Design Requirements

- percent overshoot < 5%
- settling time < 2s.

} find region in S-plane where all 2nd order systems meet these requirements.

- P.O. < 5

$$100e^{-\frac{\alpha}{\beta}\pi} < 5$$

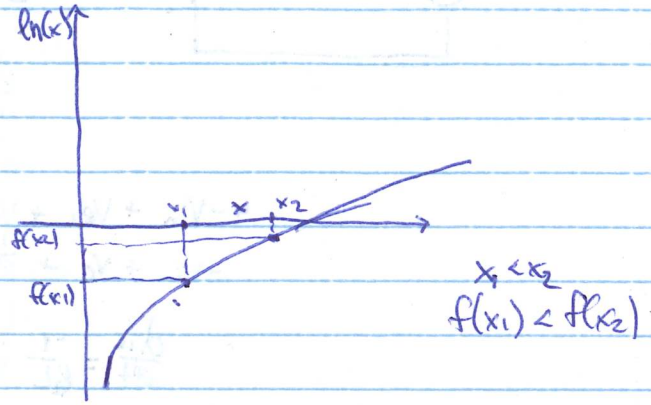
$$e^{-\frac{\alpha}{\beta}\pi} < 0.05$$

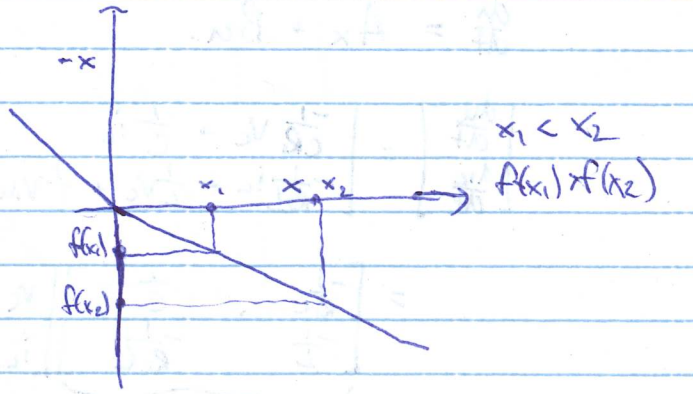
$$-\frac{\alpha}{\beta}\pi < \ln 0.05$$

$$-\frac{\alpha}{\beta} < \frac{\ln 0.05}{\pi}$$

$$\frac{\alpha}{\beta} > -\frac{\ln 0.05}{\pi}$$

$$\alpha > 0.95\beta$$



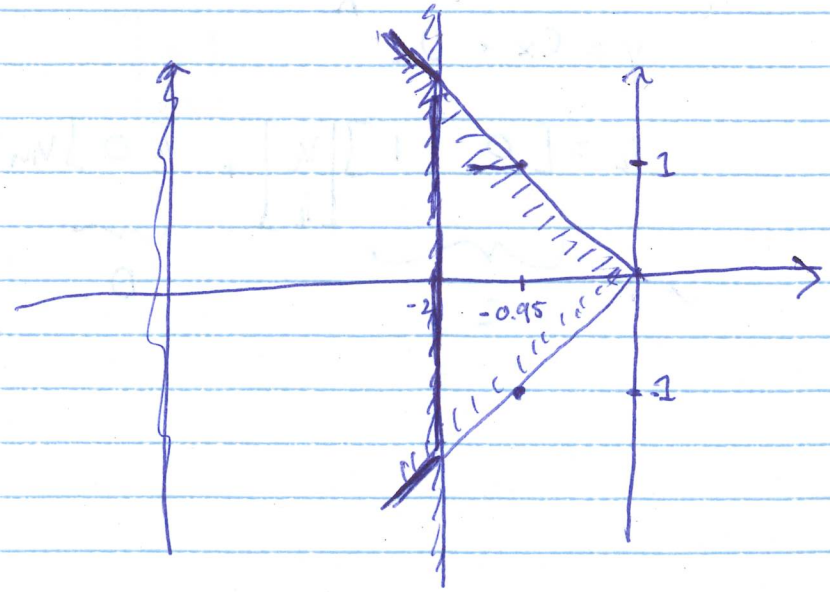


$$T_s < 2$$

$$\frac{4}{\alpha} < 2$$

$$\frac{4}{2} < \alpha$$

$$2 < \alpha$$



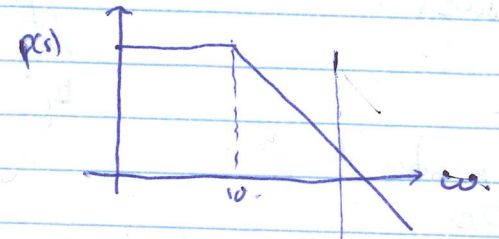
Design Requirements

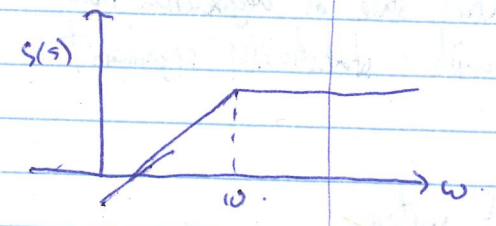
~~Reference tracking in freq range 0–5 rad/s.~~

- Disturbance rejection in all freq range. $P(s) = \frac{1}{s+10}$. Design a controller that meets this requirement.

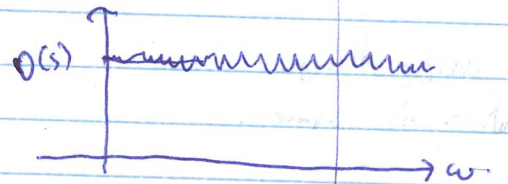
for disturbance rejection, need $S(s)P(s)D(s)$ to be small.

→ want it small everywhere.





Design $S(s)$ so that it looks like this.



$$L(s) = \frac{k_I}{s} = \frac{10}{s}$$

$$P(s)K(s) = \frac{10}{s}$$

$$K(s) = \frac{10}{s}\left(\frac{s+10}{1}\right)$$