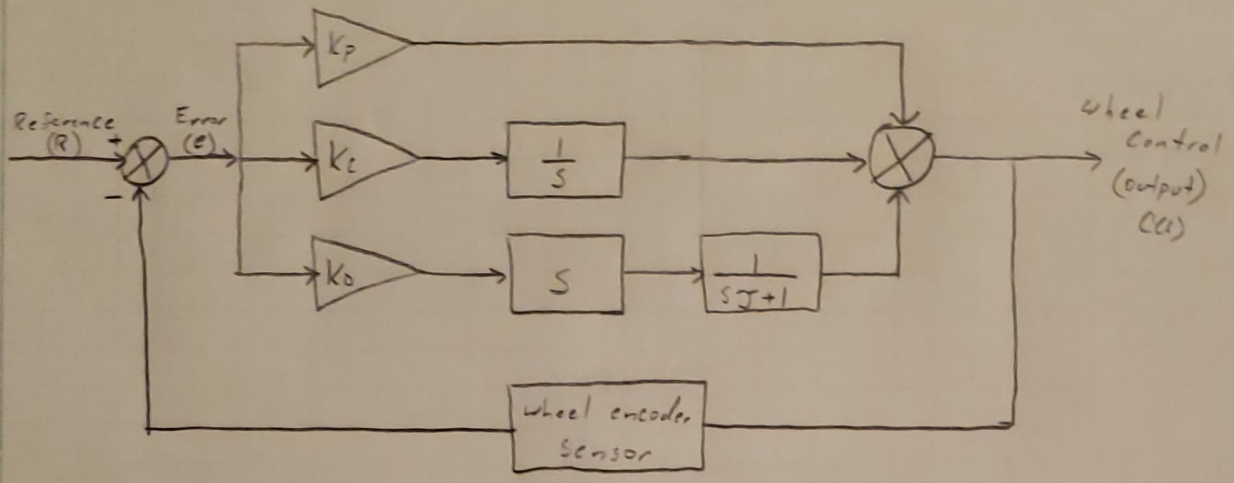
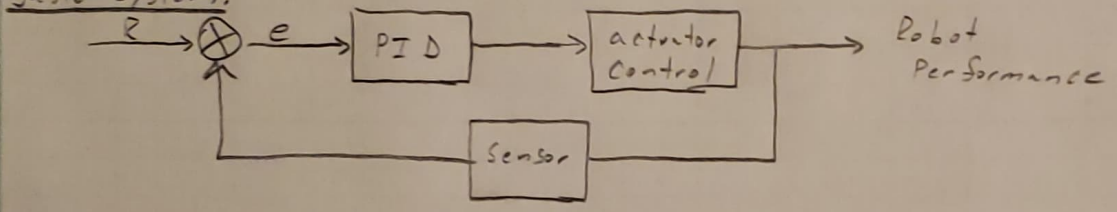
PID Basic Idea

PID in S-Domain:



Basic System:



Transfer Function: $\frac{C(s)}{e(s)} = \frac{\text{Output}}{\text{Error}} = k_p + k_i\left(\frac{1}{s}\right) + k_d\left(\frac{s}{sT+1}\right)$

Question? How to represent in terms software can use.

(Pg. 730 Controls)

Proposal: Bilinear Transform to apply s-plane analysis to digital systems.

→ Implementation: Direct substitution

$$z = \frac{as+b}{cs+d} \; ; \; s = \frac{-dz+b}{cz-a}$$

* Phil's Lab video *

Proposal: substitute for (S) → $s = \frac{2}{T}\left(\frac{z-1}{z+1}\right)$ where [T] is sampling time

Results:

$$\left[\begin{array}{l} P(n) = K_p\, e(n) \\ i(n) = \frac{K_i T}{2}\left[e(n) + e(n-1)\right] + i(n-1) \\ d(n) = \frac{2K_d}{2T+T}\left[e(n) - e(n-1)\right] + \frac{2T-T}{2T+T}\, d(n-1) \end{array}\right] \Sigma$$