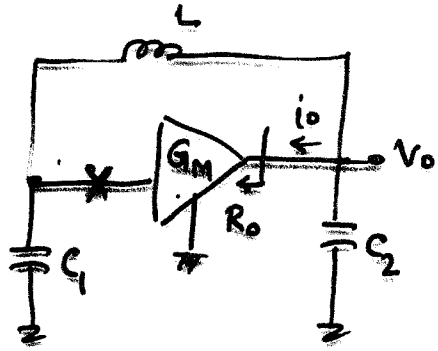
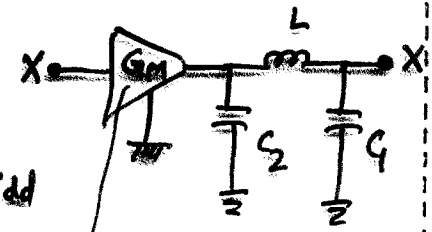
Oscillators

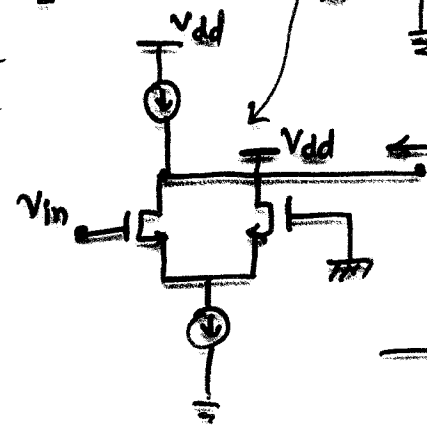
LC oscillators

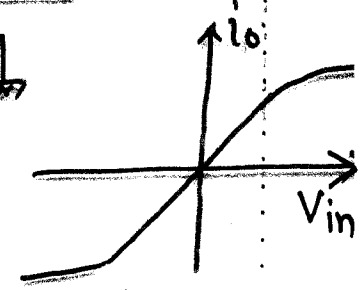
1) Colpitts Oscillator



$\Rightarrow$



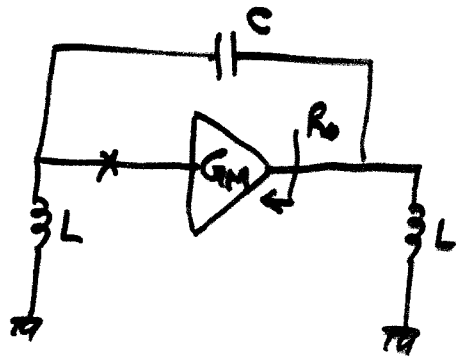




$$\omega_{osc} = \frac{1}{\sqrt{L\left(\frac{C_1 C_2}{C_1 + C_2}\right)}}$$

$$G_M R_o = \frac{C_2}{C_1}$$

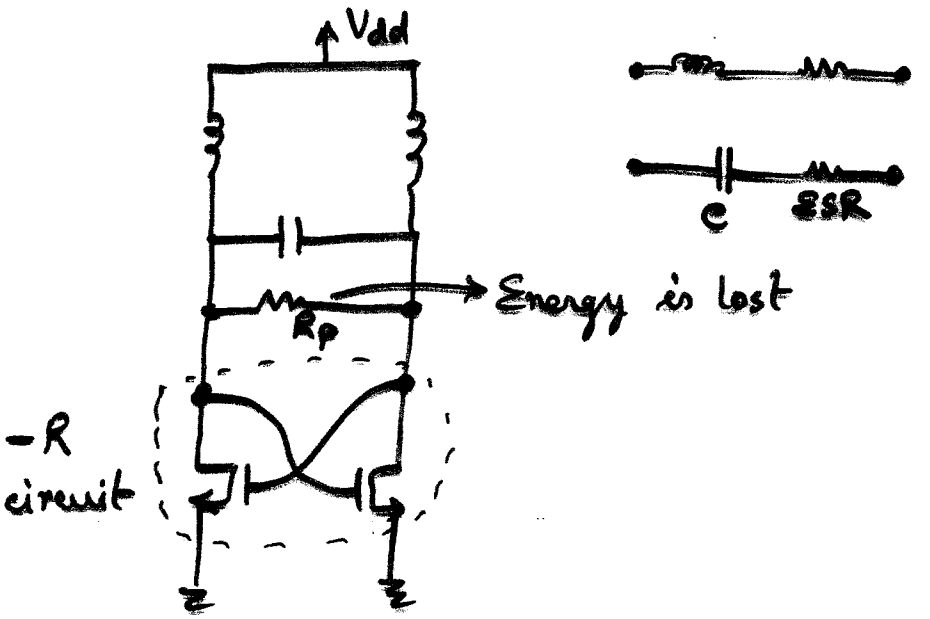
2) Hartley Oscillator

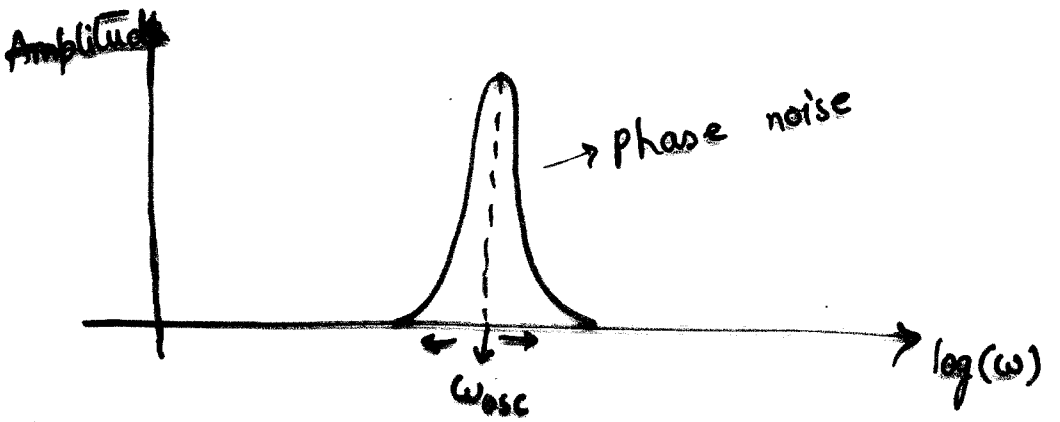


$$\omega_{osc} = \frac{1}{\sqrt{C(L_1 + L_2)}}$$

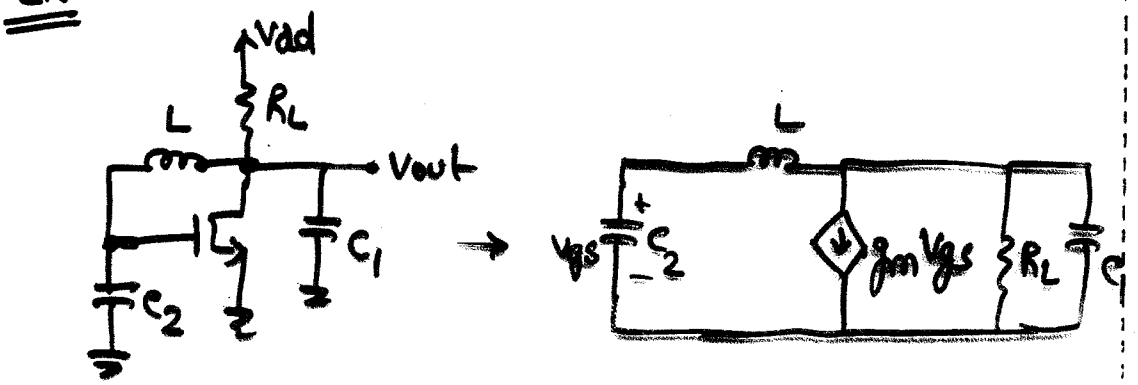
$$G_M R_o = \frac{L_1}{L_2}$$

3) LC oscillator





Ex



Nodal Equations -

① $g_m V_{gs} + G_L V_{out} + sC_1 V_{out} + \frac{V_{out} - V_{gs}}{sL} = 0$

② $\frac{V_{out} - V_{gs}}{sL} = sC_2 V_{gs}$

$T(j\omega)$

$\Rightarrow (g_m + G_L - \omega^2 L C_2 G_L) + j\omega(C_1 - \omega^2 L C_1 C_2 + C_2) = 0$

$\equiv 1 + j0$

① $\omega_{osc}(C_1 - \omega_{osc}^2 L C_1 C_2 + C_2) = 0$

$\omega_{osc} = \frac{1}{\sqrt{L\left(\frac{C_1 C_2}{C_1 + C_2}\right)}}$

② $(g_m + G_L - \omega_{osc}^2 L C_2 G_L) = 1$

$\downarrow$

$g_m R_L = \frac{C_2}{C_1}$.