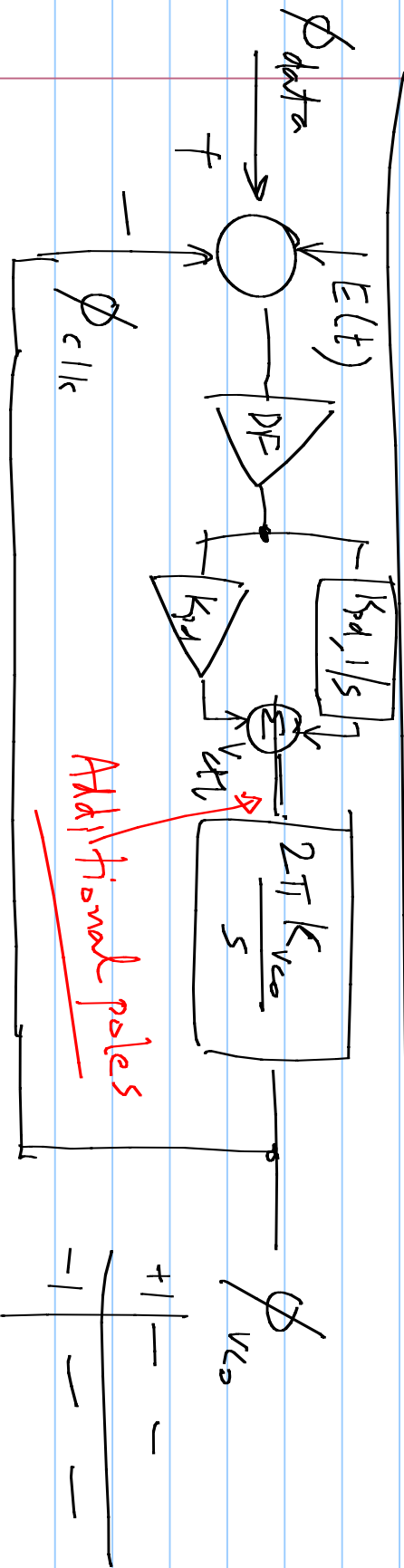
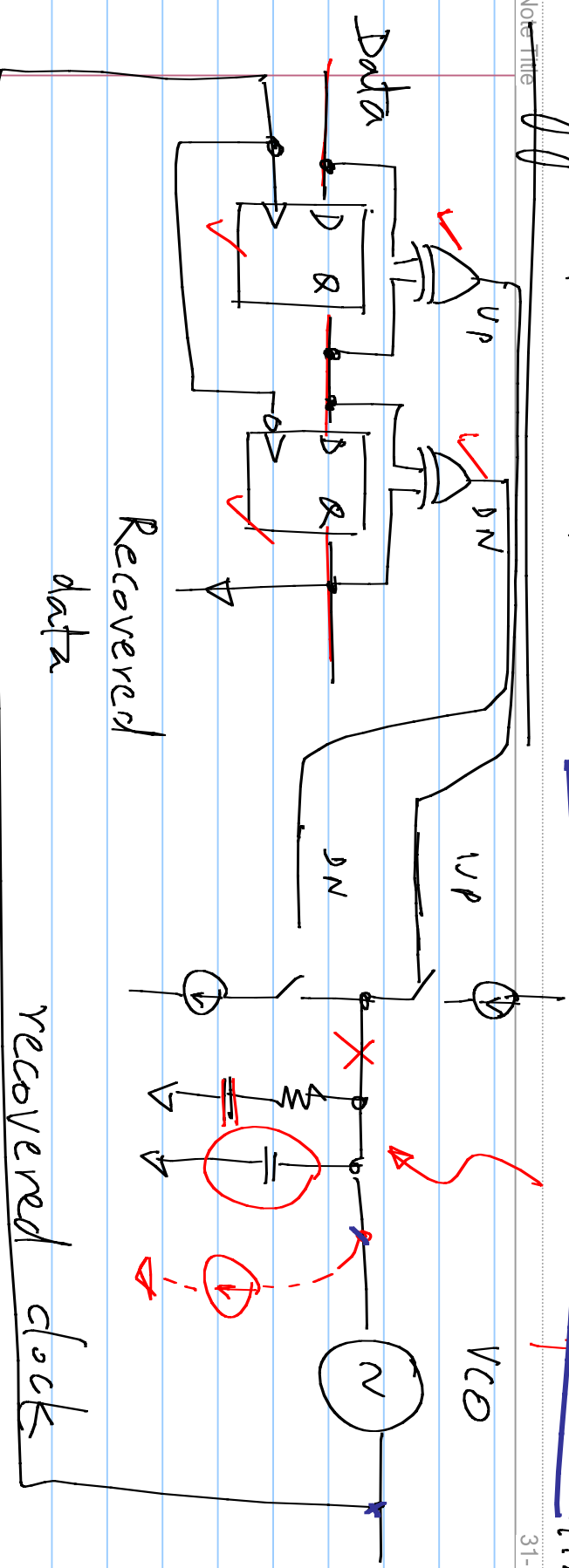


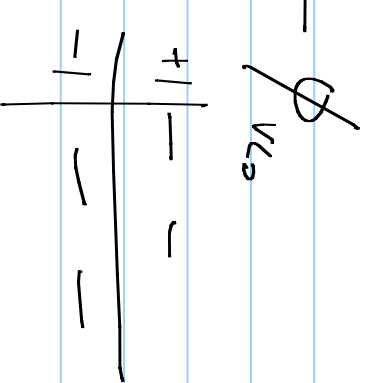
Hogge Phase detector:

Lee & Bulzarchelli

V_{THdc}

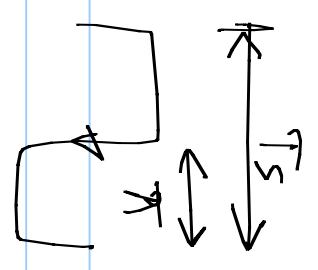


Additional poles



$$2\pi K_{V_{ce}} \int_0^{T_{max}} v_{cfl} \cdot dt = \pi$$

$$2\pi f_0 t + 2\pi K_{V_{ce}} \cdot \int v_{cfl} \cdot dt + 2\pi K_{V_{ce}} \cdot \int (\Delta v_{cfl}) \cdot dt$$

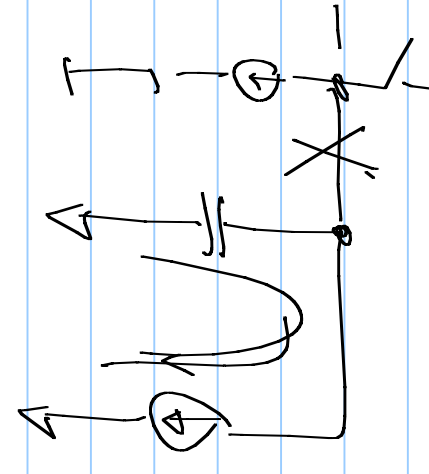


$$(f_0 + K_{V_{ce}} \cdot v_{cfl} \cdot dc)$$

$$< \pi$$

$$2\pi \cdot K_{V_{ce}} \cdot \Delta v_{cfl} \cdot T_{max}$$

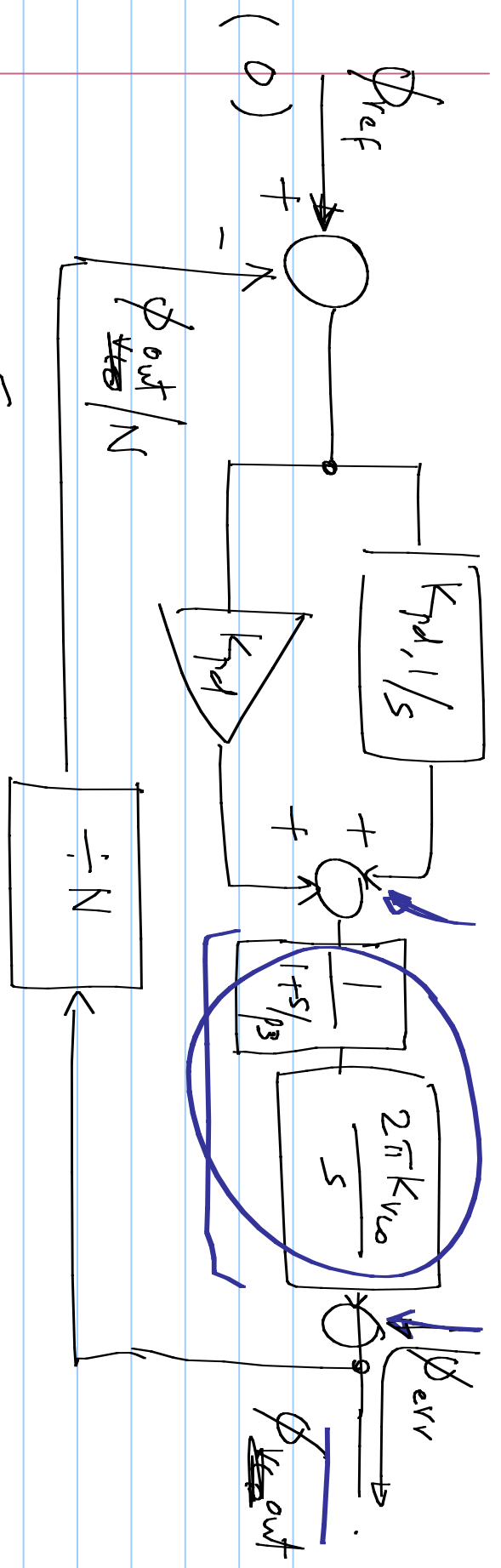
Q(



$$2\pi K_{V_{ce}} \int_0^{T_{max}} \left(\frac{1}{C} \cdot t \right) \cdot dt$$

$$T_{max} < \pi$$

$$\sim 10^{-30} \rightarrow \sim 10^{-15}$$



$$L = \left[\left(\frac{K_{pd,1}}{s} + K_{pd} \right) \cdot \frac{2\pi \cdot K_{vco}}{N \cdot s} \cdot \frac{1}{1+s/p_3} \right]$$

$$\phi_{out} \approx \frac{1}{|L|} \left[|L| \gg 1 \right]$$

$$\frac{\phi_{err}}{\phi_{ref}/V_{co}} \approx \frac{1}{|L|} \left[|L| \ll 1 \right]$$

* BW of the PLL $\left| L \right|$ Hz/V

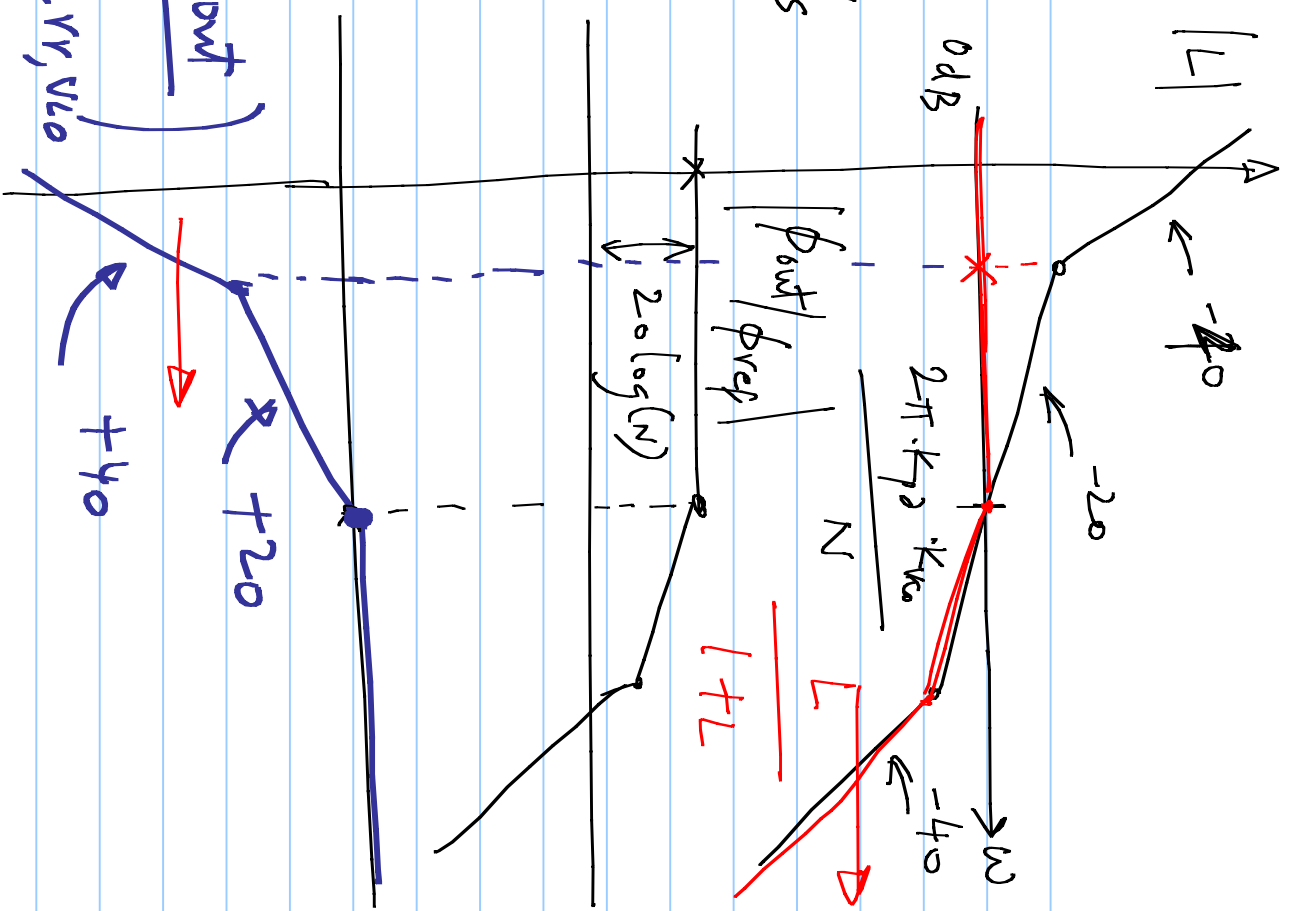
$$= \frac{2\pi \cdot K_{pd} \cdot K_{vco}}{N} \text{ rad/s}$$

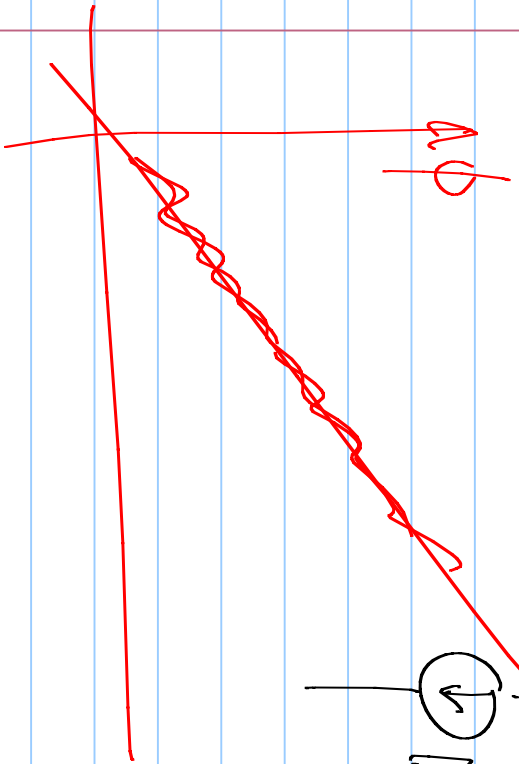
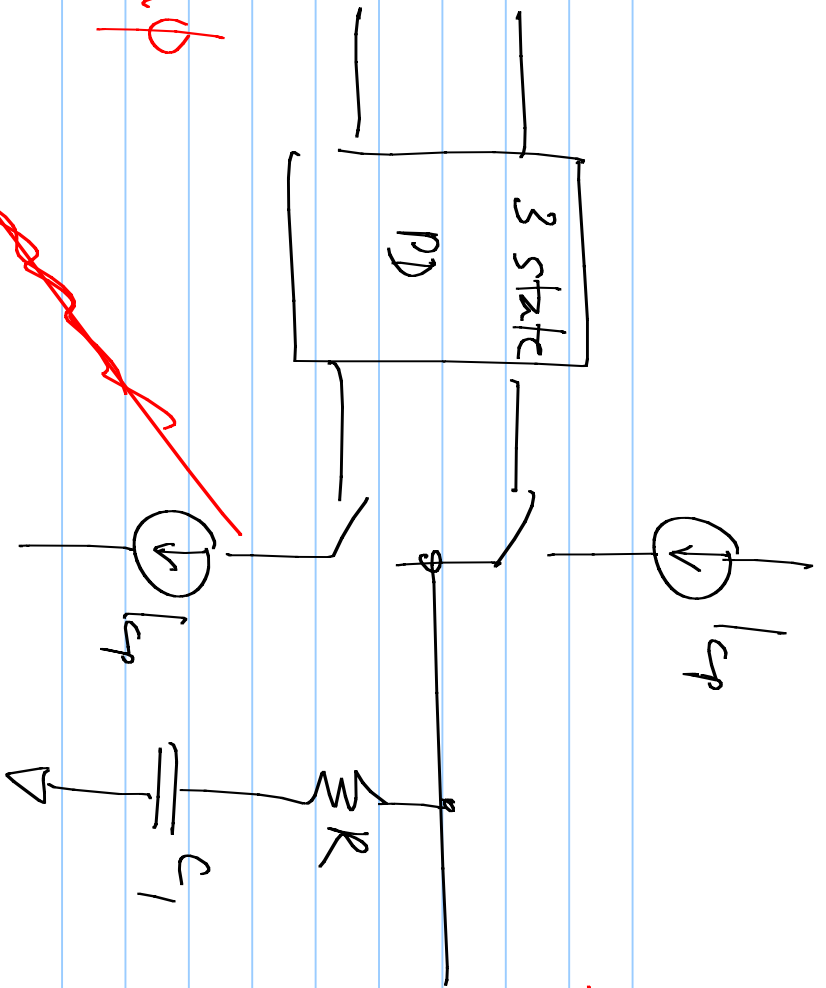
$$= \left(\frac{I_{cp} \cdot R \cdot K_{vco}}{N} \right) \cdot \text{rad/s}$$

$$\frac{\phi_{out}}{\phi_{err,vco}} = \frac{\phi_{out}}{\phi_{err,ctl}} \cdot \frac{1}{1+s/\rho_3} \cdot \frac{2\pi K_{vco}}{s}$$

$$\frac{\phi_{out}}{\phi_{err,ctl}} = \frac{\phi_{out}}{\phi_{err,vco}} \cdot \frac{1}{1+s/\rho_3} \cdot \frac{2\pi K_{vco}}{s}$$

$$\left(\frac{\phi_{out}}{\phi_{err,vco}} \right)$$

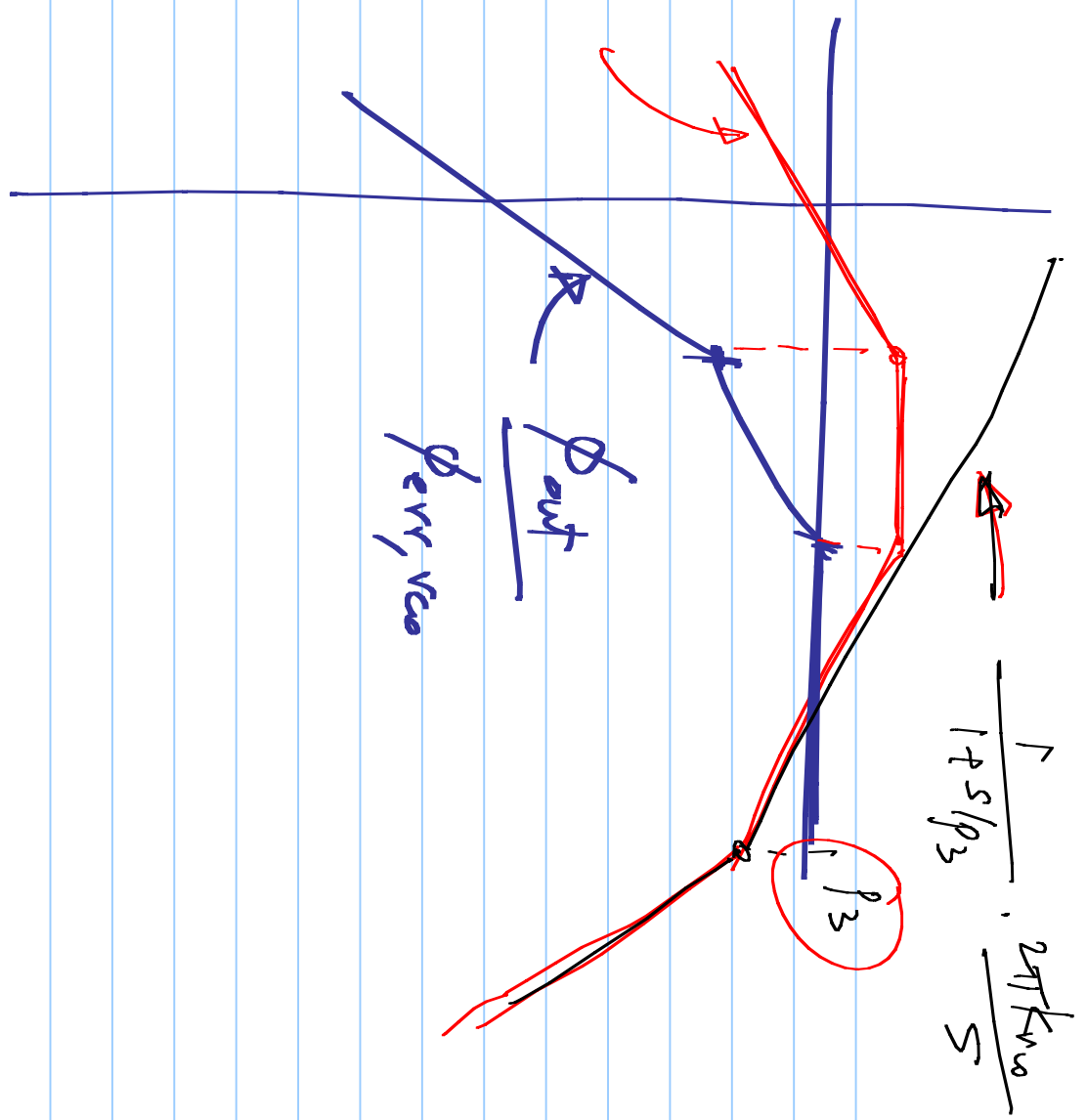




(L)

$$\frac{1}{1+L}$$

ϕ_{out}
 $\phi_{err, cl}$



$$\frac{1}{1+s/p_3} \cdot \frac{200Kv_0}{s}$$