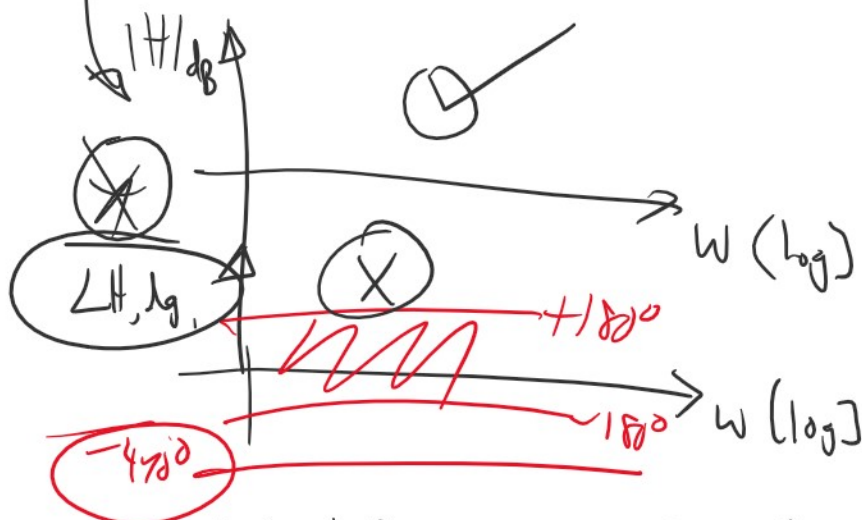
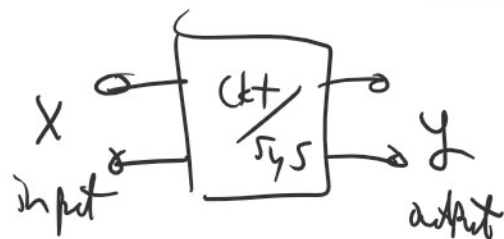


Bode plot approximation example



Suppose that we have

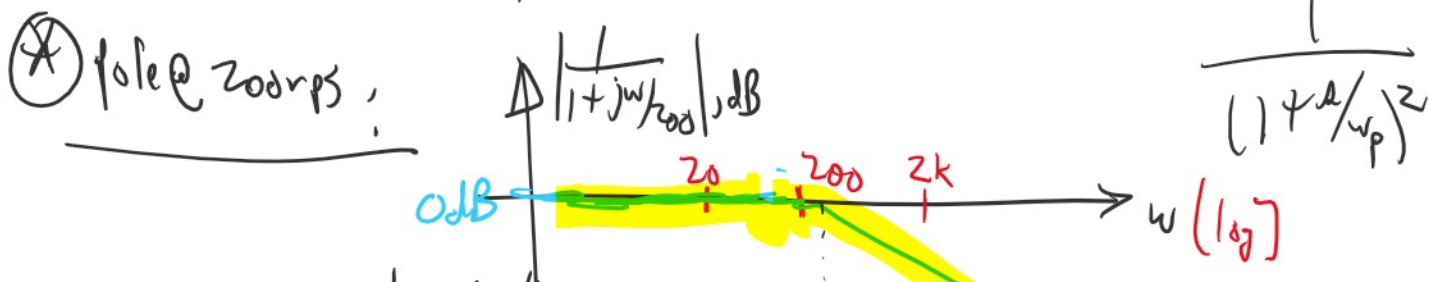
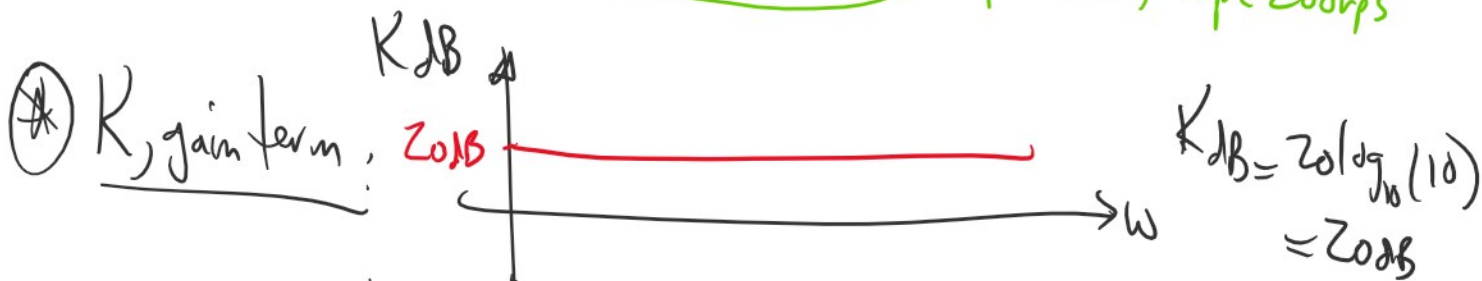
$$H(s) = \frac{Y(s)}{X(s)} = \frac{2000 (s/500)}{s + 200}$$

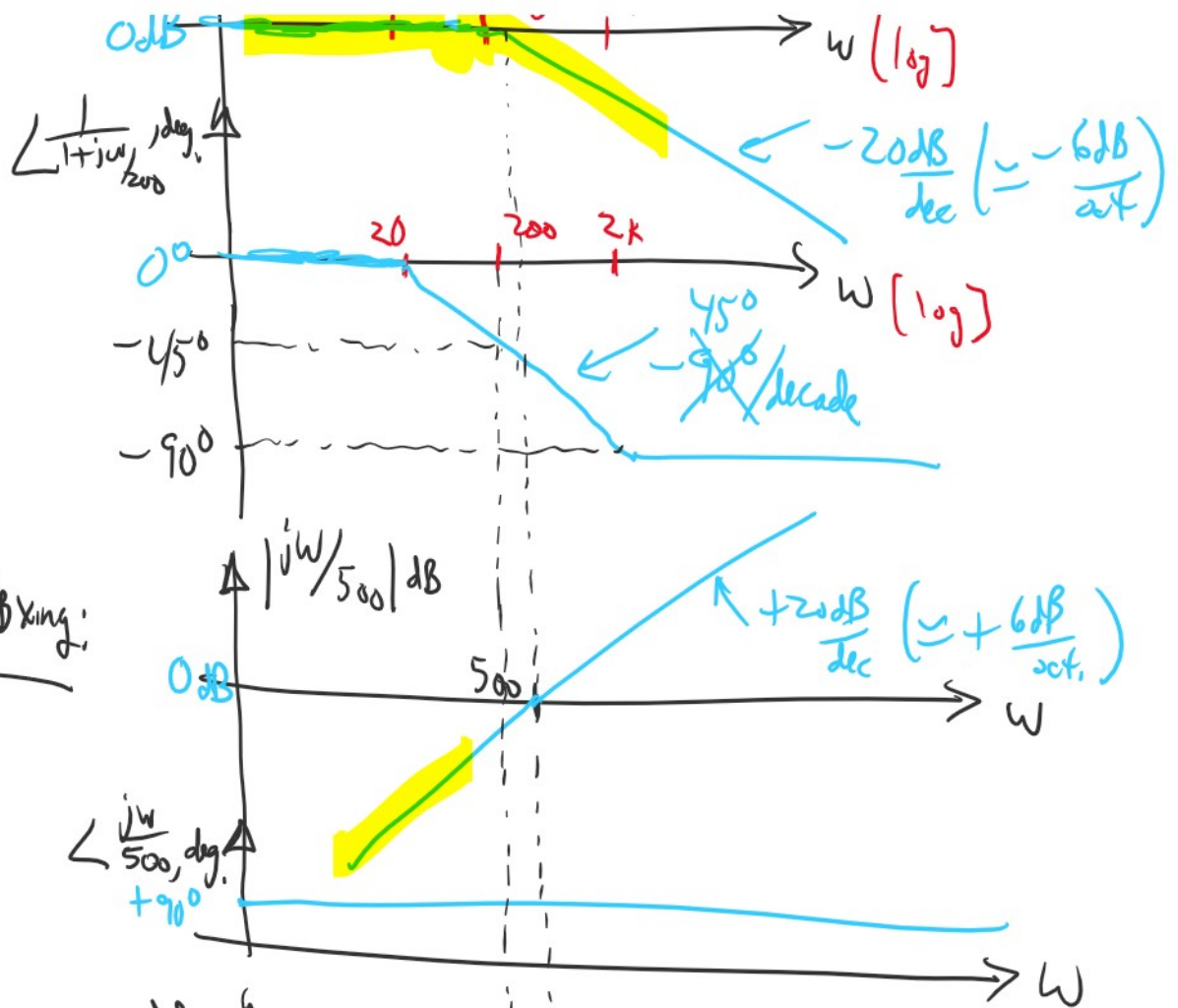


Get TF in proper Bode form \Rightarrow one or more of the 7 covered terms: $\pm K, (1+s/\omega_k), \dots$

$$H(s) = \frac{2000 (s/500)}{200 (1 + s/200)} = \overset{\text{gain}(K)}{10} \frac{(s/500)}{(1 + s/200)}$$

Annotations:
 - 2000 @ DC
 - $\omega/500$ rps ODB crossing
 - pole term, $\omega_p = 200$ rps

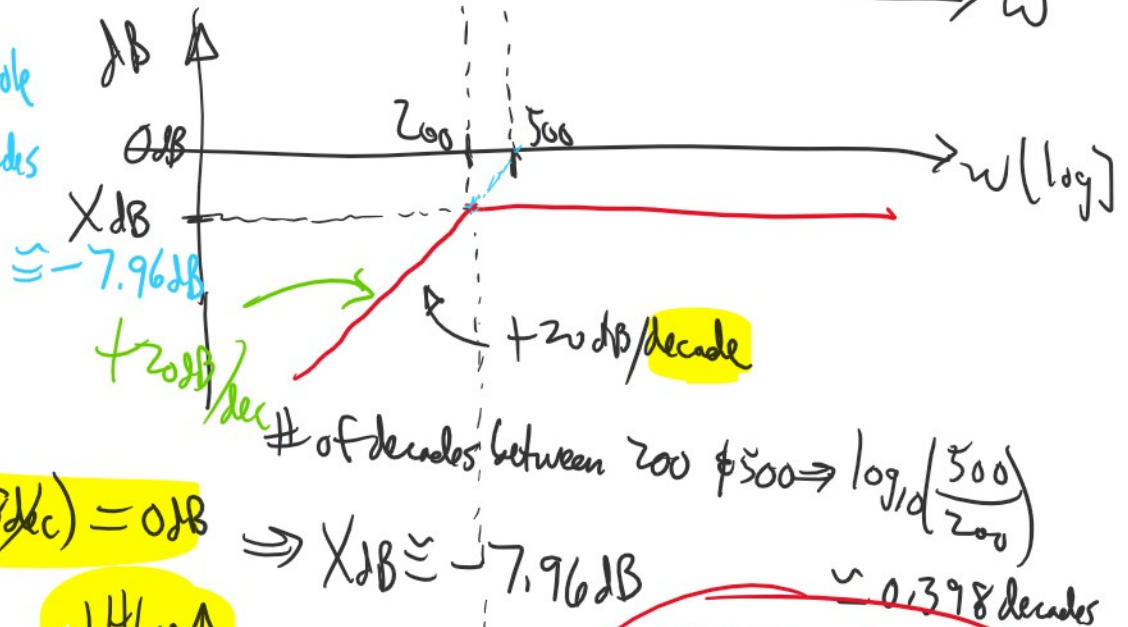




⊗ Zero @ DC
w/ 500 rps 0 dB gain:

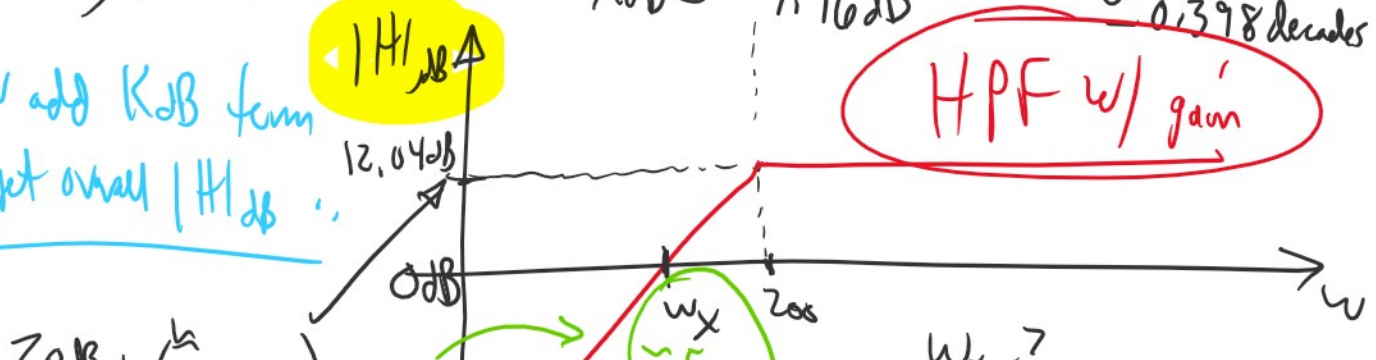
Let's combine the pole & zero @ DC magnitudes first.

$$X_{dB} = ?$$



$$X_{dB} + \frac{20 dB}{dec} (0.398 dec) = 0 dB \Rightarrow X_{dB} \approx -7.96 dB$$

Now add K dB term to get overall $|H|_{dB}$.



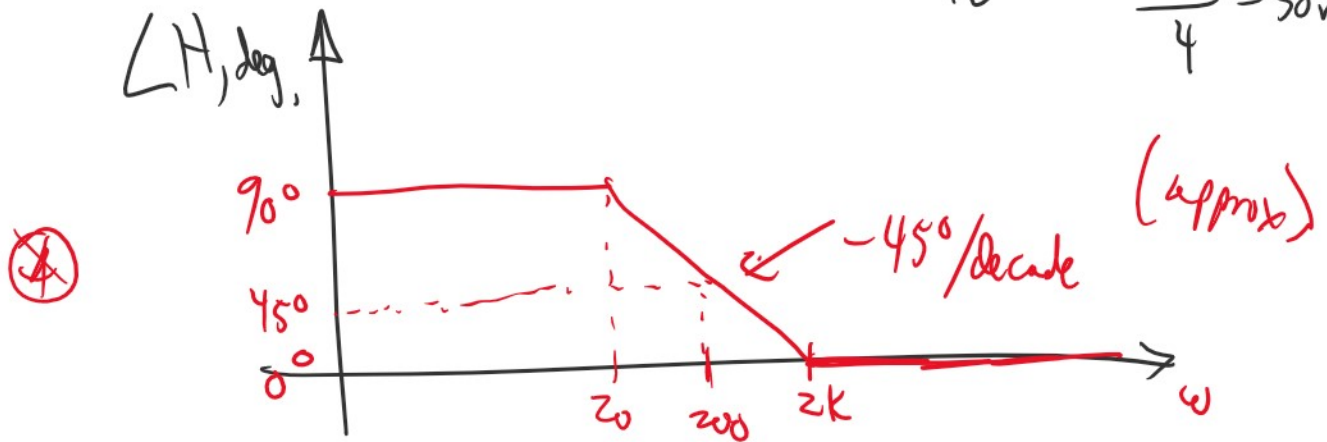
$20\text{dB} + (-7.96\text{dB})$
 (1KdB)
 $\approx 12.04\text{dB}$

0dB
 $+20\text{dB/dec}$
 $\omega_x \approx 50\text{rps}$
 $\omega_x = ?$
 $0\text{dB} + \frac{20\text{dB}}{\text{dec}} \left(\log_{10} \left(\frac{200}{\omega_x} \right) \right) = 12.04\text{dB}$

$\# \text{ of decades} = \frac{12.04\text{dB}}{20\text{dB/dec}} \approx 0.602 \text{ decades}$

$\log_{10} \left(\frac{200}{\omega_x} \right) \stackrel{\text{set}}{\approx} 0.602 \text{ decades} \Rightarrow \omega_x = \frac{200}{10^{0.602}} = \frac{200}{4} = 50\text{rps}$

$\# \text{ of decades between } \omega_x, 200$
 $12.04\text{dB} \approx 20 \log_{10}(H?)$
 $H? V/V = (12.04/20)$
 10
 $10^{0.602} = \frac{200}{4} = 50\text{rps}$



$V_{in}(t) = A \cos(\omega_0 t)$, $V_{out}(t) = A |H(j\omega_0)| \cos(\omega_0 t + \angle H(j\omega_0))$

$"undBtized"$