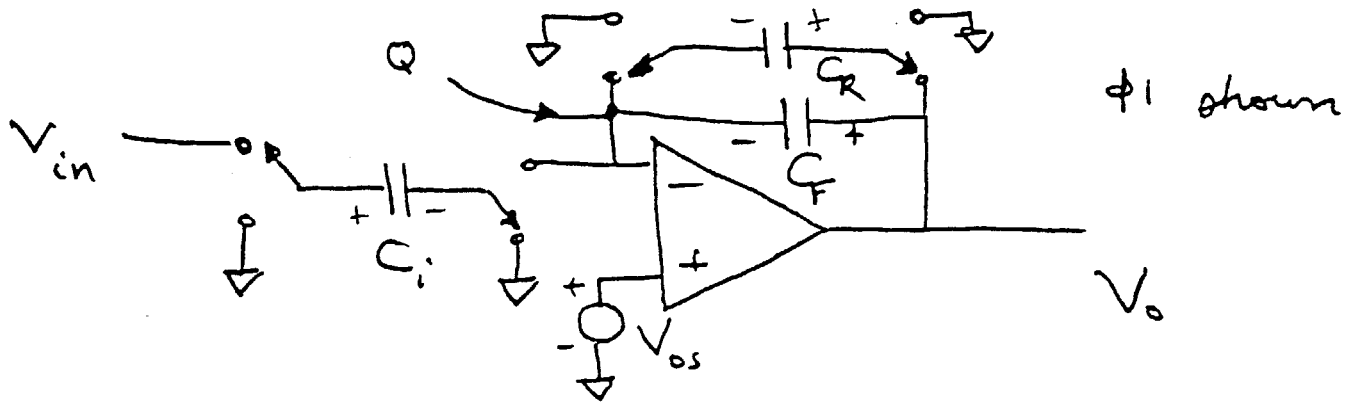
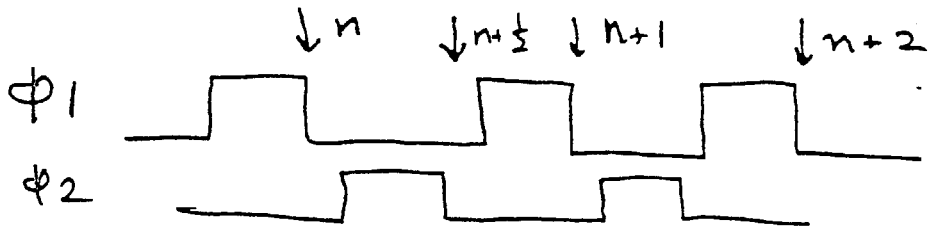
P.H.

DC output offset calculation:

1) Due to of any input offset voltage:





w/ $V_{in}=0V$, $Q=0C$.

$\phi 1$, time n: $V_o(n) = V_{C_F}(n) + V_{os}$

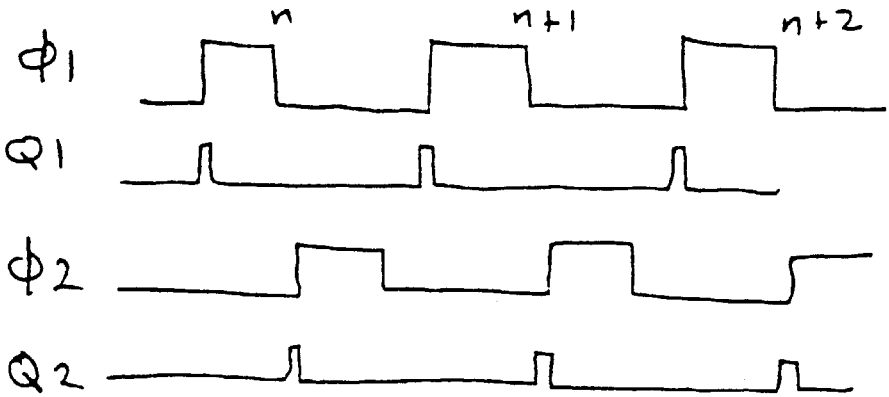
$\phi 2$, time $n+\frac{1}{2}$:
$$\begin{cases} -Q_{C_i}(n) - Q_{C_F}(n) = -Q_{C_i}(n+\frac{1}{2}) - Q_{C_F}(n+\frac{1}{2}) \\ V_o(n+\frac{1}{2}) = \underbrace{V_{C_F}(n) + \frac{C_i}{C_F} V_{os}}_{V_{C_F}(n+\frac{1}{2})} + V_{os} \end{cases}$$

$\phi 1$, time $n+1$:
$$\begin{cases} -Q_{C_R}(n+\frac{1}{2}) - Q_{C_F}(n+\frac{1}{2}) = -Q_{C_R}(n+1) - Q_{C_F}(n+1) \\ V_o(n+1) = \underbrace{\frac{C_F}{C_F+C_R} V_{C_F}(n+\frac{1}{2})}_{V_{C_F}(n+1)} + V_{os} \end{cases}$$

$$\therefore V_o(n+1) = \frac{C_F}{C_F+C_R}\left[V_o(n) - V_{os} + \frac{C_i}{C_F} V_{os}\right] + V_{os}$$

$$n \to \infty \Rightarrow V_o(\infty) = \left(1 + \frac{C_i}{C_R}\right) V_{os}.$$

2) Due to charge dumping on ⊖ node:



w/ $V_{in}=0V$ and $V_{os}=0.0mV$:

$\phi 1, n$: $V_o(n)$

$\phi 2, n+\frac{1}{2}$: $V_o(n+\frac{1}{2}) = \frac{Q2}{C_F} + V_o(n)$

$\phi 1, n+1$: $V_o(n+1) = \frac{Q1}{C_F+C_R} + \frac{C_F}{C_F+C_R} V_o(n+\frac{1}{2})$

$\phi 2, n+\frac{3}{2}$: $V_o(n+\frac{3}{2}) = \frac{Q2}{C_F} + V_o(n+1)$

<u>on $\phi 1$</u>: $V_o(n+1) = \frac{Q1}{C_F+C_R} + \frac{Q2}{C_F+C_R} + V_o(n)\frac{C_F}{C_F+C_R}$

$n \to \infty \Rightarrow V_o(\infty) = \frac{Q1+Q2}{C_R}$

<u>on $\phi 2$</u>: $V_o(n+\frac{3}{2}) = \frac{Q2}{C_F} + \frac{Q1}{C_F+C_R} + \frac{C_F}{C_F+C_R} V_o(n+\frac{1}{2})$

$n \to \infty \Rightarrow V_o(\infty) = \frac{Q1}{C_R} + \frac{Q2}{\frac{C_F C_R}{C_F+C_R}}$