smoother ride

Below is part of the Twiddle spreadsheet;

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **RUN** | **P[ 1 ]** | **P[ 2 ]** | **P[ 3 ]** | **Sum\_cte** | **dP [ 1 ]** | **dP [ 2 ]** | **dP [ 3 ]** | **Sum\_**  **dP[ i ]** |
| 1 | -.175 | -0.01 | -0.9 | 309 | 0.005 | 0.005 | 0.005 | 0.015 |
| 2 | -1.7 |  |  | 332 |  |  |  |  |
| 3 | -1.8 |  |  | 302 | 0.0055 |  |  |  |
| 4 | -1.8 | -0.005 |  | 300 |  | 0.0055 |  |  |
| 5 |  | -0.005 | -0.85 | 291 |  |  | 0.0055 |  |
| 6 | -0.1745 |  | -0.85 | 307 |  |  |  |  |
| 7 | 0.1855 |  |  | 325 | 0.00495 |  |  |  |
| 8 | -0.18 | 0.0005 |  | 651 |  |  |  |  |
| 9 |  | -0.0105 |  | >300 |  | 0.00495 |  |  |
| 10 |  | -0.005 | -.8445 | 325 |  |  |  |  |
| 11 |  |  | -.8535 | 325 |  |  | 0.00495 |  |
| . | . | . | . | . | . | . | . | . |
| . | . | . | . | . | . | . | . | . |
| 34 | -.1715756 | -.00139145 | -.85495 | 256 | .004366 | 0.00396 | 0.00396 | 0.0122 |
| . | . | . | . | . | . | . | . | . |
| . | . | . | . | . | . | . | . | . |
| 108 | -.1715756 | -.00139145 | -.85495 |  | 0.00123 | 0.00100 | 0.00112 | .00335 |