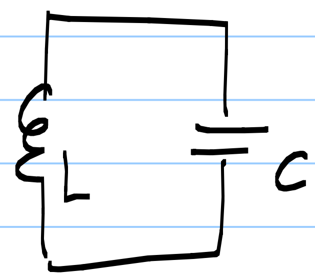
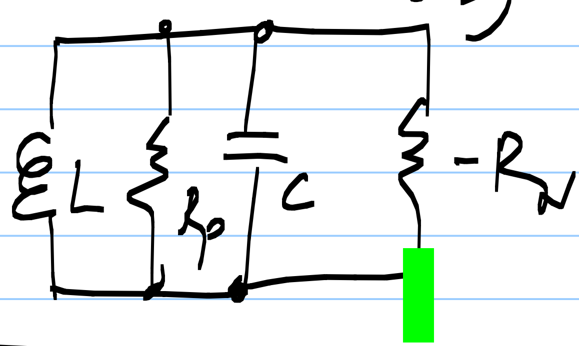
EE 2019 6/4/2017

ideal, Lossless LC



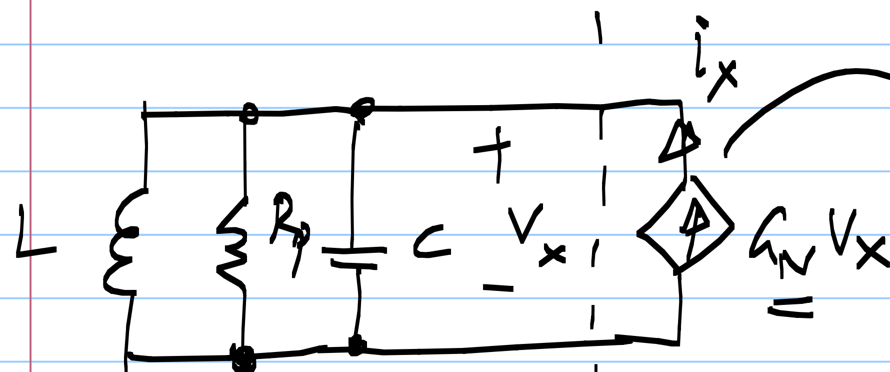

Lossy LC compensated by linear -ve resistance



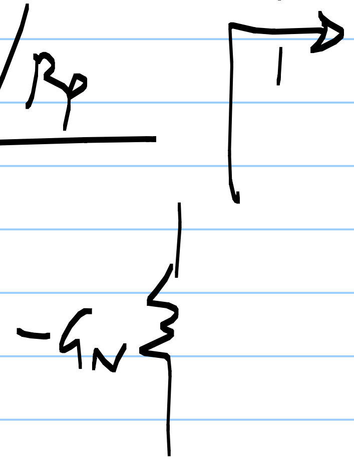

Uncertain

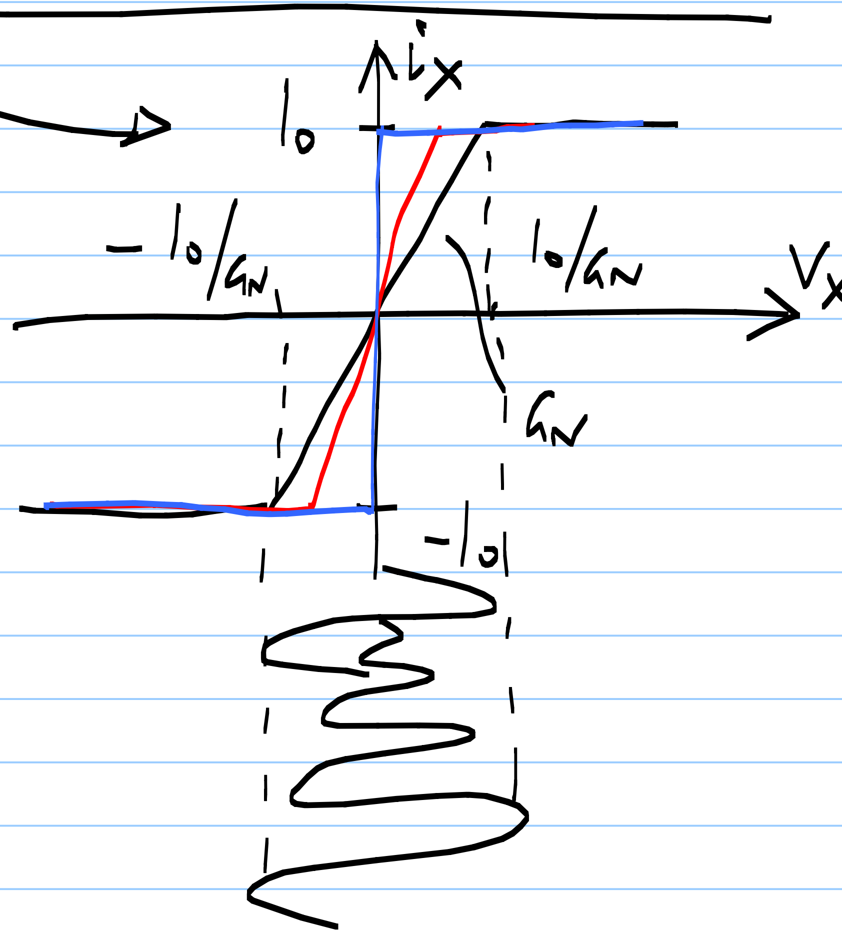
Constant amplitude oscillations

Lossy LC, compensated by -ve conductance w/ current saturation



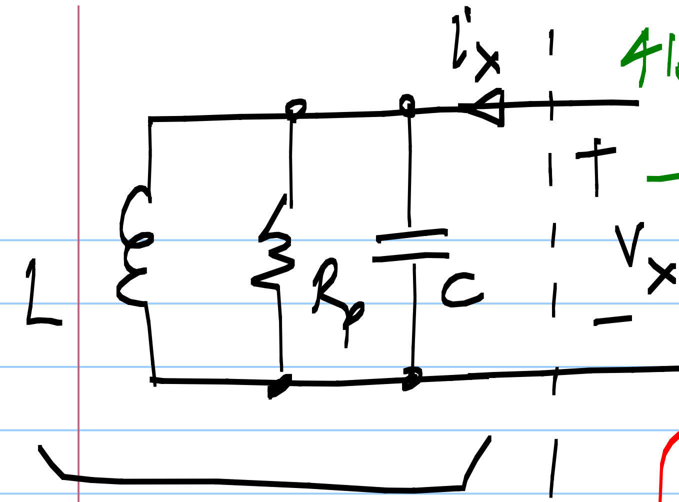

$G_p = 1/R_p$



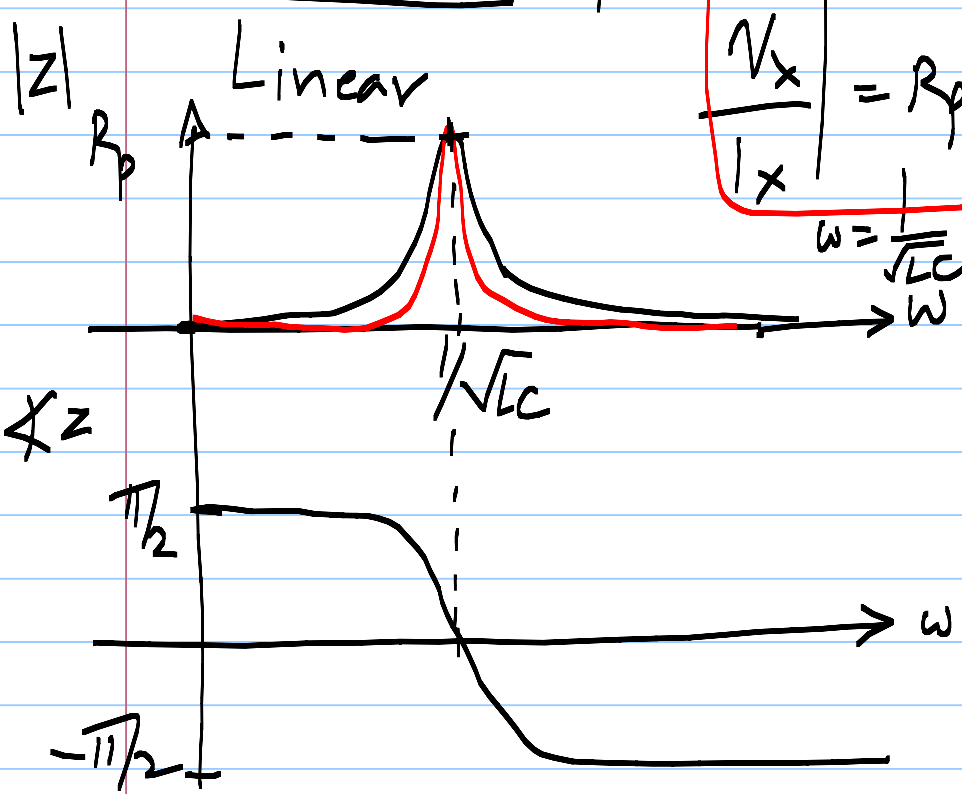

$\boxed{G_N > G_p}$

$G_N = 2G_p$




$\frac{4I_0}{\pi}\cos(\omega_0 t) \rightarrow \frac{4I_0R_p}{\pi}\cos(\omega_0 t)$

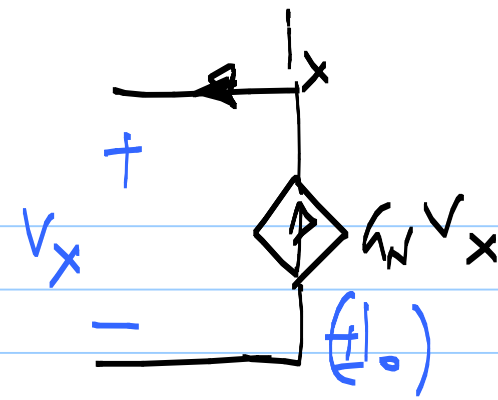
$V_x = V_p\cos\left(\frac{t}{\sqrt{LC}}\right)$

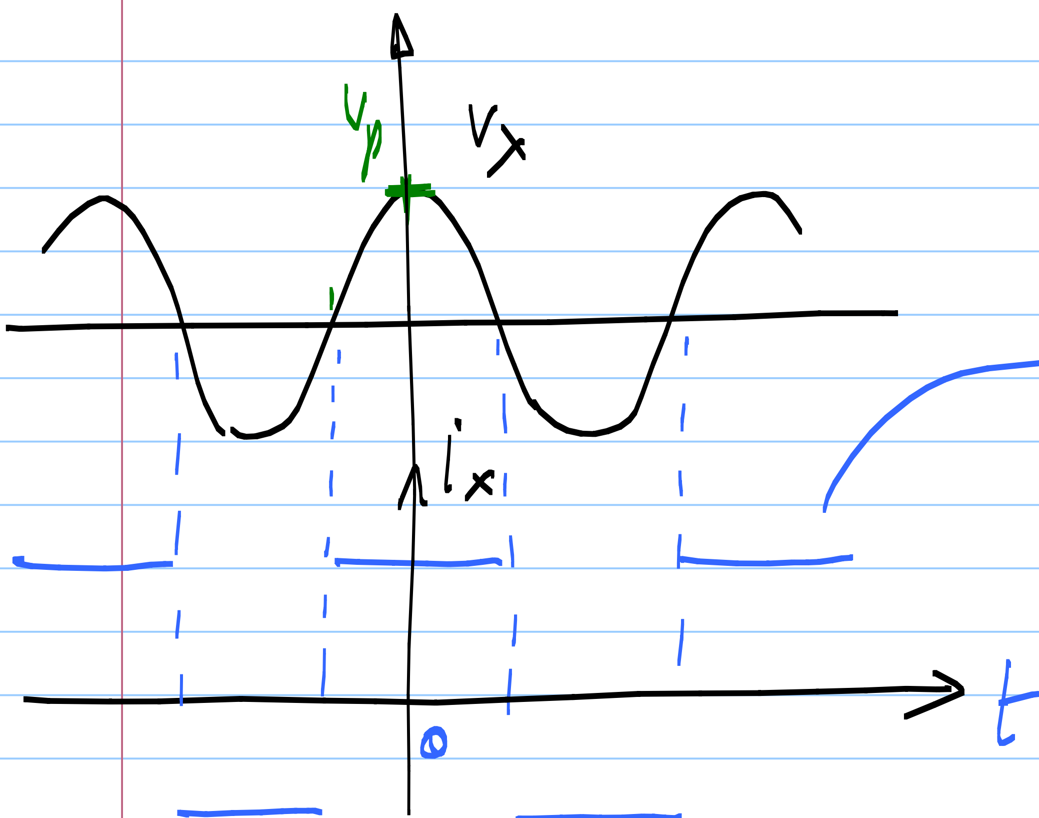



$$\boxed{\left.\frac{V_x}{I_x}\right|_{\omega=\frac{1}{\sqrt{LC}}} = R_p.}$$

$$\frac{V_x}{I_x} = R_p\cdot\frac{sL/R_p}{\underbrace{1+\frac{sL}{R_p}+s^2LC}}$$

$$Q = R_p\sqrt{\frac{C}{L}}$$

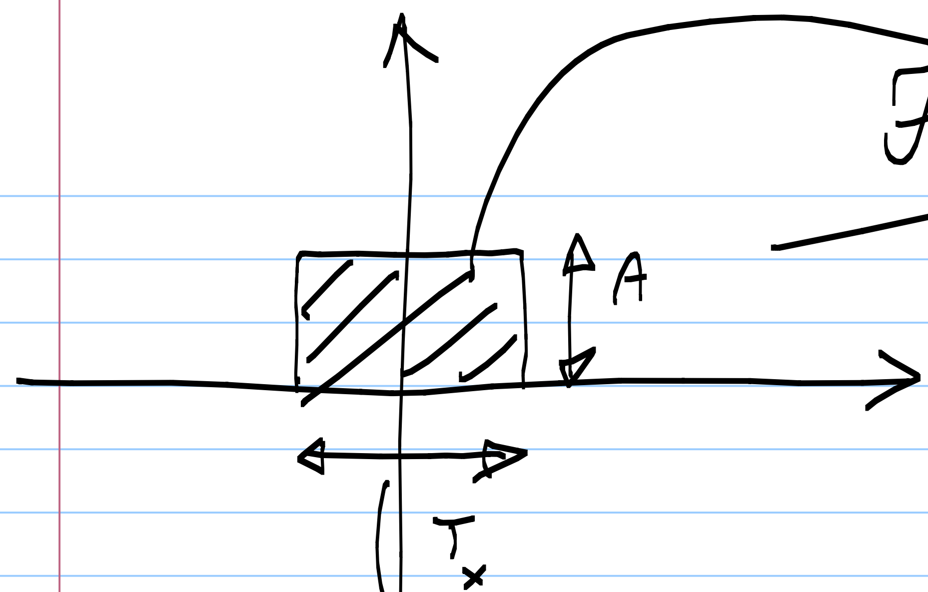



$$\frac{4I_0}{\pi}\cos(\omega_0 t)$$

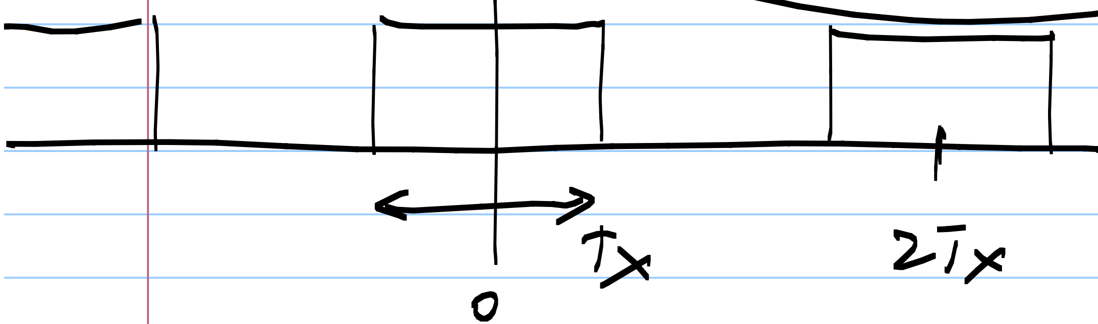
$$i(t) = \sum_{k=1}^{\infty} (-1)^n \left(\frac{4I_0}{k\pi}\right) \cos(k\omega_0 t)$$

$$p(t) = \underset{0}{\cancel{a_0}} + \sum_{k=1}^{\infty} (-1)^n \left(\frac{4I_0}{k\pi}\right) \cos(k\omega_0 t)$$



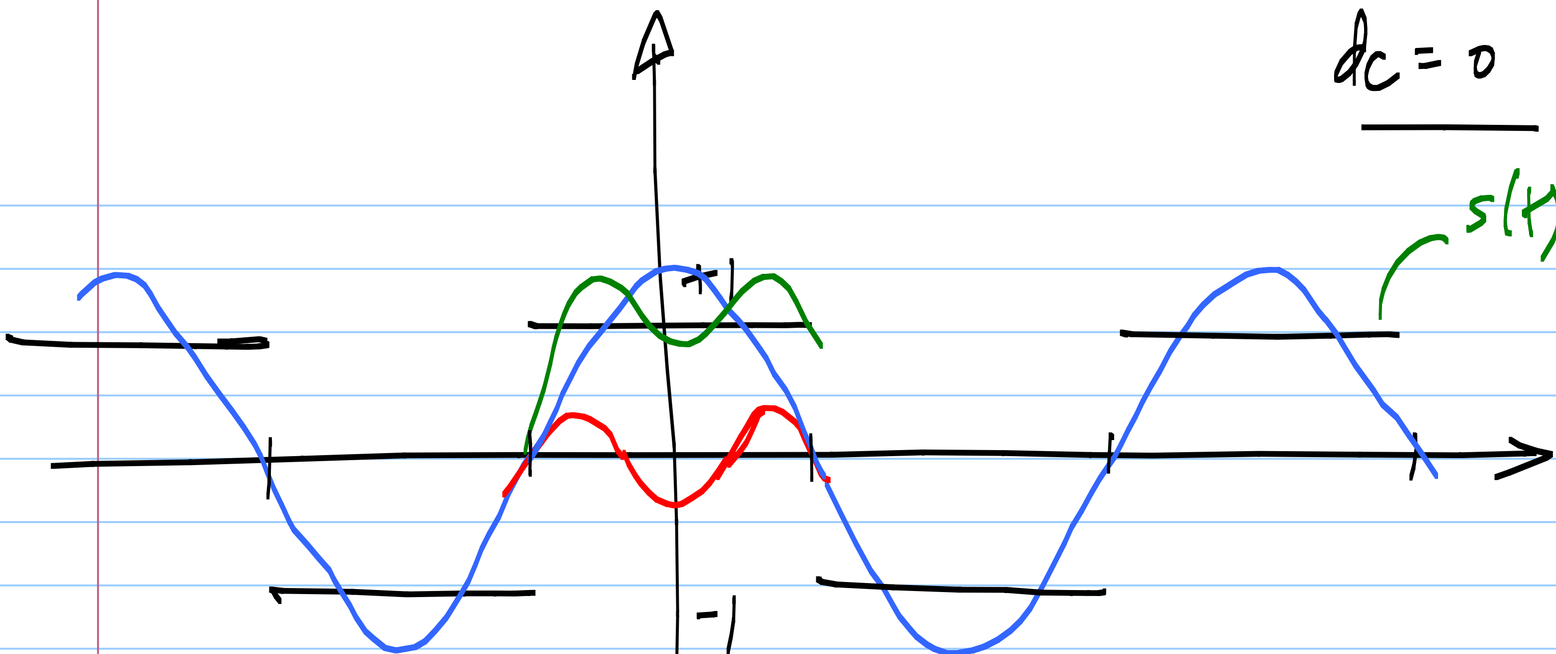

$$\xrightarrow{\mathcal{F}} (AT_x)\,\mathrm{sinc}\,(f \cdot T_x)$$

$$\frac{\omega}{2\pi} \cdot f : Hz$$




$$AT_x\,\mathrm{sinc}\,(fT_x) \cdot \frac{1}{2T_x} \sum \delta\left(f - \frac{n}{2T_x}\right.$$

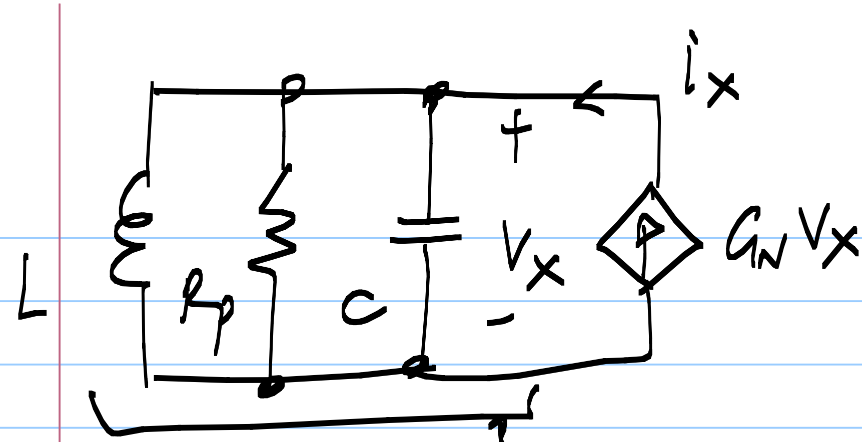
$\underline{dc = 0}$

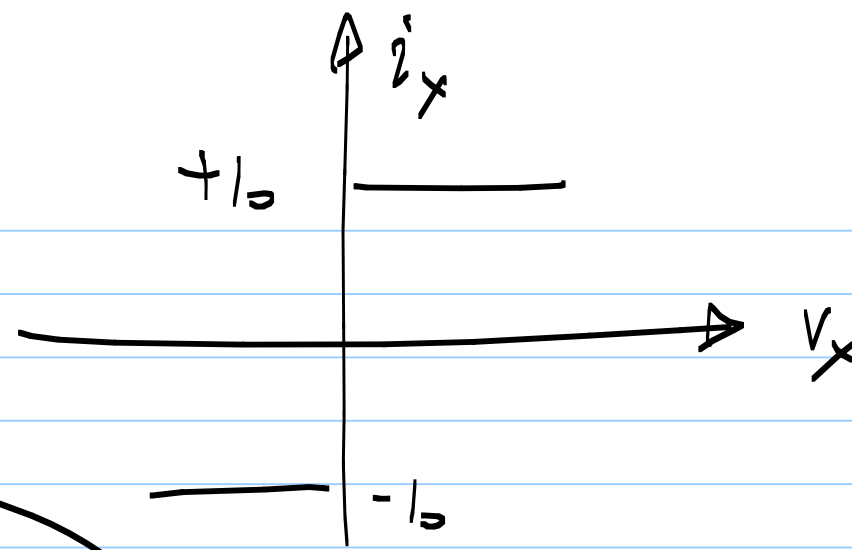



$\frac{4}{\pi}, \frac{4}{3\pi}$

$$s(t) = \sum_{k=0}^{\infty} (-1)^k \frac{4I_0}{(2k+1)\pi} \cdot \cos\left((2k+1)\cdot\omega_0 t\right)$$

$$\sum_{k;\,odd} \frac{4I_0}{k\pi} \cos(k\omega_0 t) \cdot (-1)^{\frac{(k-1)}{2}}$$




$$V_x = \left[\frac{4 I_0 R_p}{\pi}\right] \cos(\omega_0 t)$$

$G_N \gg G_p$

Amplitude : $\frac{4 I_0 R_p}{\pi}$

High Q ⇒ only fundamental voltage exists across the tank

High Q: Tank voltage is of the form

$$V_p \cos\left( t/\sqrt{LC} \right)$$

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Current from $G_v$: $\displaystyle\sum_k \left(\frac{4I_o}{\pi}\right)(-1)^{(k-1)/2} \cos\left(\frac{kt}{\sqrt{LC}}\right)$

Fund. comp. $\displaystyle\frac{4I_o}{\pi} \cos\left(\frac{t}{\sqrt{LC}}\right)$

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@ $\dfrac{1}{\sqrt{LC}}$ $\quad \left.\dfrac{V}{I}\right|_{tank} = R_p$ $\qquad \dfrac{4I_o}{\pi} \cdot R_p = V_p$