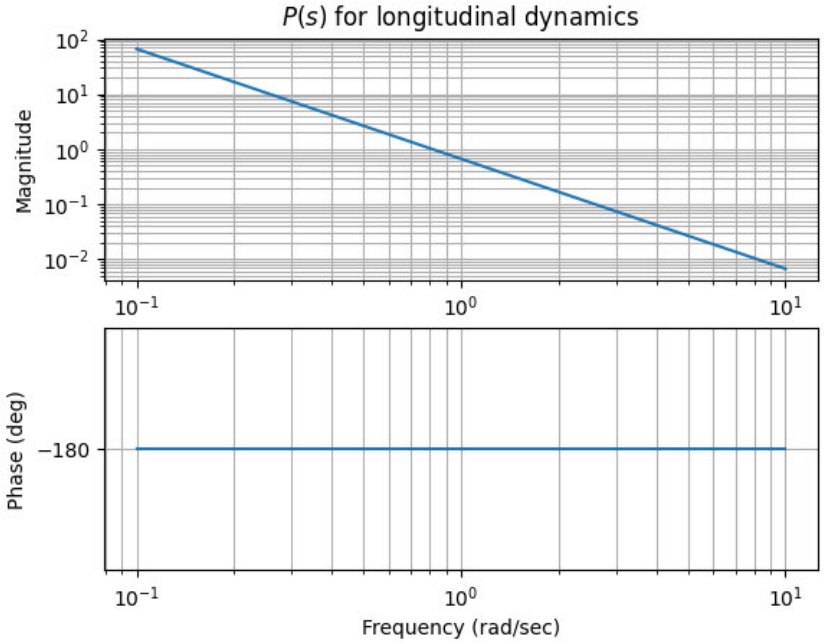
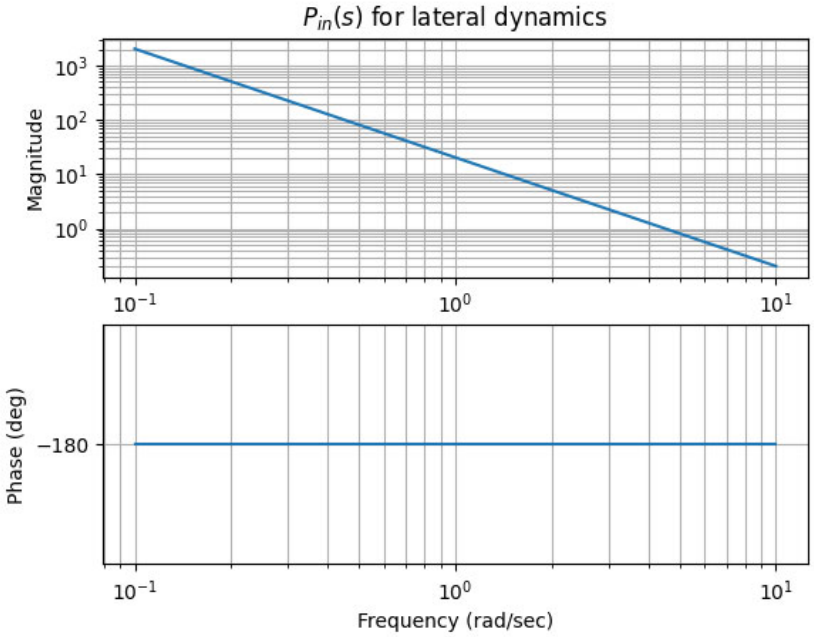
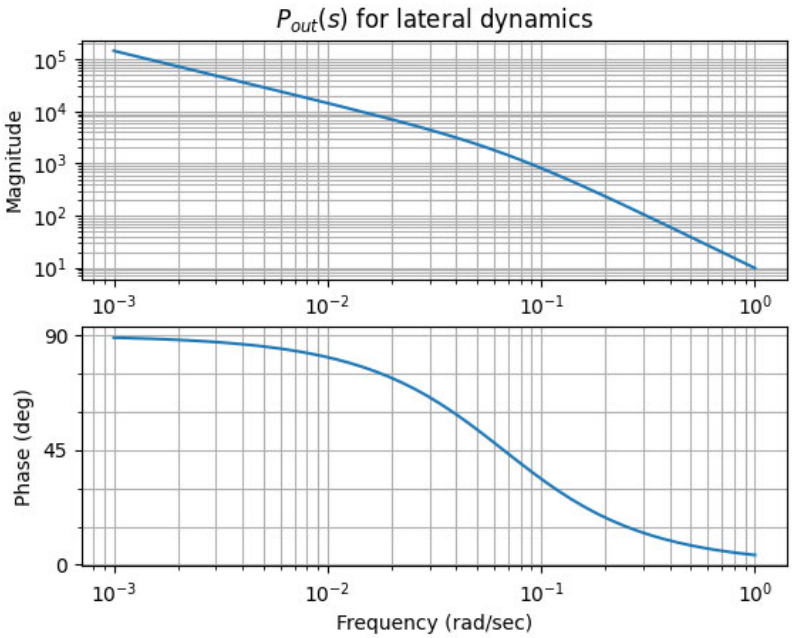
Assignment 11 - F.15 and F.16

F.15

compare plots below to your sketches
(see code on learning suite)



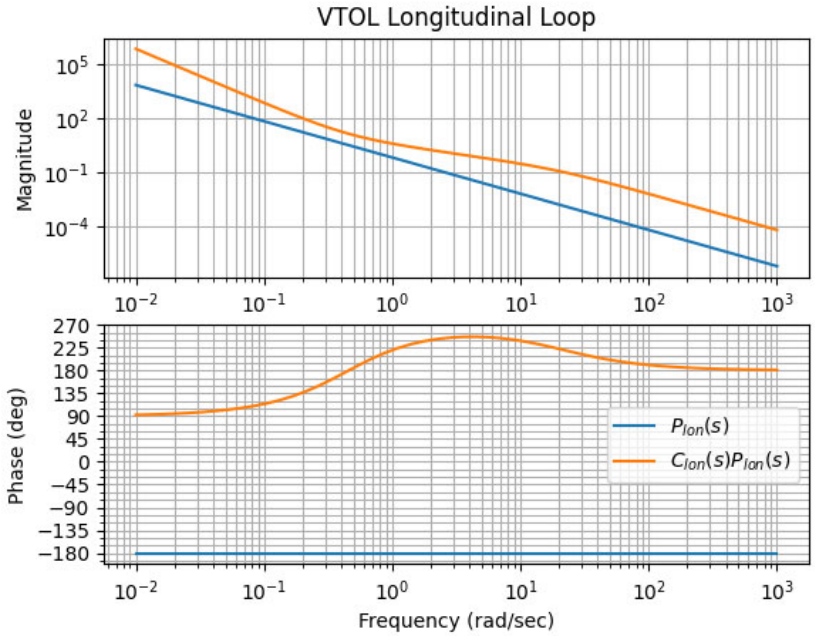




F.16 (see code on learning suite)

using the following gains gives the bode plots below:

sigma: 0.05
kp_z: -0.147
ki_z: 0.0
kd_z: -0.213
kp_h: 4.218
ki_z: 1.0
kd_h: 4.779
kp_th: 7.099
kd_th: 1.064



a) from code ⇒

$$C_{lon}P_{lon} = \frac{3.327s^2 + 2.845s + 0.667}{s^3(0.05s + 1)}$$

so $l = 3$ ∴

$$e_{ss} = \lim_{s\to 0} \frac{1}{s^3 + \bar{C}\bar{P}} \cdot s^{3-k}$$

for a parabola input, $k = 2$ ⇒

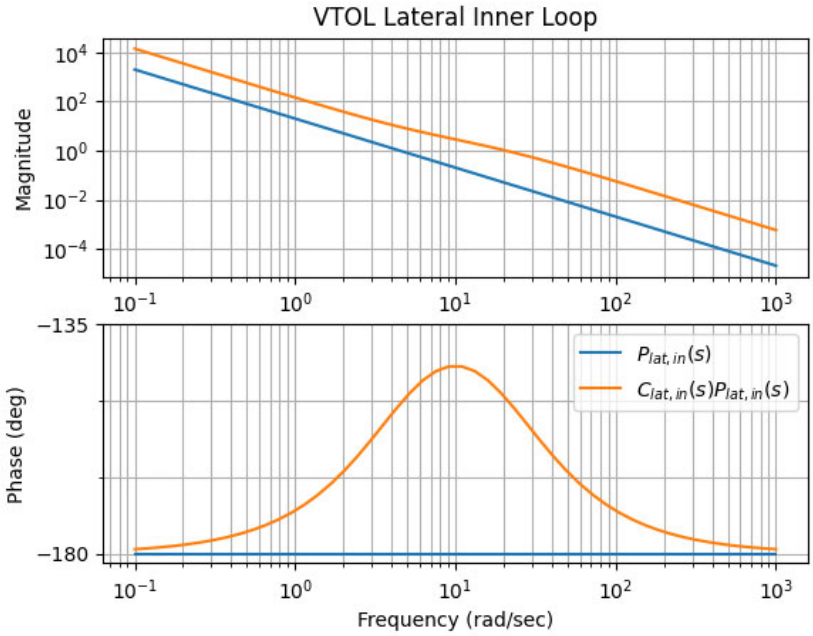
therefore

$$\boxed{e_{ss} = 0}$$

b) % error $= \gamma_n \cdot 100$ ⇒

$\gamma_n = M_{C_{lon}P_{lon}}(\omega_{no}) = 0.0615$ ⇒

$$\boxed{\%\ \text{error} = 6.15\%}$$



c) % of $D_{in} \simeq \gamma_{d_{in}} \cdot 100 \Rightarrow$

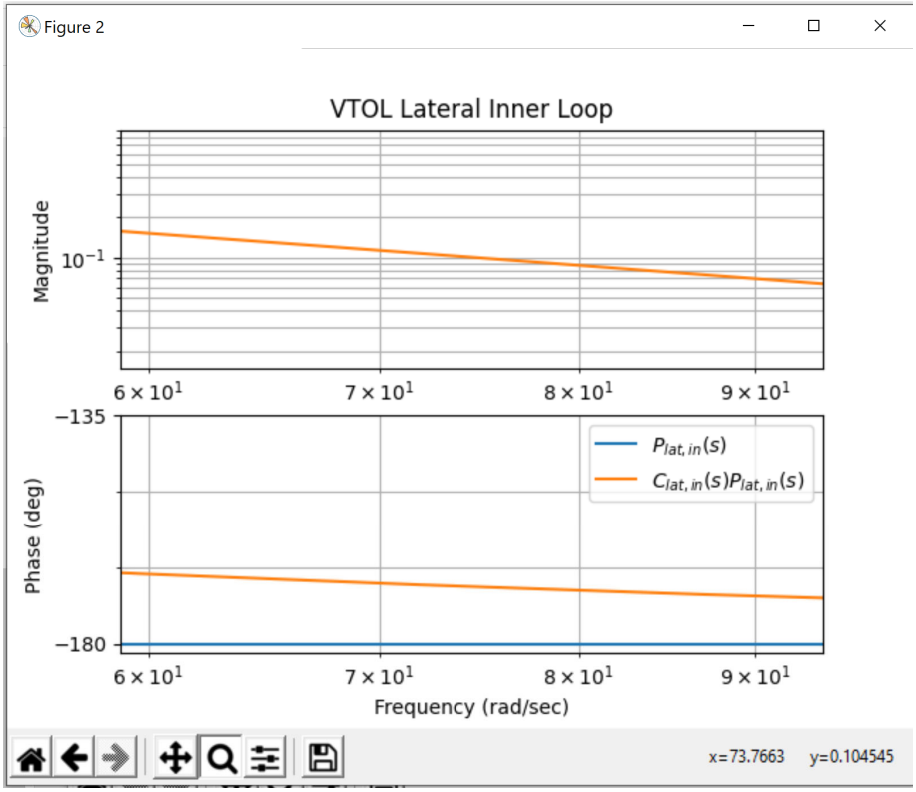
$$\gamma_{d_{in}} = \frac{M_{P_{in}}(\omega_{d_{in}})}{M_{C_{in}P_{in}}(\omega_{d_{in}})} \simeq 0.131 \Rightarrow$$

% error = 13.1%

d) assume that $|N| \approx 1$ degree $\Rightarrow$ (if you chose differently, that's fine)

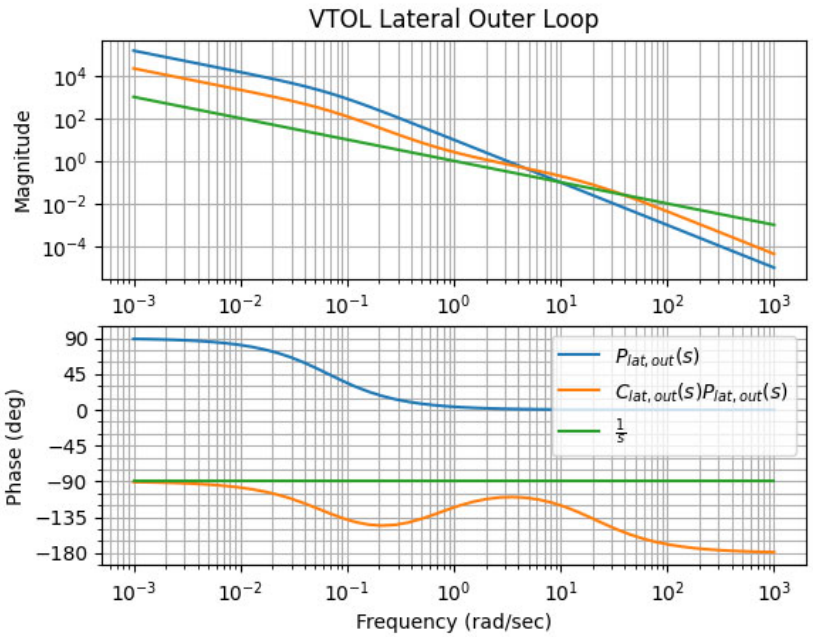
$$|e| = 0.1 \leq \gamma_n |1 \text{ degree}| \Rightarrow$$

$\gamma_n = 0.1$, where does $M_{cp}(\omega_{no}) = \gamma_n = 0.1$?



this plot shows it is at about

$\omega_{no} = 73$ rad/s



e) % error tracking $= \gamma_r \cdot 100 \Rightarrow$

$$\gamma_r = \frac{1}{M_{Cont} P_{out}(\omega_r)} = 0.00824$$

% error $= 0.824\%$

f) % error from $P_{out} = \gamma_{d_{out}} \cdot 100 \Rightarrow$

$$\gamma_{d_{out}} = \frac{1}{M_{Cont} P_{out}(\omega_{d_{out}})} = 0.000467 \Rightarrow$$

% error $= 0.0467\%$