EE 310 - LAB10

Question:

a. Sketch (by hand) the Nyquist plot of the following transfer function

$$G_2(s) = \frac{1}{s(s+10)(s+20)}$$

b. Compare your result in **a.** to the Nyquist plot obtained in Matlab (command `nyquist`).

Solution:

We find the magnitude and phase for $\omega \to \pm\infty$ and $\omega \to 0$ as follows.

- $\omega \to 0$: Magnitude goes to ∞ and phase goes to $\pm\pi/2$ (one pole at $s = 0$)
- $\omega \to \infty$: Magnitude is 0 and phase goes to $-\pi$ (relative degree $r = 2$)
- $\omega \to -\infty$: Magnitude is 0 and phase goes to $-3\pi/2$ (relative degree $r = 3$)

For the pole at $s = 0$ we use the small semi-circle $re^{j\varphi}$ and find that it maps to the large circle $G_2(re^{j\varphi}) \approx \frac{4}{10 \cdot 20} \cdot \frac{1}{r} e^{-j\varphi}$ that closes from phase $\pi/2$ over phase 0 to phase $-\pi/2$ (clockwise)