ECEN 415
Assignment 1 Submission

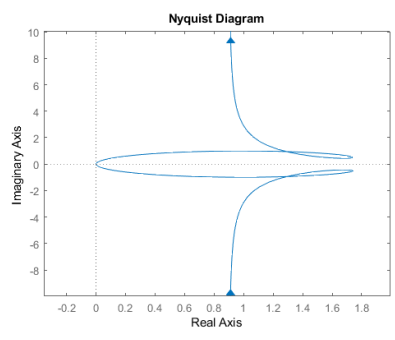
Daniel Eisen : 300447549

July 26, 2021

Section A - Formative Questions

1. (a)

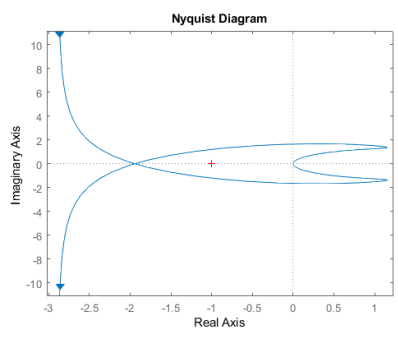
$$G_1(s) = \frac{20(s^2 + s + 0.5)}{s(s+1)(s+10)}$$



The system in its current state is stable as there are no enclosures of the critical point, and no open open-loop poles in the right half side of the s-place. No level of gain from $0 \rightarrow \infty$ result in an enclosure, and thus the system cannot be made unstable with this method.

(b)

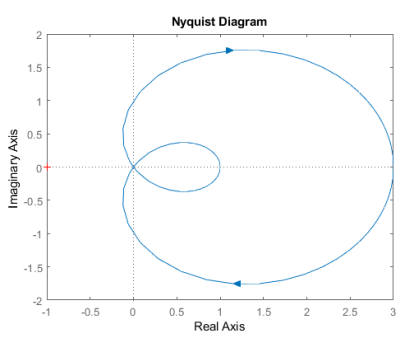
$$G_2(s) = \frac{20(s^2 + s + 0.5)}{s(s-1)(s+10)}$$



The system in its current state is stable as there is one open-loop pole in the right half side of the s-place and one anti-clockwise encirclement of the critical point. However with reduced gain, there will be no enclosure of the critical point and the system can be driven unstable.

(c)

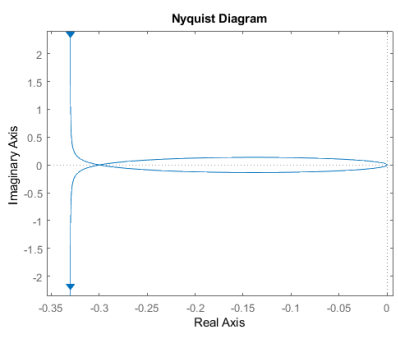
$$G_3(s) = \frac{s^2 + 3}{(s+1)^2}$$



The system in its current state is stable as there are no enclosures of the critical point, and no open open-loop poles in the right half side of the s-place. No level of gain from $0 \rightarrow \infty$ result in an enclosure, and thus the system cannot be made unstable with this method.

(d)

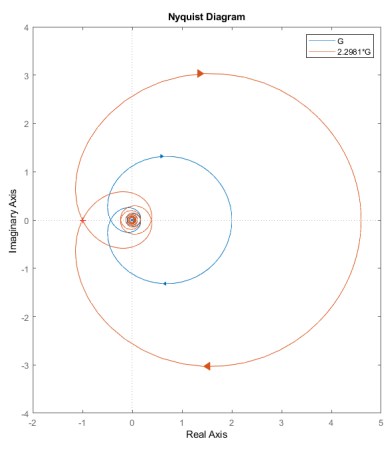
$$G_4(s) = \frac{3(s+1)}{s(s-10)}$$



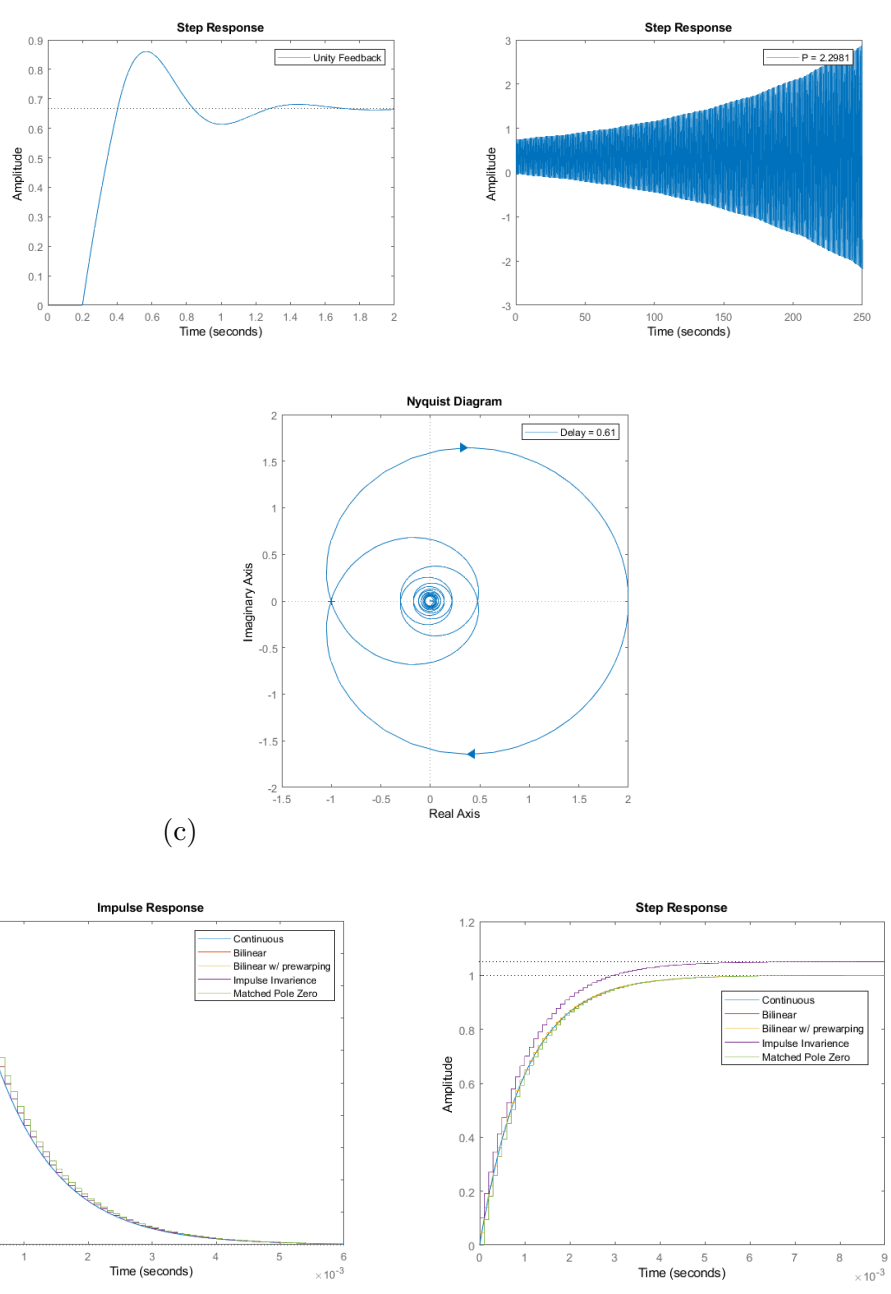
The system is currently unstable, as there is one open-loop pole in the right half side of the s-place and no anti-clockwise encirclements of the critical point. By increasing the gain we can make and anti-clockwise encirclement of the critical point and result in a stable system.

2.

$$G = e^{-0.2s}\frac{4}{s+2}$$



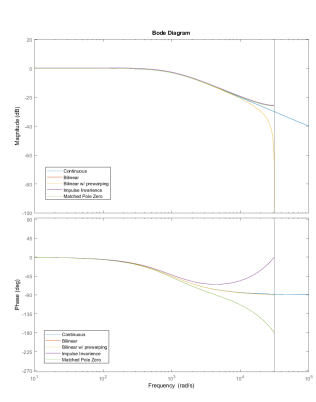
(a)



(b)

(c)

3.



Section B - Summative Questions

1. (a)

$$D(s) = e^{st_d} = e^{(\sigma + j\omega)t_d}$$

$$e^{j\omega t_d} = cos(\omega t_d) + jsin(\omega t_d)$$

$$\omega t_d = -\frac{\pi}{2},\ \omega = -\frac{\pi}{2t_d}$$

(b)

$$\omega = 1000rad/s,\ \phi = 15° = \frac{\pi}{12}$$

$$t_d = \frac{\pi}{1200}$$

(c)

2.

3.