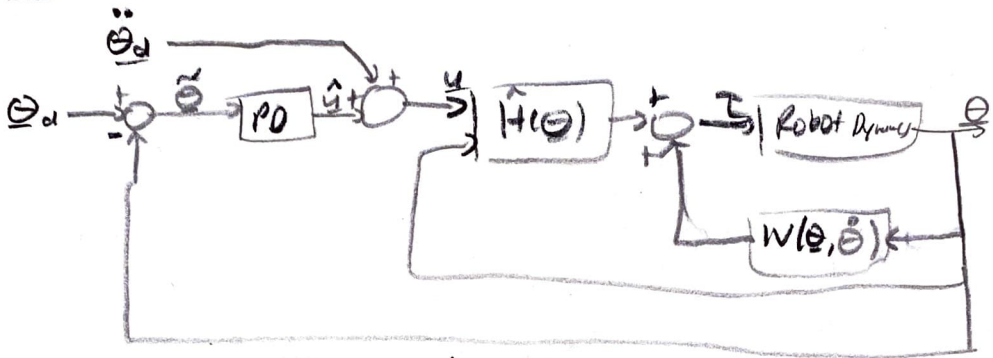
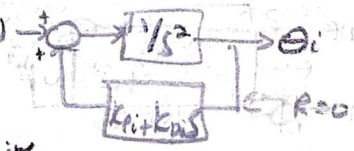
2 2.1 IDC controller

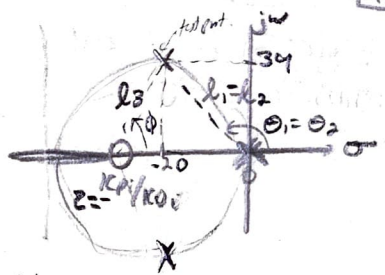


b) Assuming perfect model, indexed notation and $PD = K_{Pi} + K_{Pi}s$, w/ disturbances, dist

will design for disturbance rejection:



Loop Gain: $\frac{K_{Pi}+K_{Di}S}{S^2} = \frac{K_{Di}(S+K_{Pi}/K_{Di})}{S^2}$ ← can do root locus now



Poles: $s=0$ $s=0$
Zeros: $s = -K_{Pi}/K_{Di}$

For %OS = 20% and $T_S = 0.2s$
↳ Desired CLP: $s = -20 \pm 39.04j$

Angle Condition: $\phi_1 - 2\theta_1 = \pm 180°$ $\phi = \pm 180° + 2\tan^{-1}\left(\frac{39}{-20}\right)$ $\phi = 54.25°$

$\tan(\phi_1) = \left(\frac{39}{-20-z}\right)$ $z = -48.07 = -K_{Pi}/K_{Di}$

Magnitude Condition: $K_{Di} = \frac{(l_1)^2}{l_3} = \frac{\sqrt{(39.04)^2+(20)^2}^2}{\sqrt{(25.02)^2+(20)^2}} = 55.89$ $K_{Pi} = K_{Di}(48.07)$

$K_{Di} = 55.89$ $K_{Pi} = 2686.83$

↳ will use

$K_{Di} = 55.9$ and $K_{Pi} = 2687$