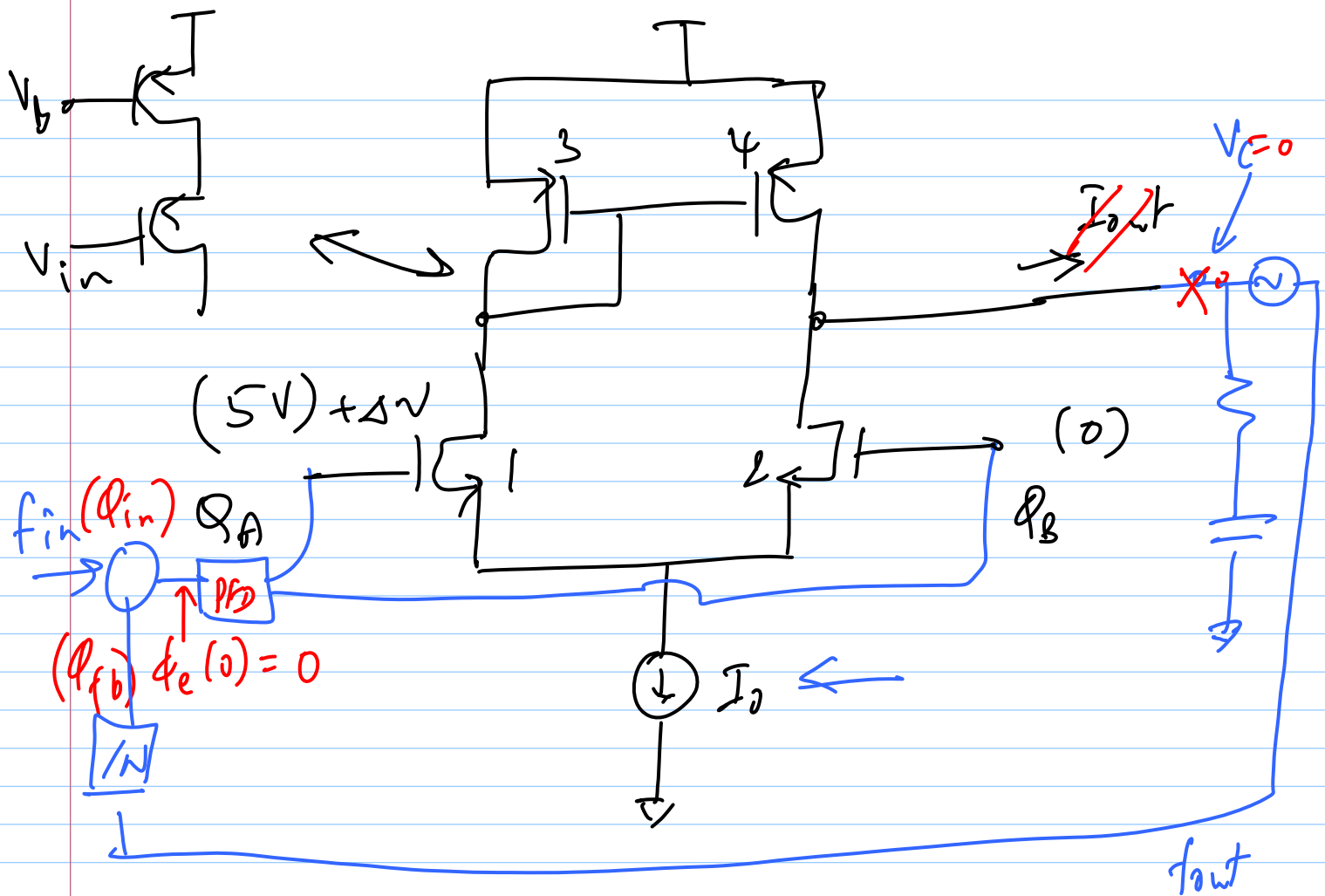
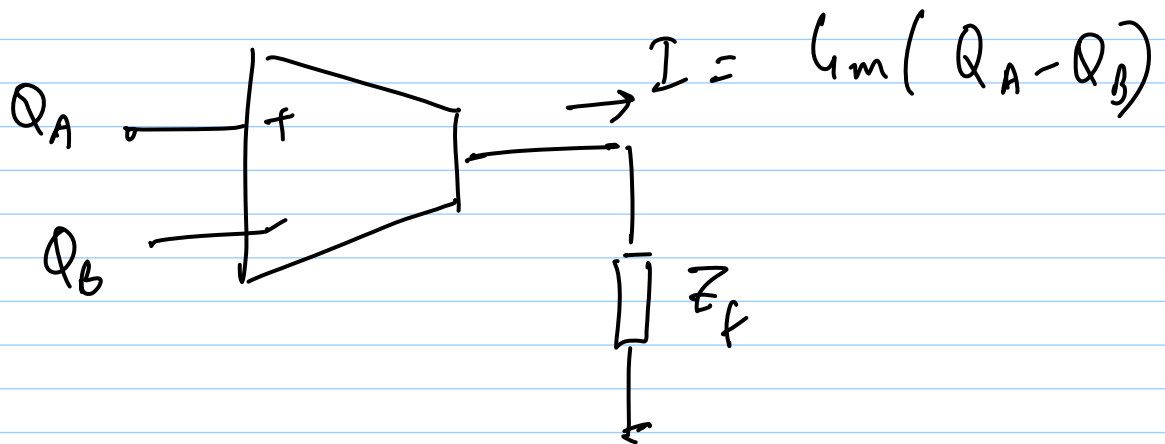
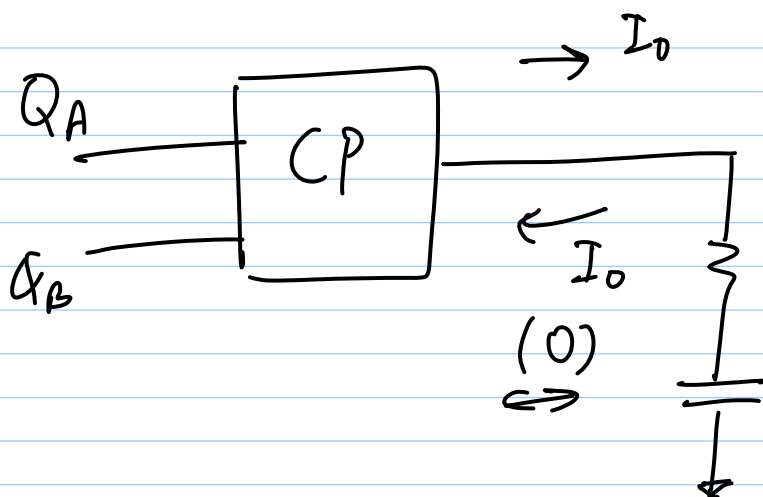
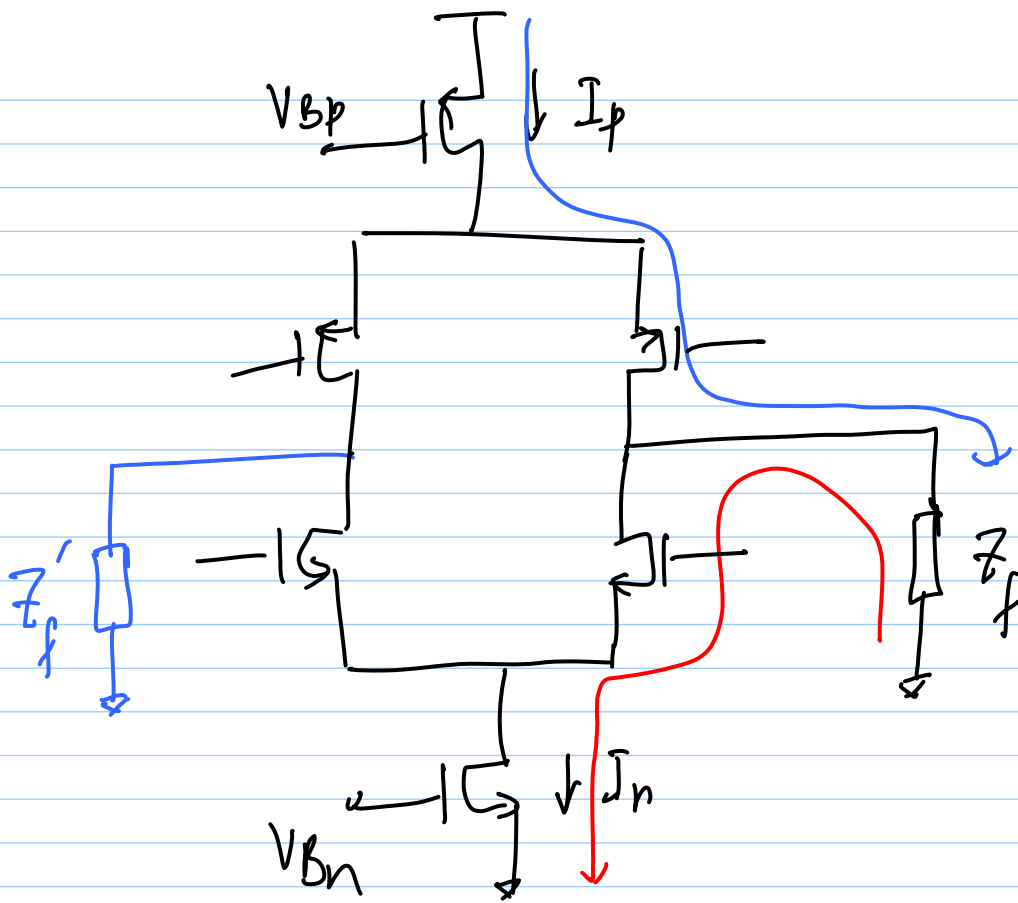
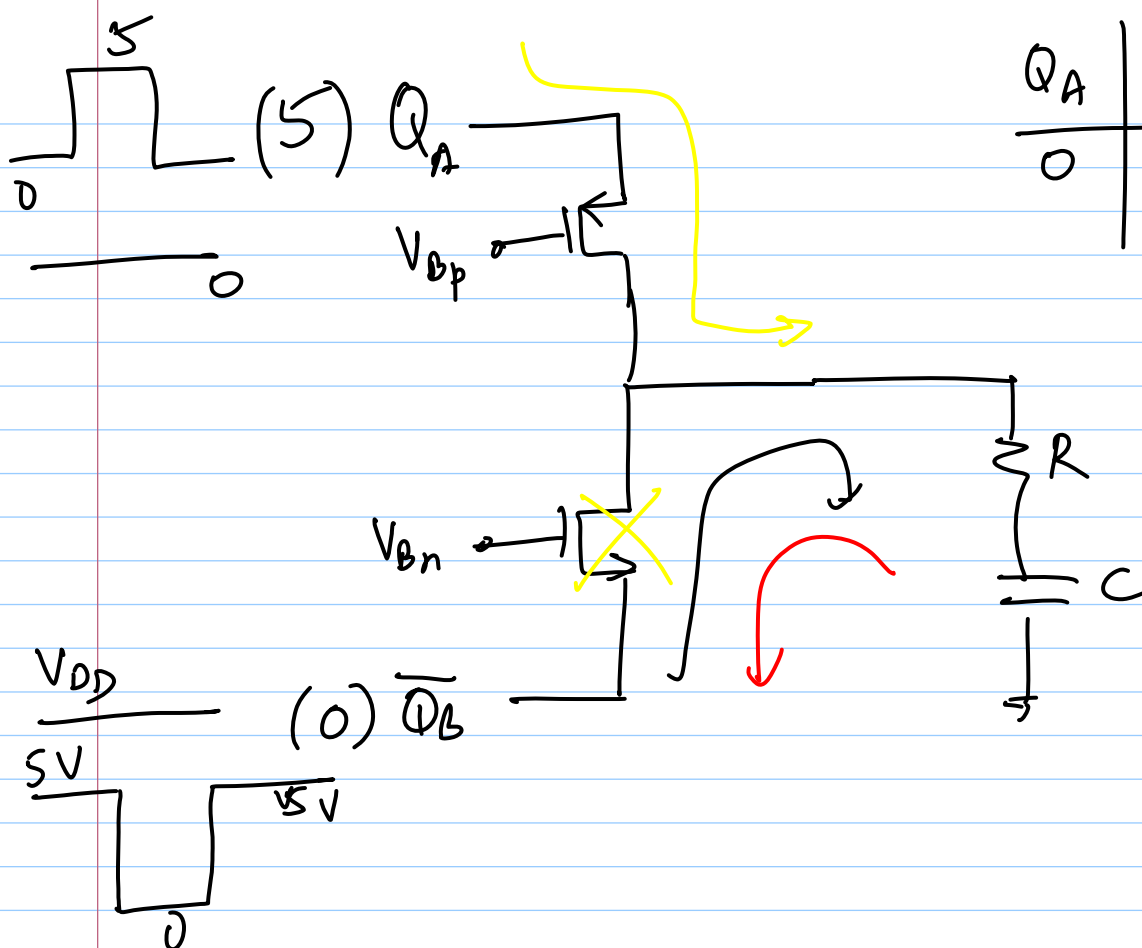
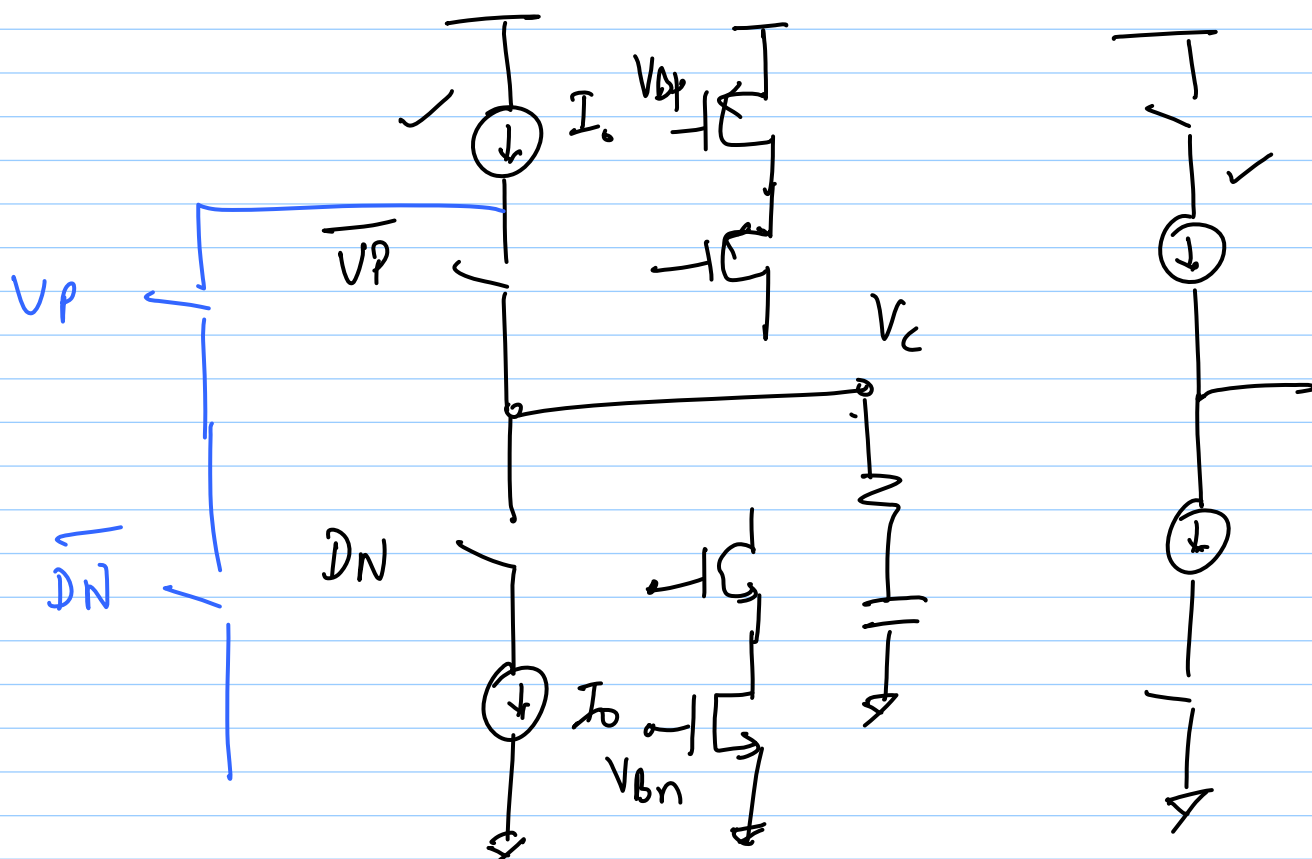


$$\underline{17-4-13}$$

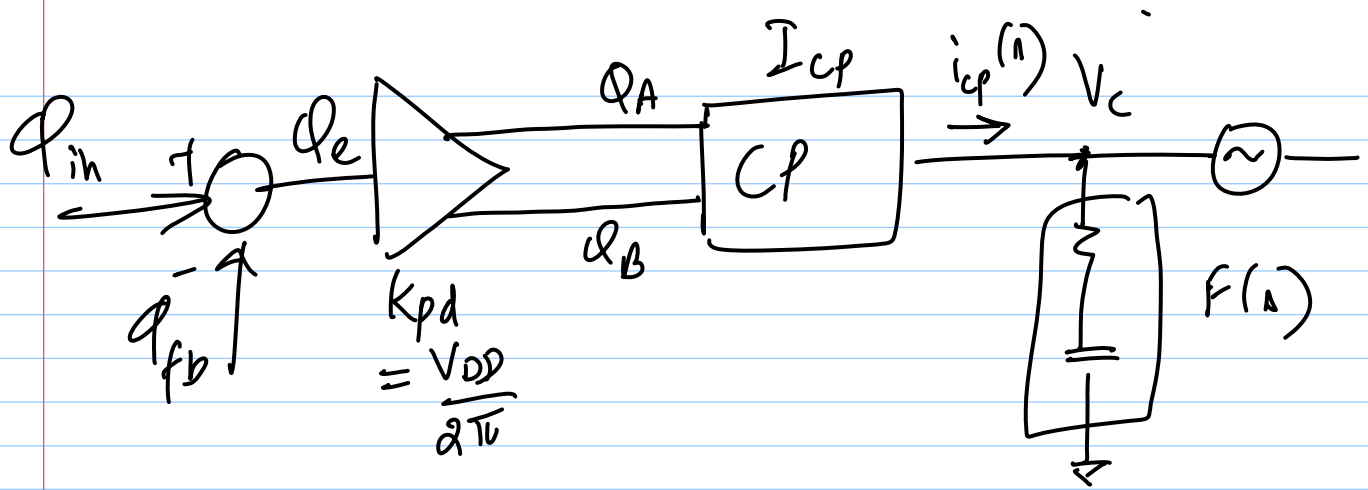
Lec 44





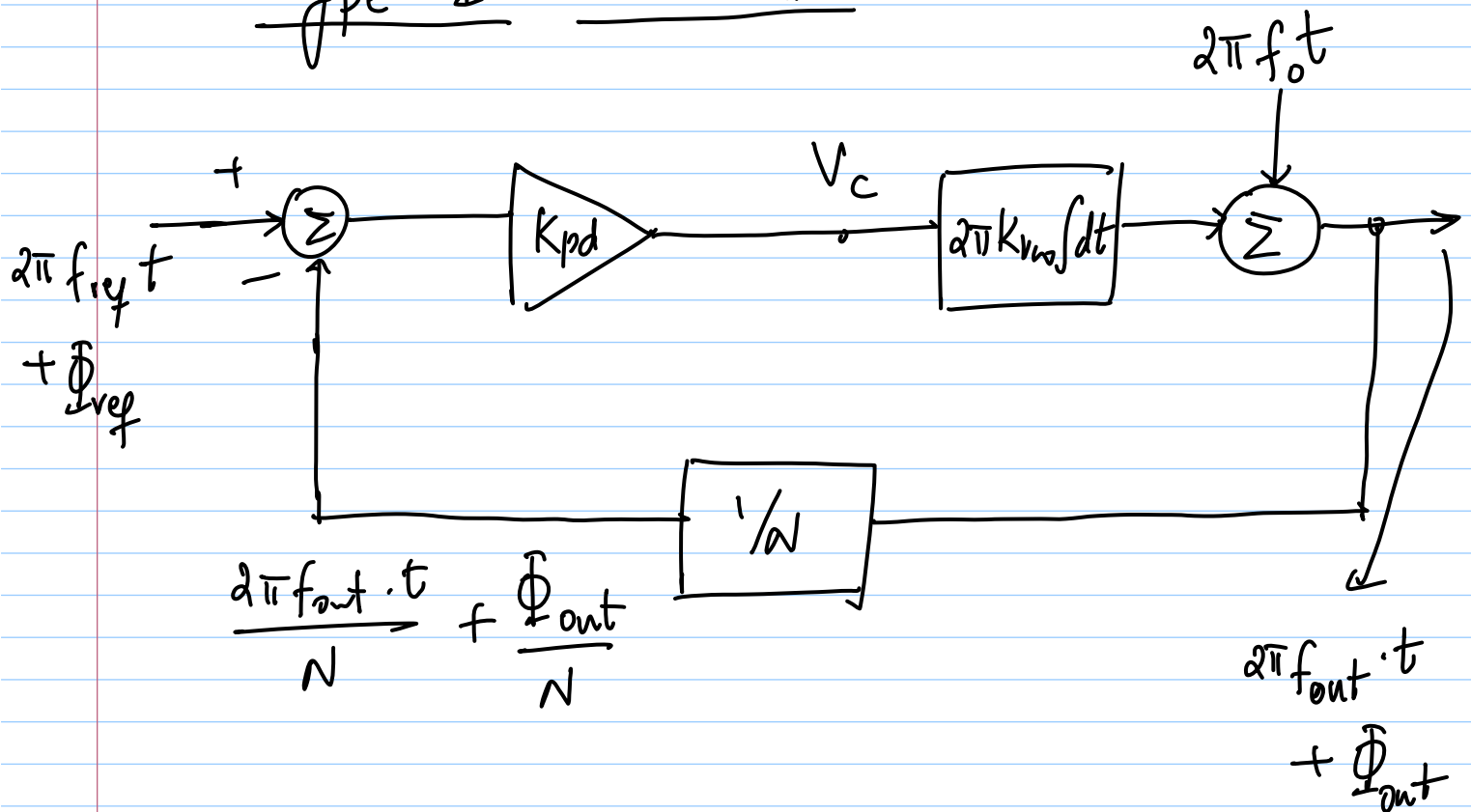


Q_A	$\overline{Q_B}$	
0	V_{DD}	✓



$$\begin{aligned} \frac{i_{CP}}{\phi_e}(s) &= \frac{V_{DD}}{2\pi} \cdot \left(\frac{I_{CP}}{V_{DD}} \right) \\ &= \frac{I_{CP}}{2\pi} \end{aligned}$$

Type-I PLL model

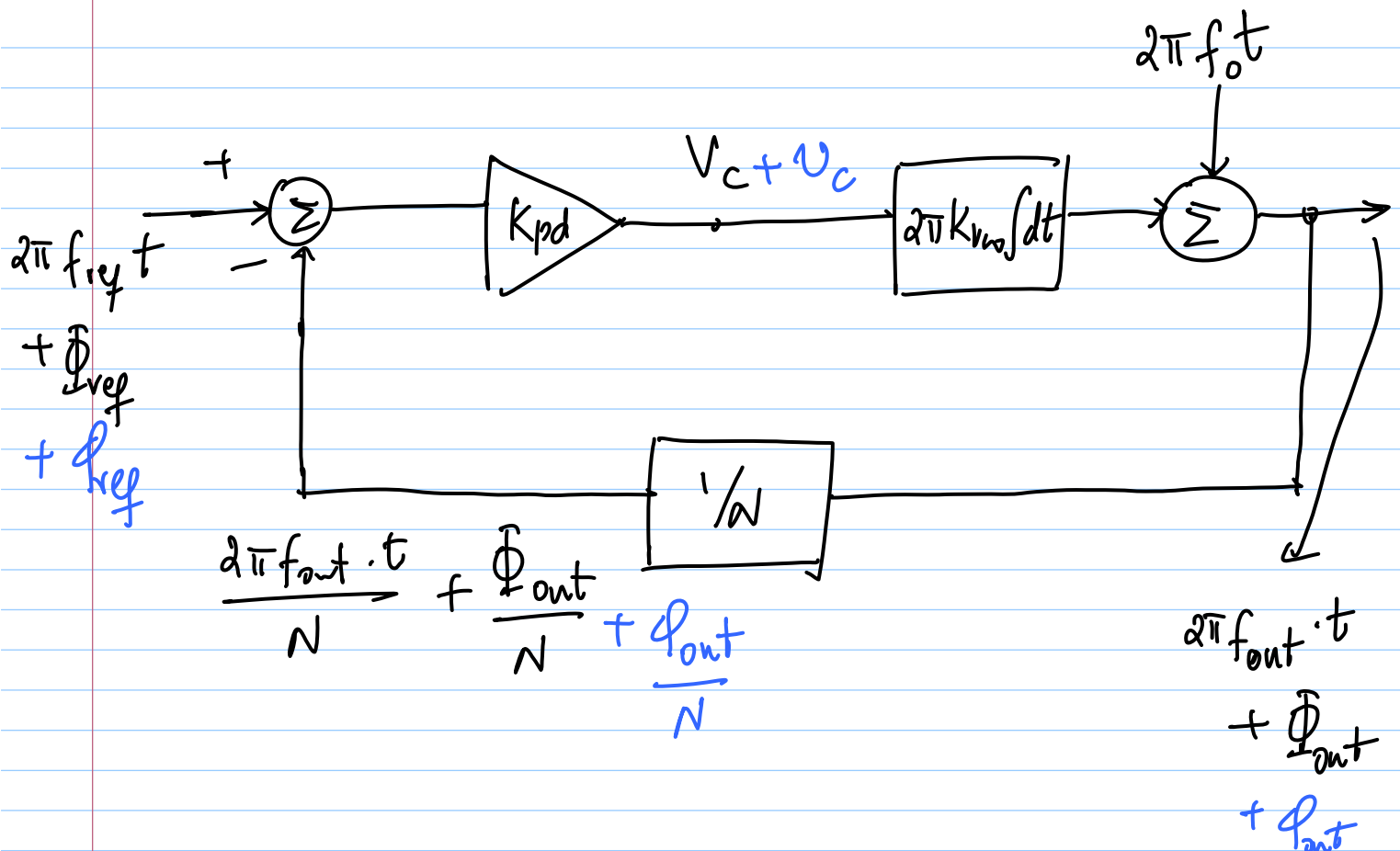


In steady state (lock),

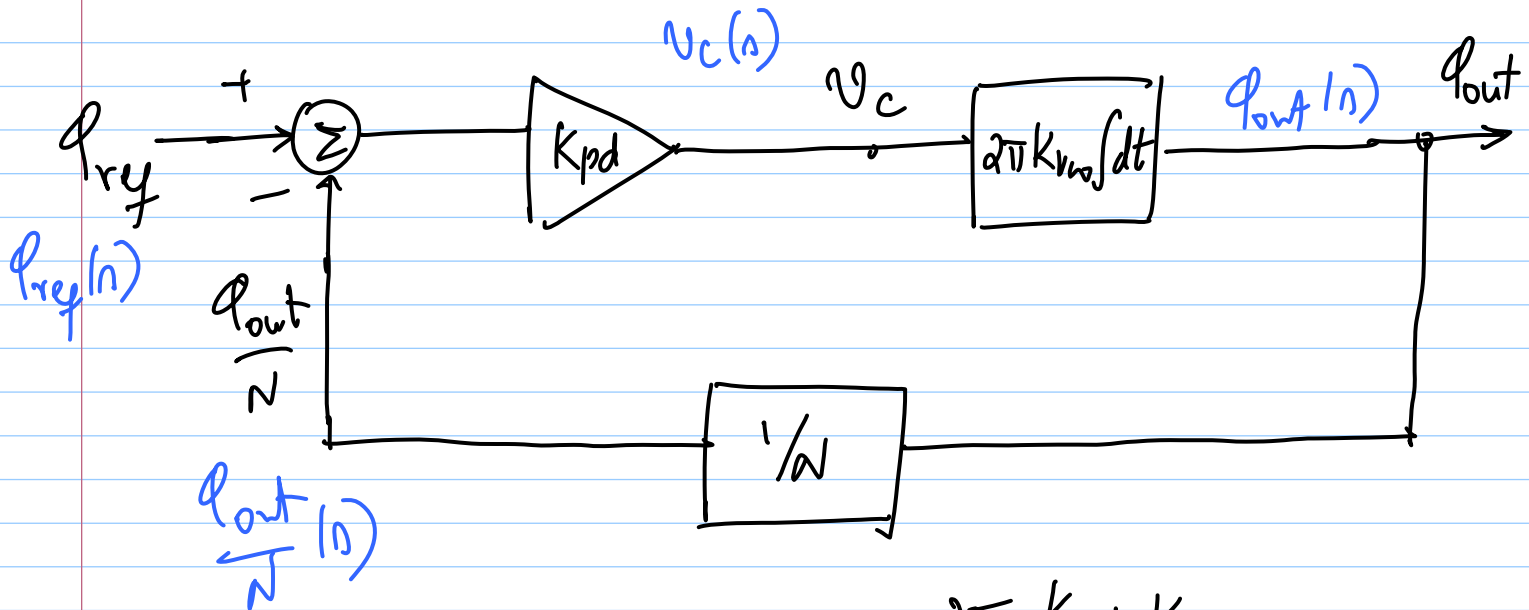
$$f_{ref} = \frac{f_{out}}{N}$$

$$V_c = K_{pd} \left(\Phi_{ref} - \frac{\Phi_{out}}{N} \right)$$

$$= \frac{(N f_{ref} - f_o)}{K_{vco}}$$



Incremental Picture



Loop gain $L(n) = \frac{2\pi K_{pd} K_{vco}}{N s}$

$$\frac{q_{out}}{q_{ref}}(n) = \frac{N \cdot \frac{L(n)}{1+L(n)}}{N}$$

$$= \frac{1}{1 + \frac{N s}{2\pi K_{pd} K_{vco}}}$$