2

Nyduist diagram

Integral action?

No integral action. My brain is not powerful enough to memorize the sum of error, or the total area under graph. My brain is simply capturing the difference and directly apply an proportional output (the movement of the pc mouse).

2.1 oscillation of the feedback loop

The phase margin of this open loop is -185+180 = -5 degrees. A negative phase margin suggests unstable closed loop. (but why)

Theoretically, instability will occur when phase is -180. From the bode diagram, it is at 2.34 rad/s. Since w=2pi\*f and T=1/f, the period of oscillation would be 2pi/w = 2.685 second. The observed oscillation period is about 2.2 seconds which is close to theoretical prediction.

2.1 guideline

Try to put avoid negative phase margin. This could be done by adding a phase conpensator?

2.2 Able to reduce error?

Initially, control input only made the error larger. But as my brain is an advanced controller with reinforce learning implemented, the error was reduced significantly after a few seconds. However, this error was still a bit larger than the error without control.

2.3 Nyquist diagram of G2(s)

When gain is smaller than 0.5, the Nyquist plot will no longer encircle -1.

Nyquist diagram will have many curl at right half plane.

2.4 ask

3

Gain margin is defined as the change in open-loop gain required to make the closed-loop system unstable. It is found by finding the (0- Gain) at the frequency where phase is -180 (limiting point of stability). Here, this point has been reached as the system is just oscillating. So the gain margin is by definition is value of Kc