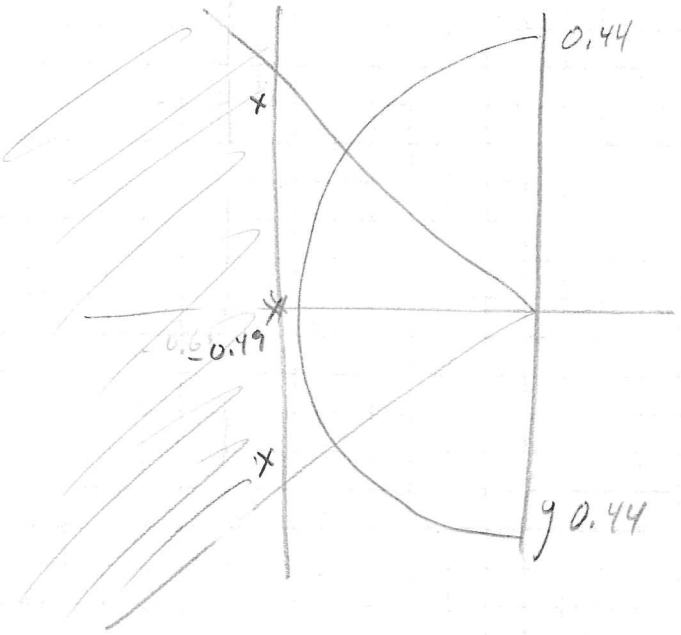
D.10

a) $t_r < 5 \Rightarrow \omega_n > \frac{2.2}{5} = 0.44$

$M_p < 5\% \Rightarrow \theta > \sin^{-1}\sqrt{\frac{\ln^2\left(\frac{100}{5}\right)}{\pi^2+\ln^2\left(\frac{100}{5}\right)}} = 43^\circ$

$t_s < 8 \Rightarrow \sigma > \frac{1}{8}\ln\left(\frac{1.41}{.1}\right) = 0.498$

The possible pole locations are



pick pole locations at $-0.49 \pm j0.49$

The desired char polynomial is

$$\Delta_d = (s+0.49)(s+0.49) = s^2 + 0.98s + 0.2401$$

From the solution of problem D.8 the closed loop char polynomial is

$$\Delta_d = s^2 + \left(\frac{b}{m} + \frac{k_D}{m}\right)s + \left(\frac{k}{m} + \frac{k_P}{m}\right)$$

Q.10

Equations terms given

$$k_0 = 0,98m - 6 = 4.4$$

$$k_p = 0,2451\,m - k = -1.7995$$