

Homework D.10 - Solution

Soln

(1)

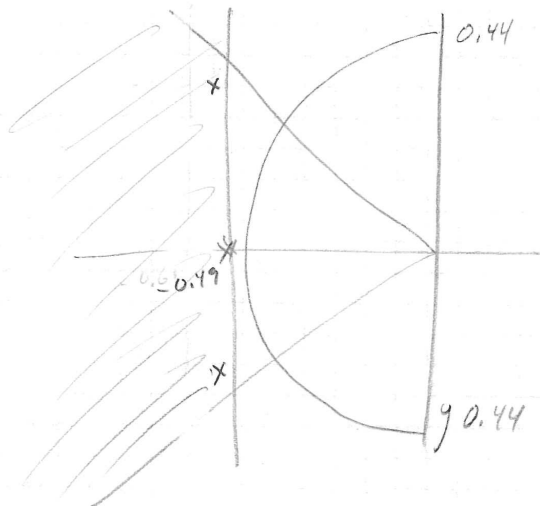
D.10

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

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

$$t_s < 8 \Rightarrow \sigma > \frac{1}{8} \ln\left(\frac{141}{1}\right) = 0.49$$

The possible pole locations are



possible pole locations at $-0.49 \pm j0.44$

The desired char polynomial is

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

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

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

Soln

②

Q.10

equating terms given

$$k_0 = 0.98m - 5 = 4.4$$

$$k_p = 0.2401m - k = -1.7995$$

Answer