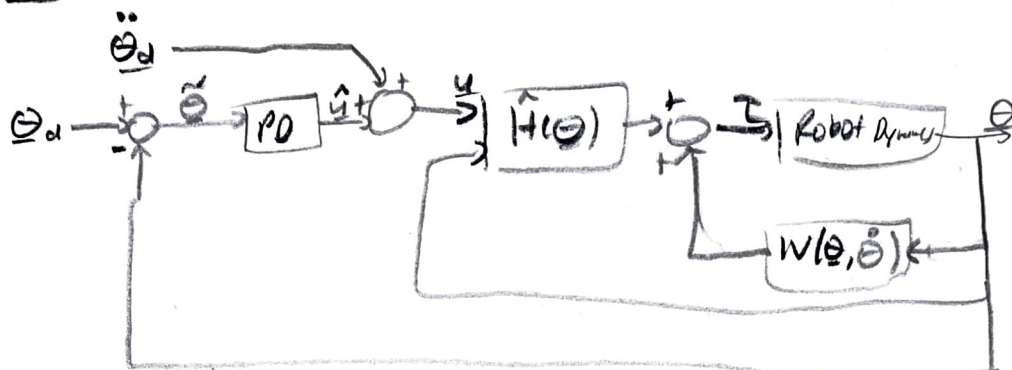


2.2.1

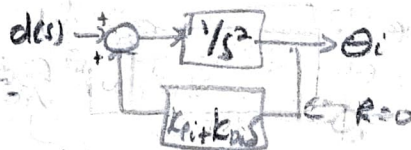
IPC controller



Assuming perfect model, indexed notation and $PD = K_p + K_i s$, w/d disturbance, des

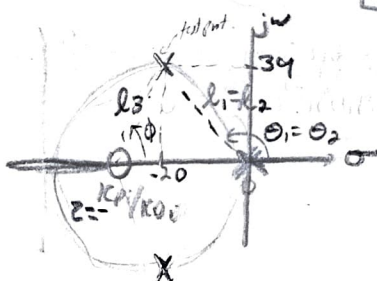


will design for disturbance rejection



loop gain:

$$\frac{K_p + K_i s}{s^2} = \frac{K_i (-s + K_p/K_i)}{s^2}$$



Poles: $s=0, s=0$

Zeros: $s = -K_p/K_i$

For $\%OS = 20\%$ and $T_s = 0.2s$

Desired CLP: $s = -20 \pm 39.04j$

Angle Condition

$$\tan(\phi) = \left(\frac{39}{-20-2} \right)$$

$$\phi_1 - 2\theta_1 = \pm 180^\circ$$

$$\phi = \pm 180^\circ + 2 \tan^{-1} \left(\frac{39}{-20} \right) \quad \phi = 54.25^\circ$$

$$2 = -48.07 = -K_p/K_i$$

Magnitude Condition

$$K_i = \frac{(21)^2}{23} = \frac{\sqrt{(39)^2 + (20)^2}}{\sqrt{(28.02)^2 + (20)^2}} = \frac{40}{39} = 40 \quad K_p = K_i(48.07) = 1922$$

$$K_i = 40$$

$$K_p = 1922$$