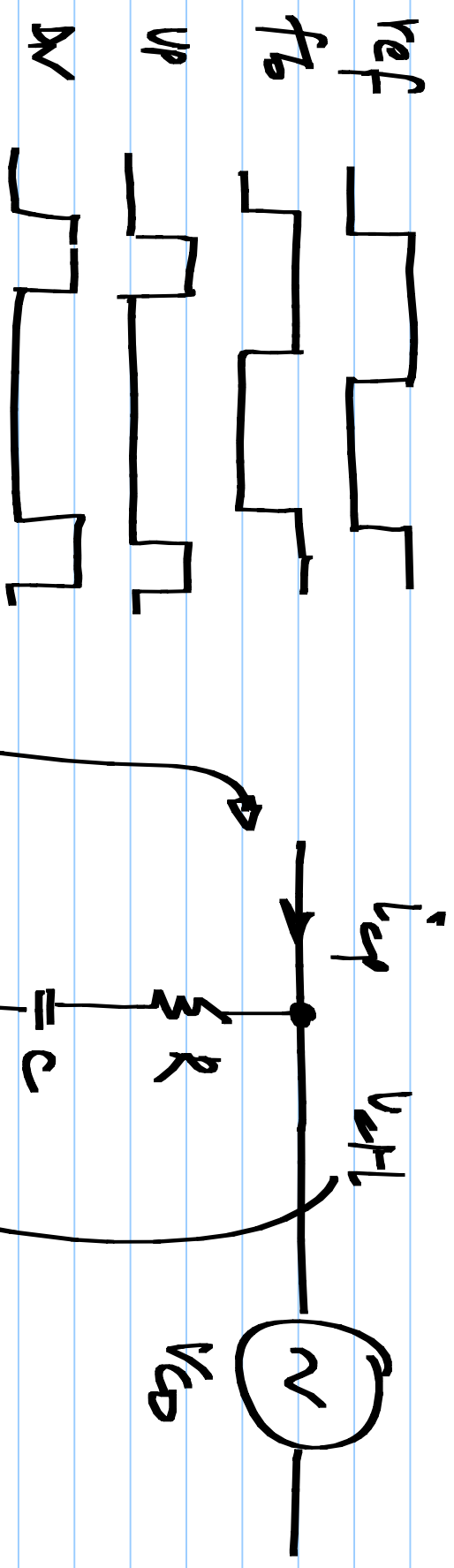


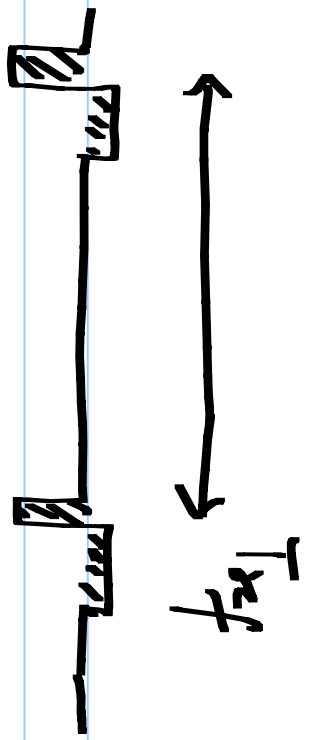
EE 6322

20/3/2018



$$i_g \cdot \Delta\phi \rightarrow k \rightarrow \Delta I$$
$$i_g \cdot \Delta\phi = \frac{T_{cg}}{2\pi} = \Delta T \cdot T_{cg}$$

$i$

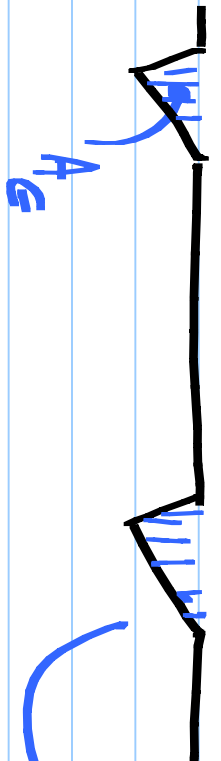


$T_{yf}$

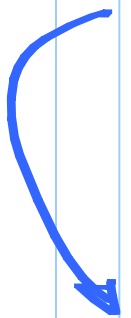
$$j2\pi f \frac{A_E}{T_{yf}} \sum_n \delta(f - nT_{yf})$$

Spectrum?

$\int dt$



$A_E$



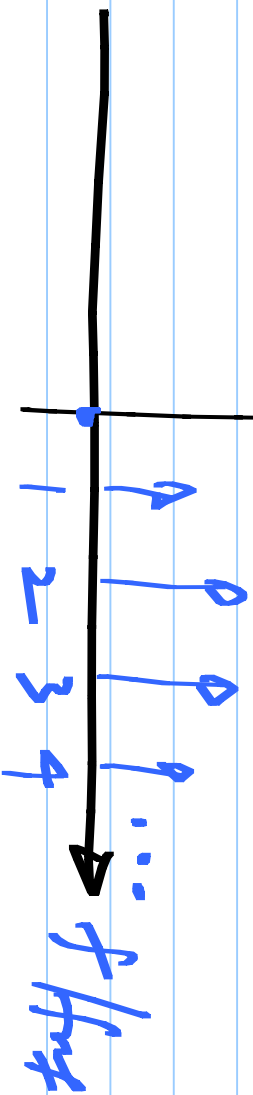
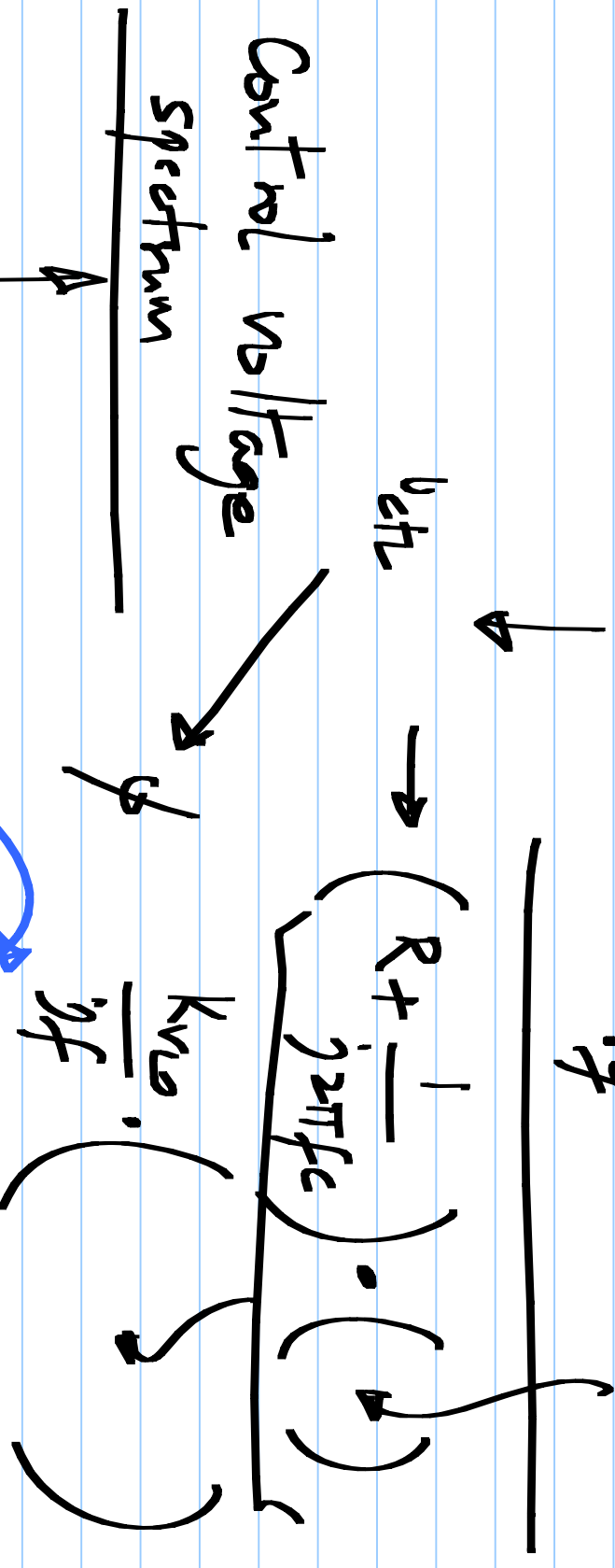
$$\sum_{n=-\infty}^{\infty} A_E \cdot \delta(t - nT_{yf})$$

Approximated as  
An impulse train

$$\frac{A_E}{T_{yf}} \sum_{n=-\infty}^{\infty} \delta(f - nT_{yf})$$

$$\sum_{n=-\infty}^{\infty} \delta(t - nT_{yf}) \xleftrightarrow{F} \frac{1}{T_{yf}} \sum_{n=-\infty}^{\infty} \delta(f - nT_{yf})$$

Fourier transform of  $i_p$ :  $j2\pi \frac{A_e}{T_{rep}} \cdot \sum_n n f_{rep} \delta(f - n f_{rep})$

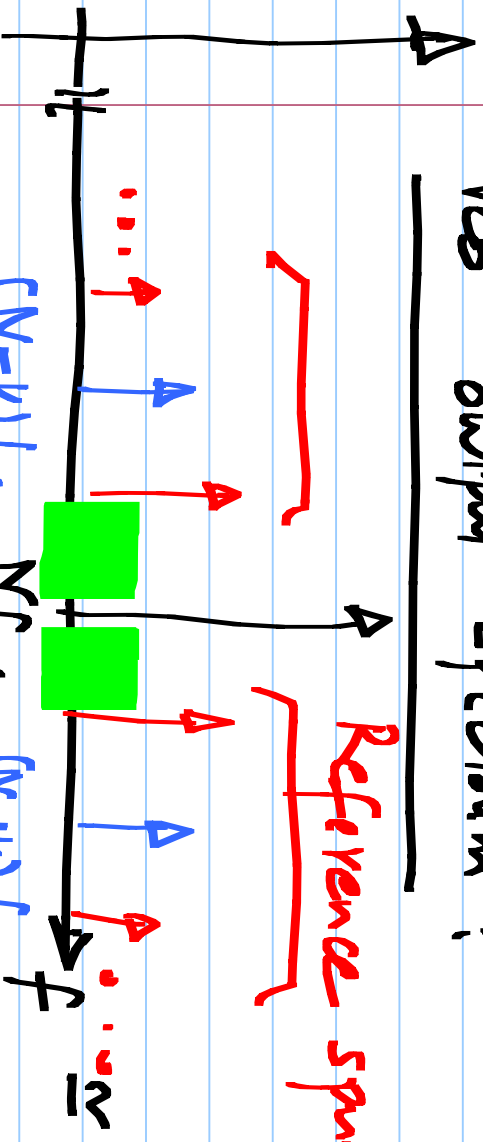


Vco output spectrum:

$$\cos(2\pi N \cdot f_{ref} t + \phi(t))$$

Reference spurs

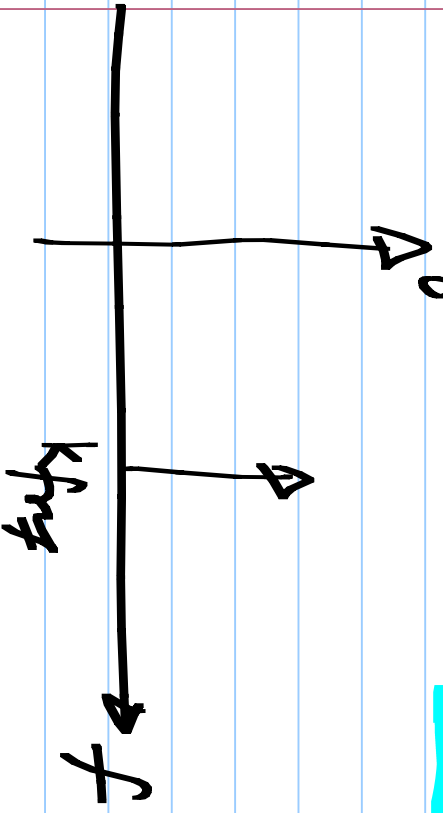
$$\phi_k = \cos(2\pi k f_{ref} t)$$



$$\cos(2\pi N f_{ref} t)$$

$$\sin(2\pi N f_{ref} t) \cdot \phi(t)$$

$$\sin(2\pi N f_{ref} t) \cdot \phi_k \cdot \cos(2\pi k f_{ref} t)$$



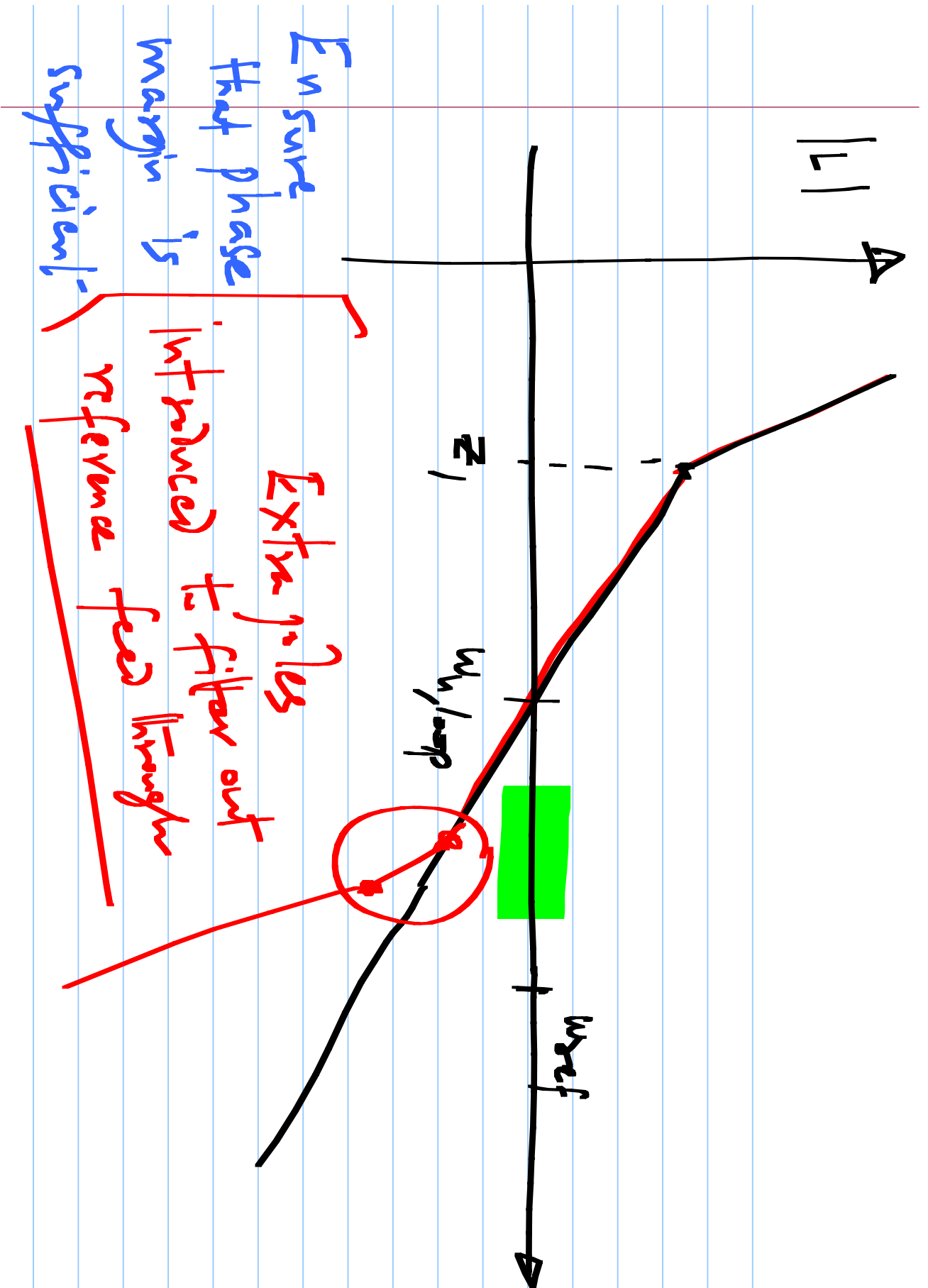
$$\cos(2\pi k f_{ref} t)$$

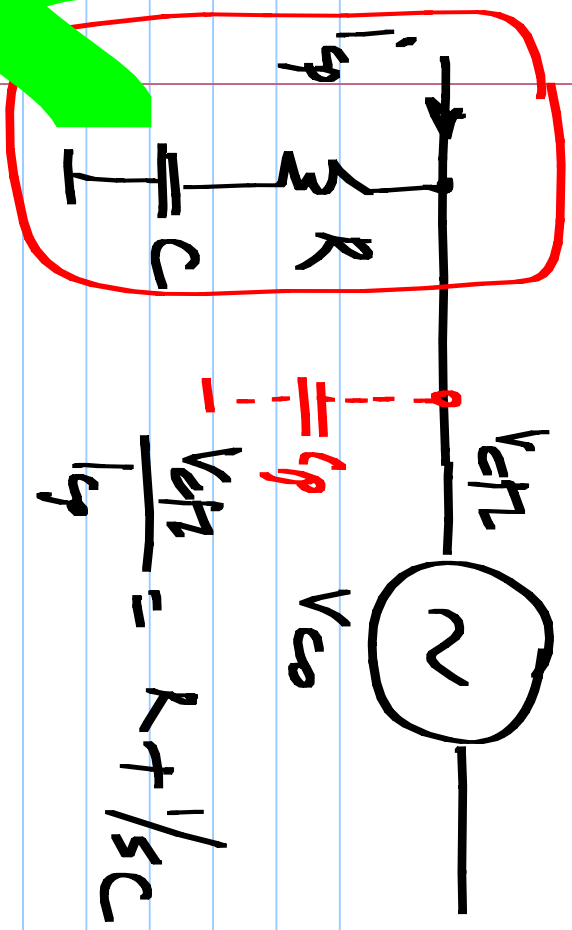
Charge pump current mismatch + reset delay

⇒ Reference feed through

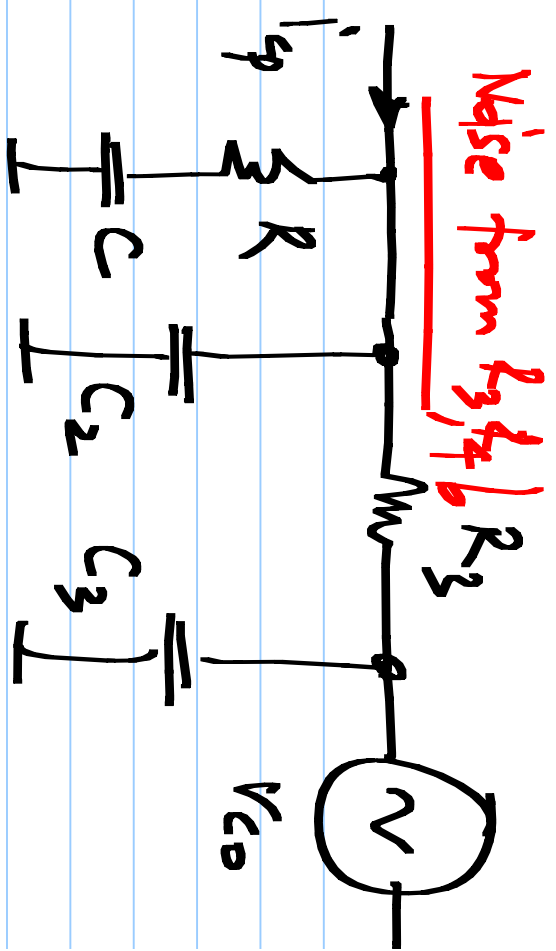
⇒ Reference spurs ] sidebands of the VCO

@ integer multiples  
of  $f_{ref}$

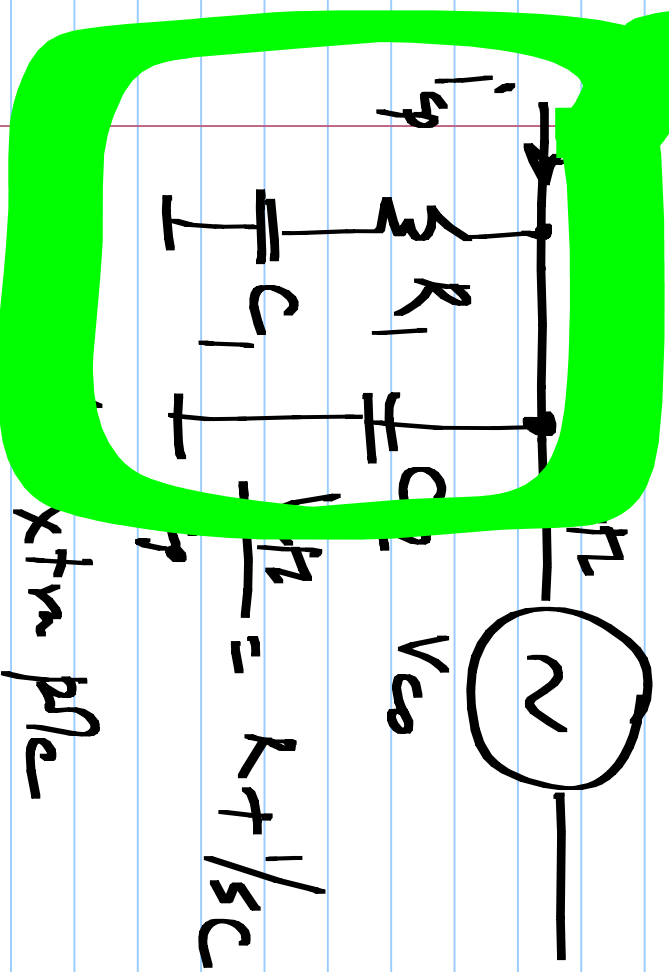




$$\frac{v_{eH}}{i_q} = R + 1/sC$$



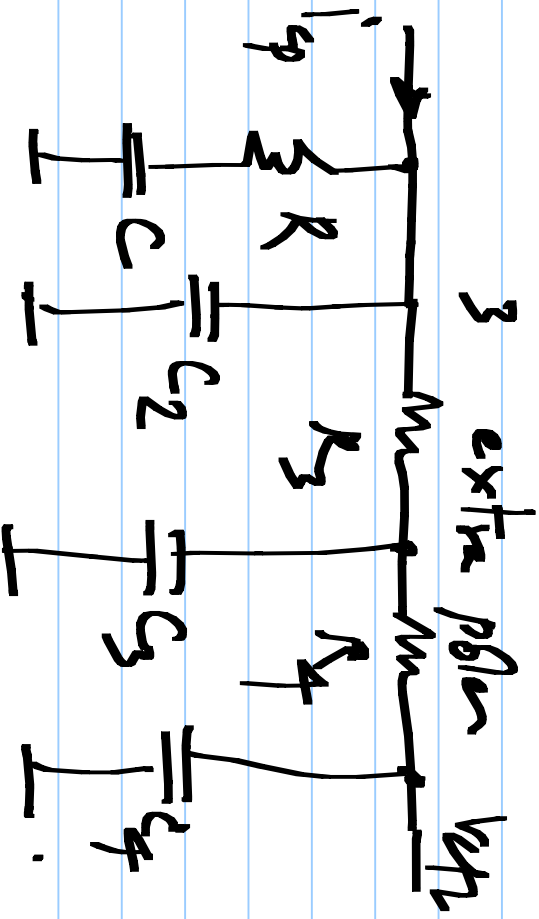
Noise from  $R_3, R_4, C_2, C_3$



$$\frac{v_{eH}}{i_q} = R + 1/sC$$

extra pole

2 extra poles



3 extra poles

