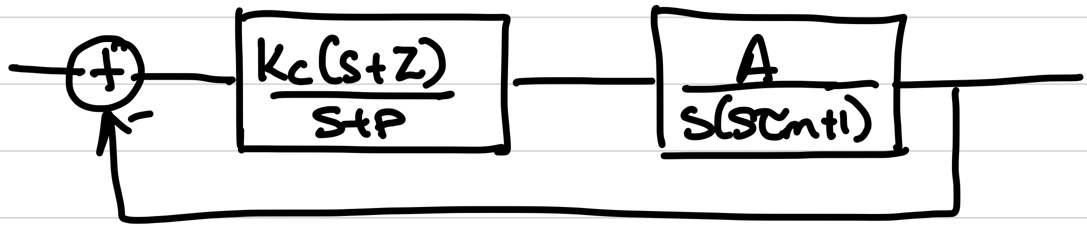
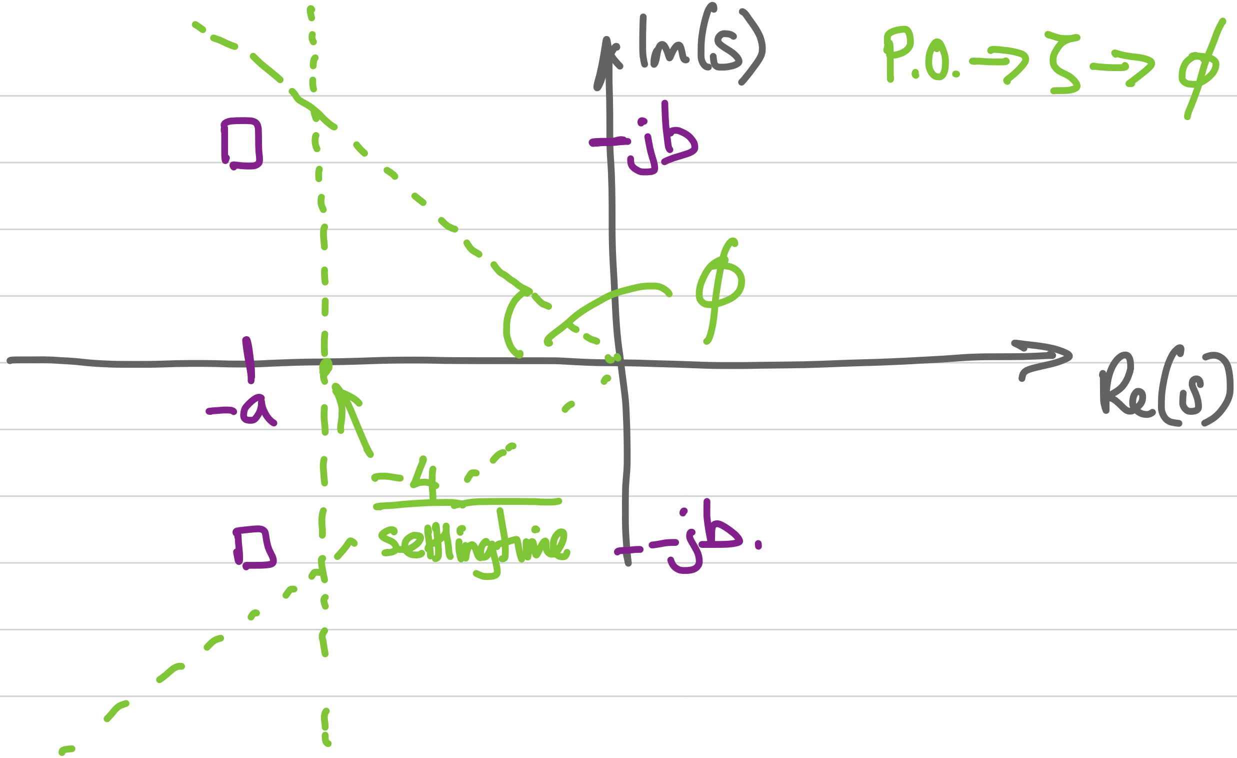
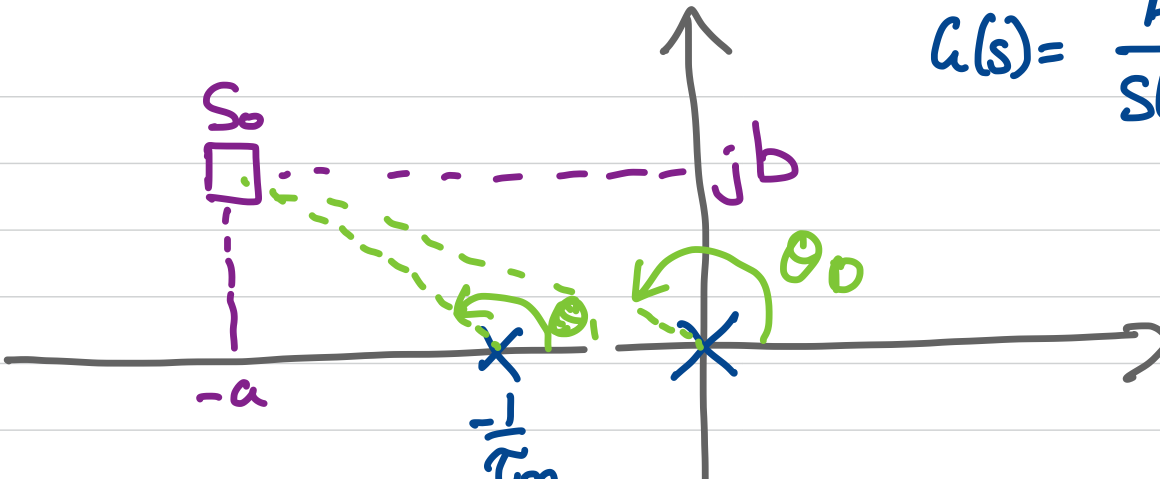
LAB 4



- Design lead controller for servomotor to achieve
  - desired settling time
  - desired percentage overshoot.
- Open loop has 3 poles and one zero; so does closed loop
- We will try to design using insight from second-order underdamped with no zeros; will try to keep those poles dominant
- Maybe review lecture 13.5 from module 3


P.O. → ζ → φ
Im(s)
Re(s)
jb
-jb
-a
φ
-4
settling time

$$G(s) = \frac{A/\tau_m}{s(s+1/\tau_m)}$$



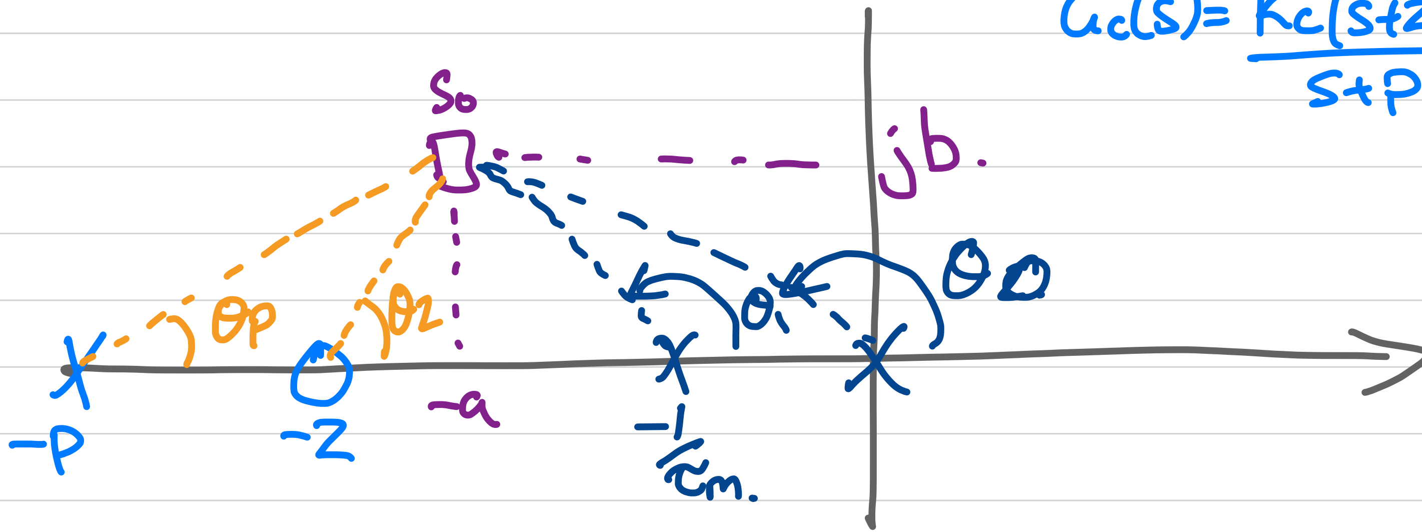
$$\angle G(s_0) = 0 - \angle\left(s_0 - (-0)\right) - \angle\left(s_0 - (-1/\tau_m)\right) = -\theta_0 - \theta_1$$

$$\angle G_c(s_0)G(s_0) = 180^\circ + l\,360^\circ$$

$$\angle G_c(s_0) + \angle G(s_0) = 180^\circ + l\,360^\circ$$

$$\angle G_c(s_0) = 180^\circ + l\,360 + \theta_0 + \theta_1$$

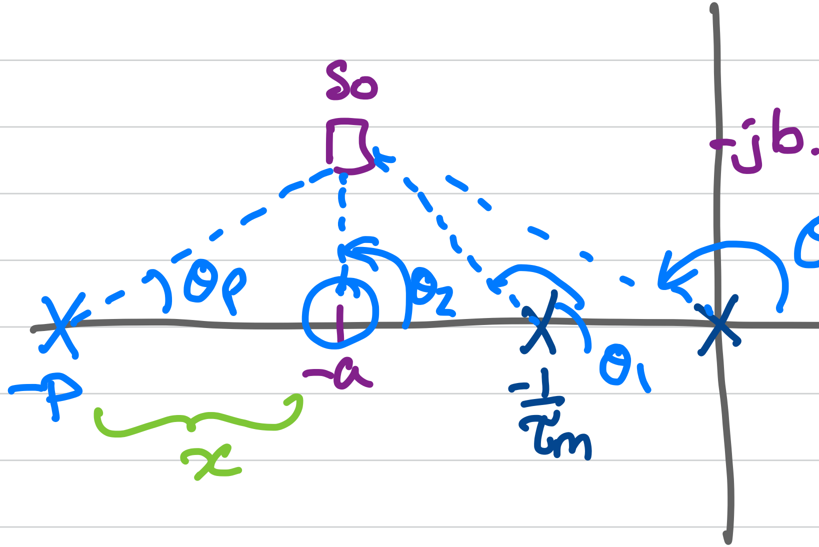
$$G_c(s) = \frac{K_c(s+z)}{s+p}$$



$$\angle G_c(s_0) + \angle G(s_0) = 180^\circ + l\,360^\circ$$

$$\theta_z - \theta_p - \theta_0 - \theta_1 = 180^\circ + l\,360^\circ$$

$$-z = -a.$$



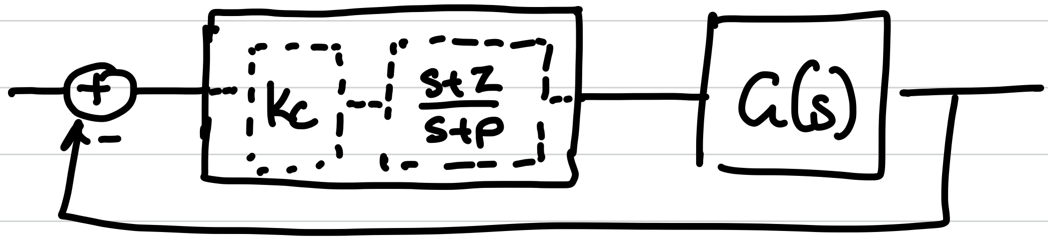
$\theta_z = 90°.$

$\tan\theta = \dfrac{b}{x}$

$x = b/\tan\theta.$

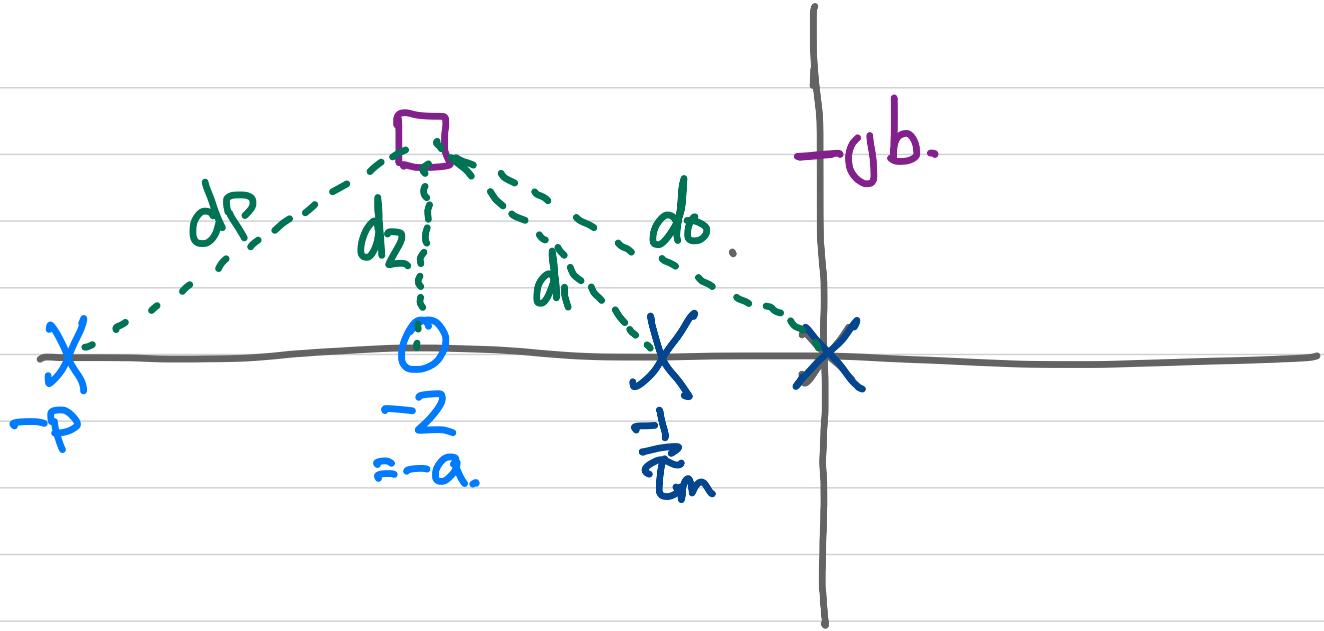
$$90° - \theta_p - \theta_o - \theta_1 = 180° + l\,360.$$

$$-p = -a - \frac{b}{\tan\theta}$$



$$G(s) = \frac{A/\tau_m}{s(s+1/\tau_m)}.$$

$$K_G = A/\tau_m.$$



$$K_c \cdot K_a = \frac{\Pi \text{ distances from ol poles to } s_o}{\Pi \text{ distances from ol zeros to } s_o.} = \frac{d_o \cdot d_1 \cdot d_p}{d_z}$$