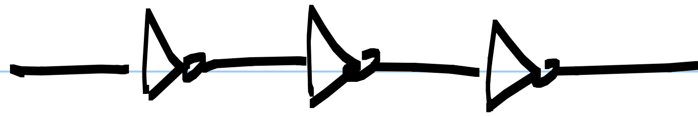
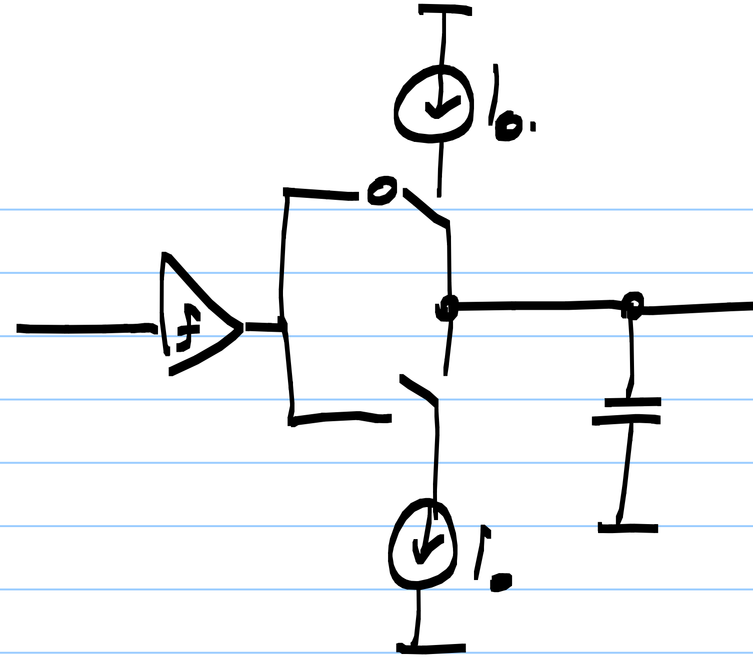
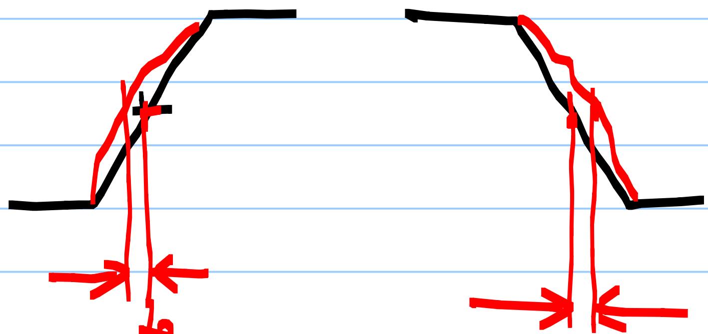
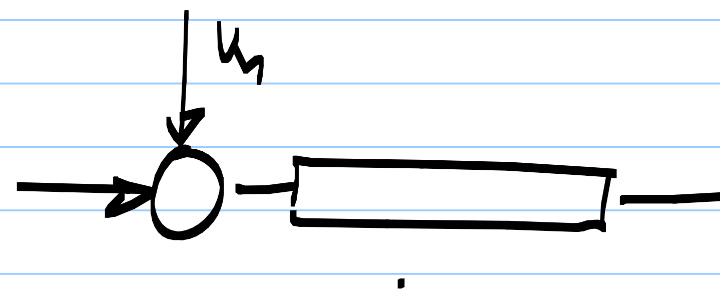


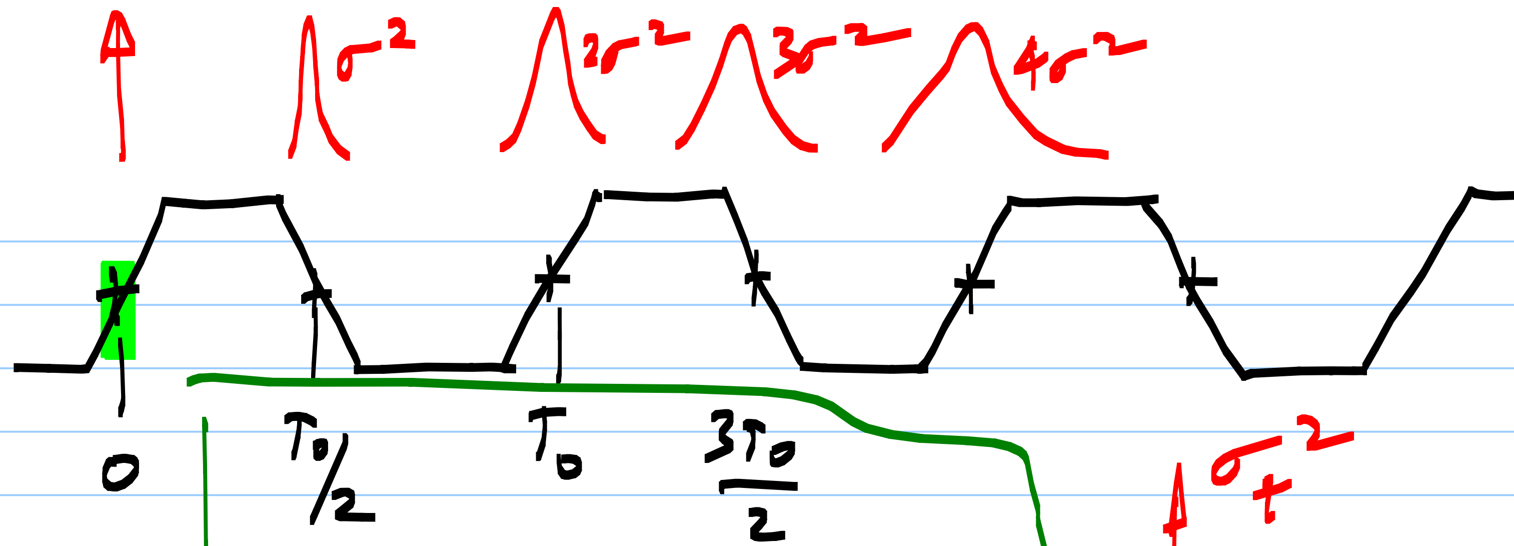




$$-\frac{v_n(t_0)}{R} \qquad\qquad +\frac{v_n(t_0)}{R}$$

↳ slope

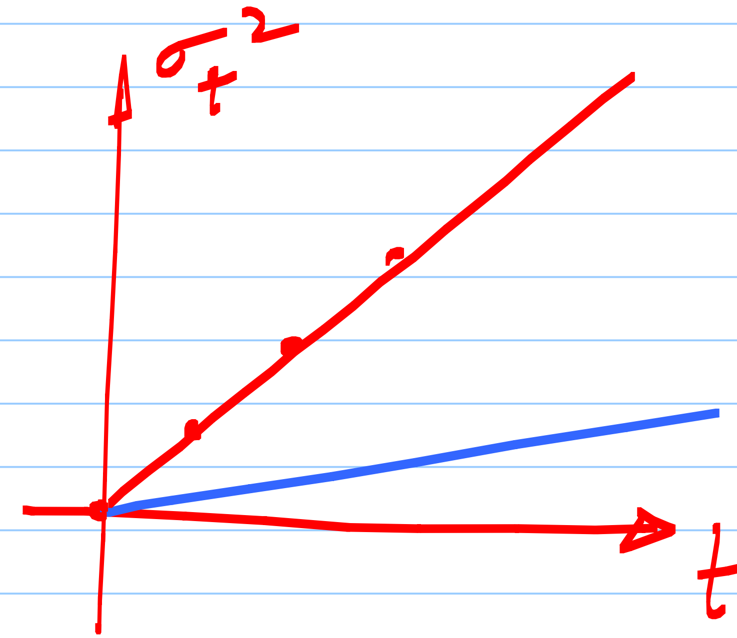




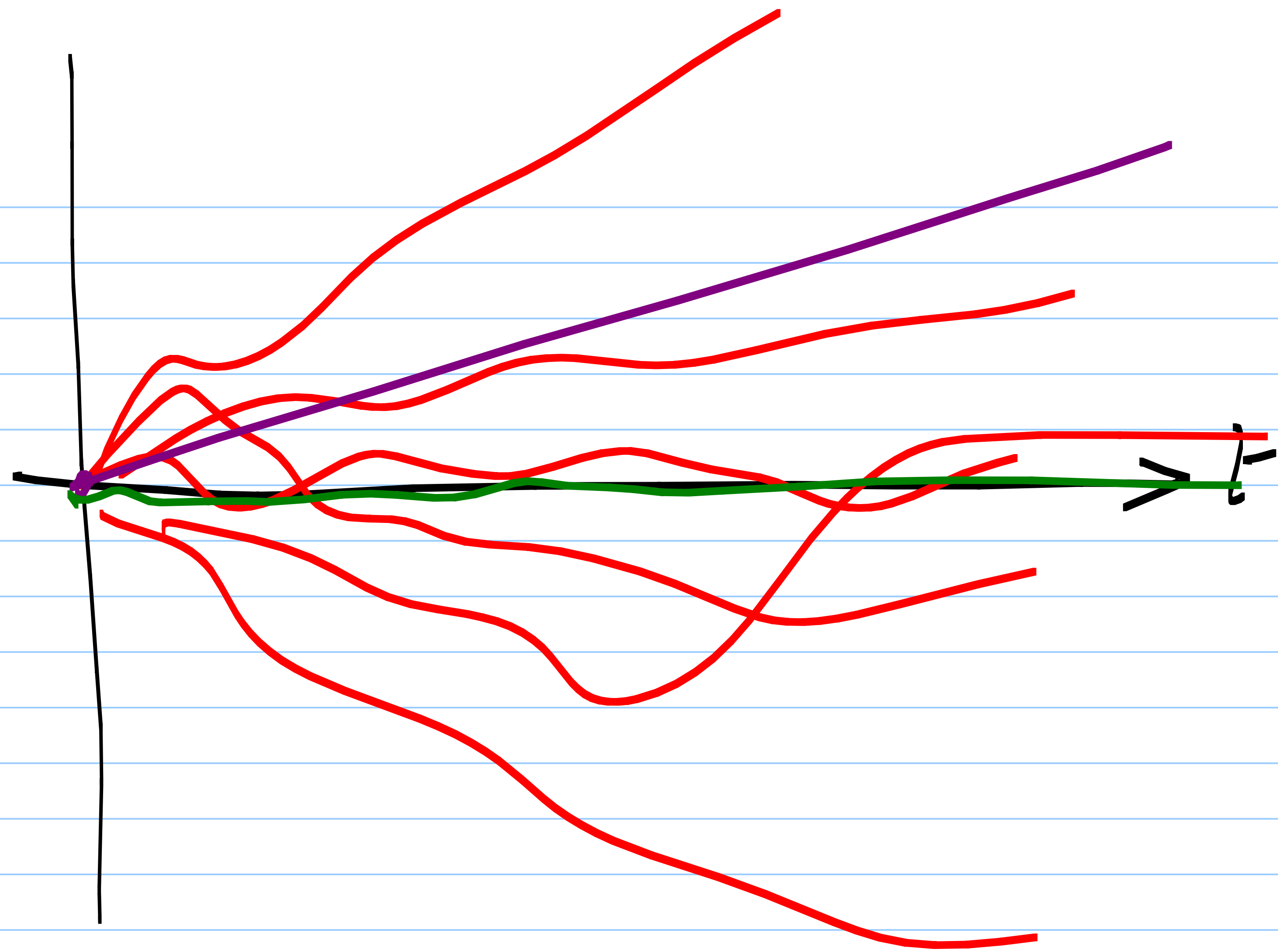
$$-\frac{V_n(0)}{R} \quad -\frac{V_n[0]}{R} \quad -\frac{V_n[0]}{R}$$

$$+\frac{V_n[T_0/2]}{R} \quad +\frac{V_n[T_0/2]}{R}$$

$$-\frac{V_n[T_0]}{R}$$



Longitude



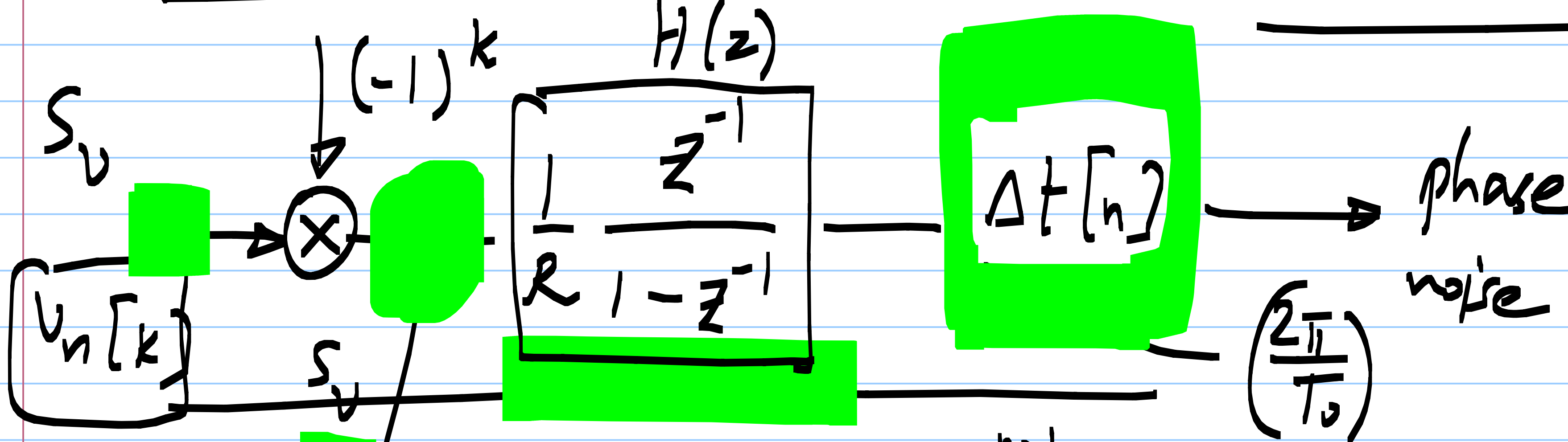
t

Deviation in the position of the n^{th} edge

$$\Delta t[n] = \underbrace{\sum_{k=0}^{n-1} \frac{(-1)^k v_n[k]}{R}}$$

discrete-time

sampling period $= T_0/2$



$$\Delta t[n] - \Delta t[n-1] = \frac{(-1)^{n-1} v_n[n-1]}{R}$$

$H(z)$:

Sampling period $= \frac{T_0}{2}$

$$\frac{\left| H\left(\exp\left(j\,2\pi \frac{f}{f_s}\right)\right)\right|^2}{}$$

Sampling rate

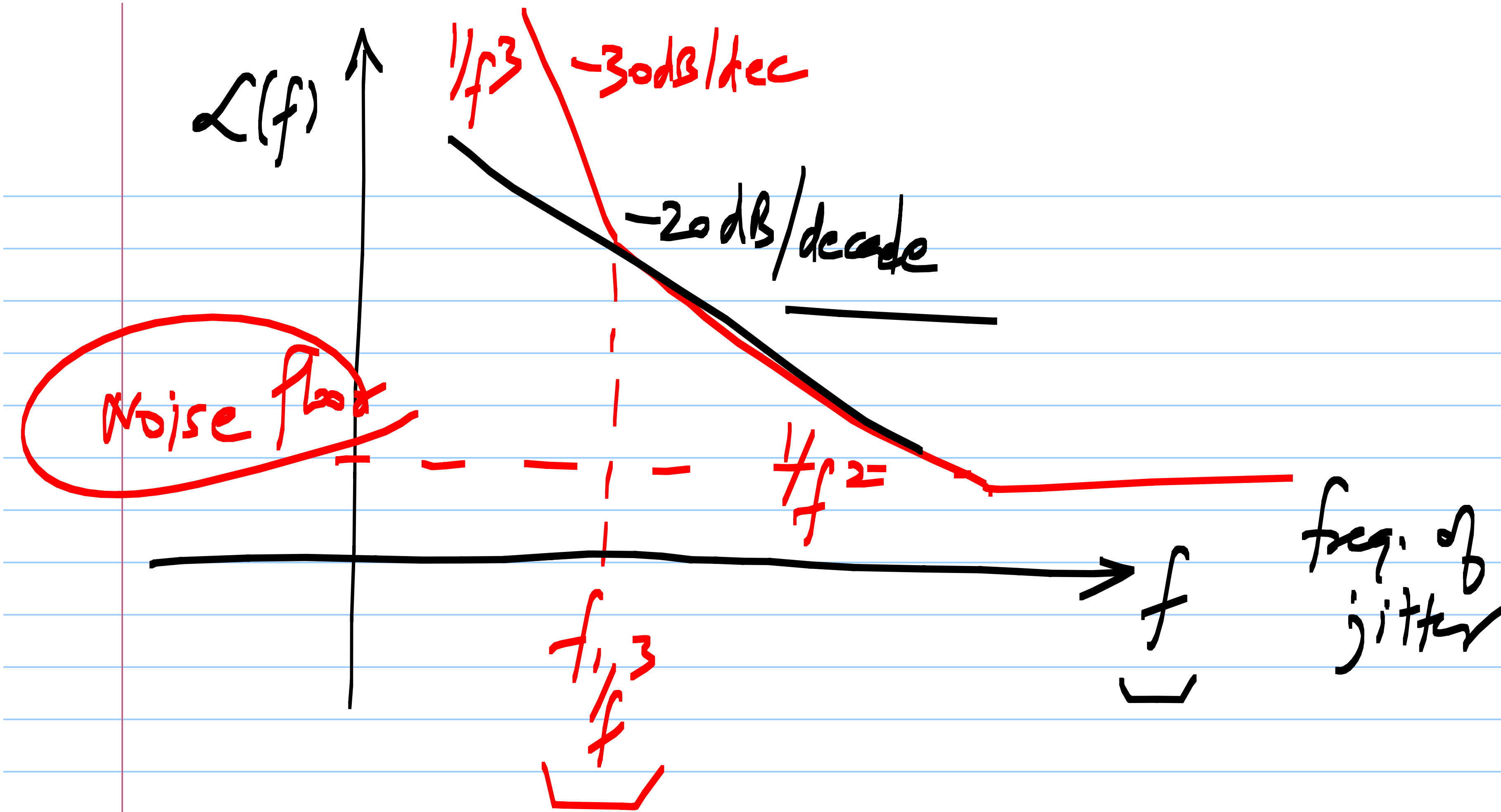
$$\left|\frac{1}{R}\cdot\frac{z^{-1}}{1-z^{-1}}\right|^2 = \frac{1}{R^2}\left|\frac{z^{-1/2}}{\underbrace{z^{1/2}-z^{-1/2}}_{\underbrace{\exp\left(j\frac{\pi f}{f_s}\right)-\exp\left(-\frac{j\pi f}{f_s}\right)}_{j2\sin\left(\pi f/f_s\right)}}}\right|^2$$

$$\frac{1}{\underbrace{4R^2\underbrace{\sin^2\left(\frac{\pi f T_0}{2}\right)}}} \simeq \frac{1}{\underbrace{R^2\cdot\pi^2 f^2 T_0^2}}$$

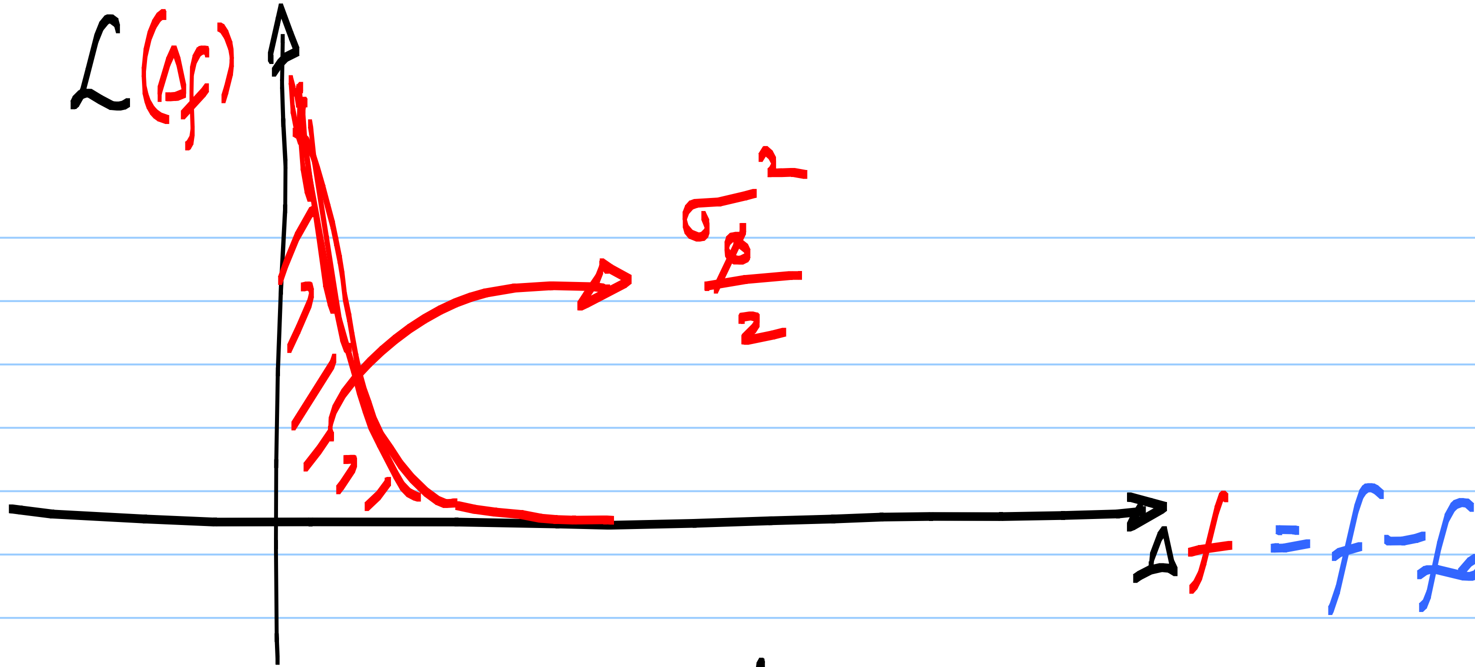
$$-\frac{1}{T_0} \quad + \quad \frac{1}{T_0}$$

$$f \ll 1/T_0 \qquad \frac{\pi^2 f^2 T_0^2}{4} \qquad f_s = \frac{2}{T_0}$$

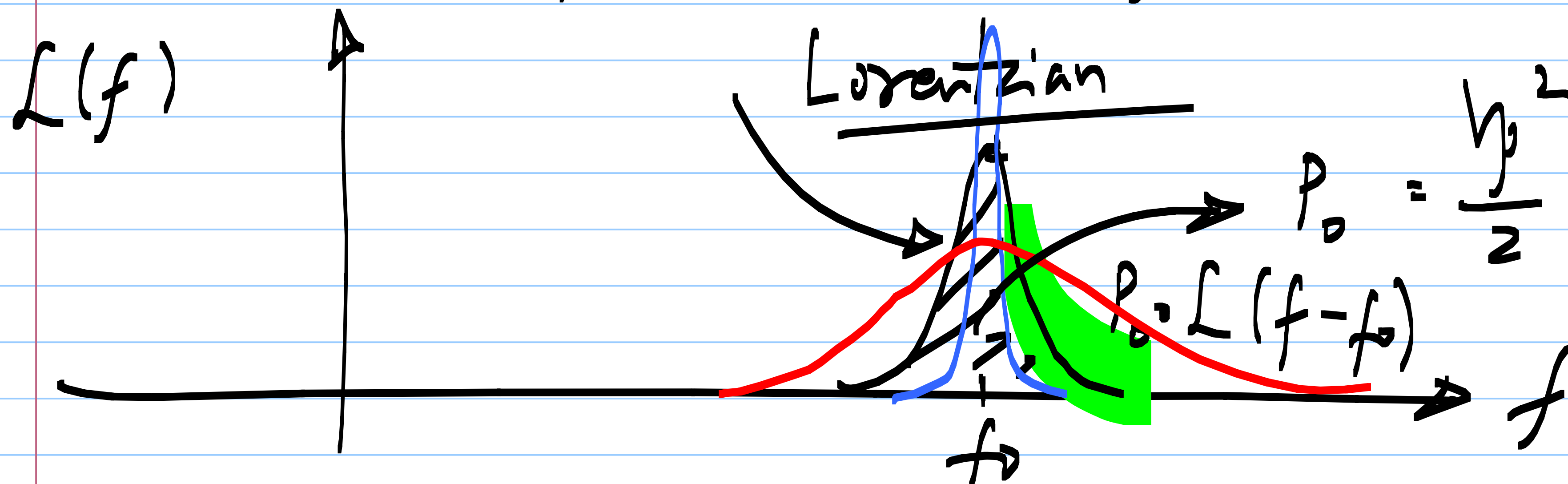
1/f²
1/f₀



$\mathcal{L}(f)$
$1/f^3$
-30dB/dec
-20dB/decade
Noise floor
$1/f^2$
f
f_{1/f^3}
freq. of jitter



Oscillator @ f_0 which has phase noise



Lorentzian : $\dfrac{\alpha}{1+\left(\dfrac{f-f_0}{f_w}\right)^2} \simeq \dfrac{\alpha \cdot f_w^2}{(f-f_0)^2}$

$f-f_0 \gg f_w$

$$\int_{-\infty}^{\infty} \frac{\alpha}{1+\left(\frac{f-f_0}{f_w}\right)^2}\, f_w \cdot d\left(\frac{f-f_0}{f_w}\right) = P_0 = \frac{V_p^2}{2}$$

$$\pi \cdot \alpha \cdot f_w = V_p^2/2$$

$$\alpha =$$

$$\underbrace{\mathcal{L}(f) = \frac{A}{f^2}} \cdot \left| \frac{\phi_{out}}{\phi_{n,vco}} \right|^2$$