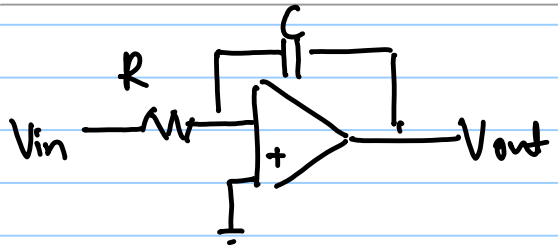
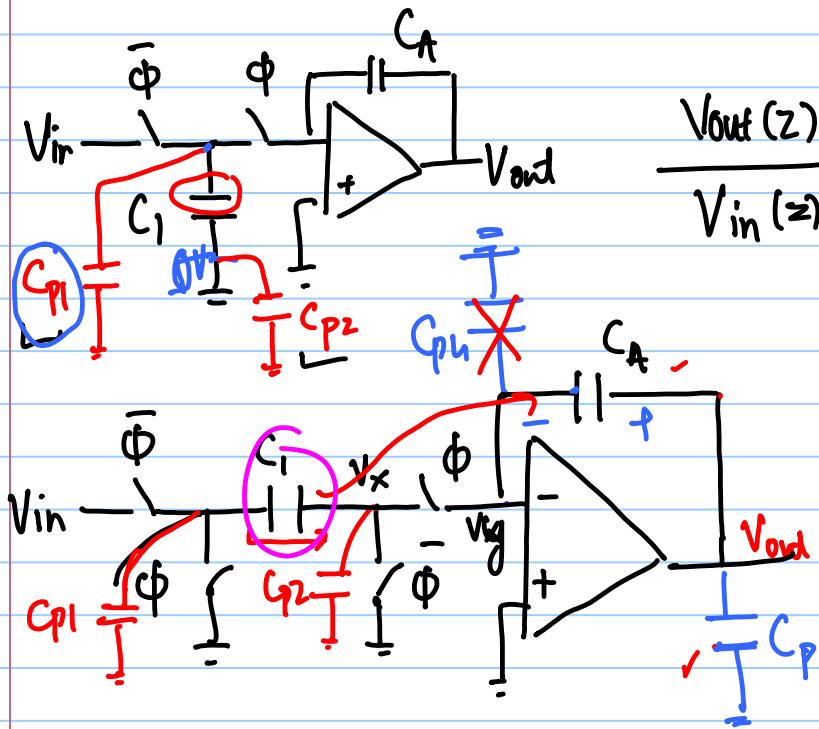
Note Title 16-04-2019

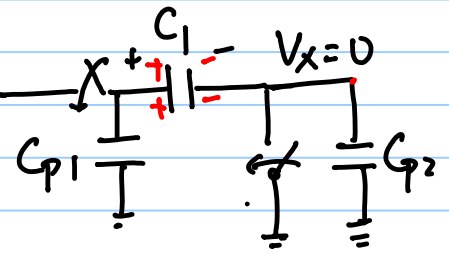
Lecture # 44





$$\frac{V_{out}(z)}{V_{in}(z)} = -\frac{(C_1' + C_{p1})}{C_A(z-1)} = C_1$$

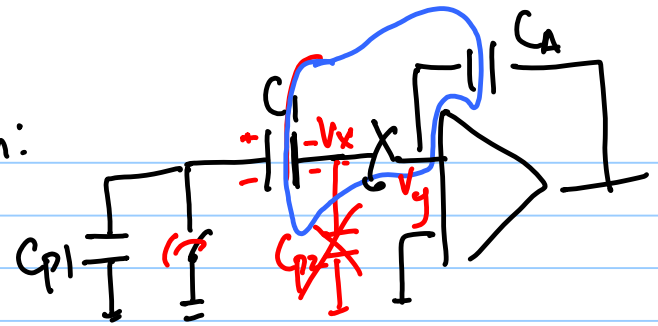
ϕ is low:



$$q_1(nT + T/2) = C_1 V_{in}(nT + T/2)$$

$$q_{cp1}(nT + T/2) = C_{p1} V_{in}(nT + T/2)$$

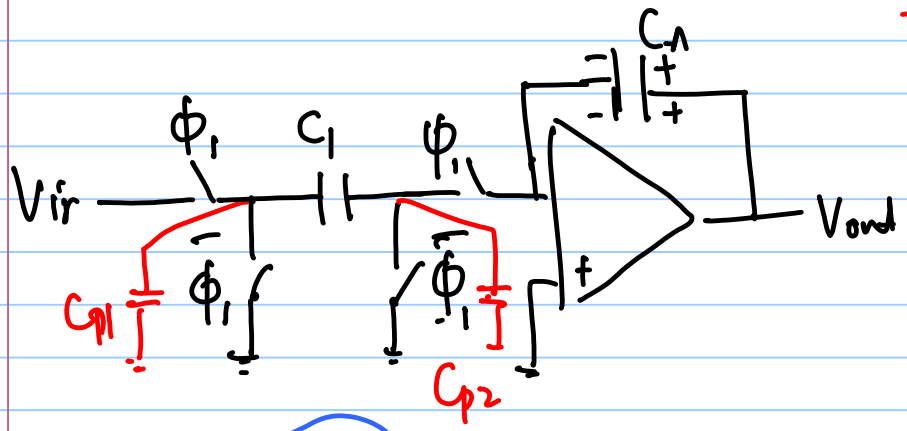
ϕ is high:



$$-C_1 V_{in}(nT+T/2) - C_A V_{out}(nT) = -C_A V_{out}(\overline{n+1}\,T)$$

$$V_{out}(\overline{n+1}\,T) = V_{out}(nT) + \frac{C_1}{C_A} V_{in}(nT+T/2)$$ ✓

$V_{in}(nT)$

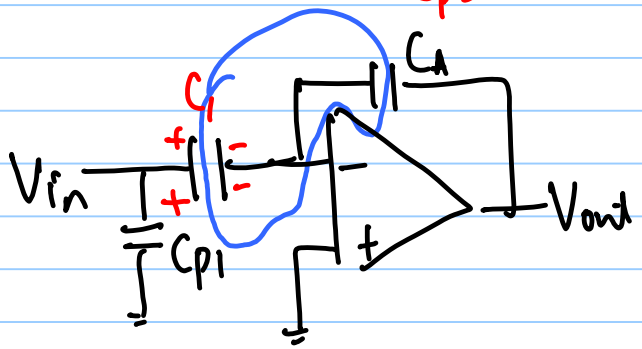


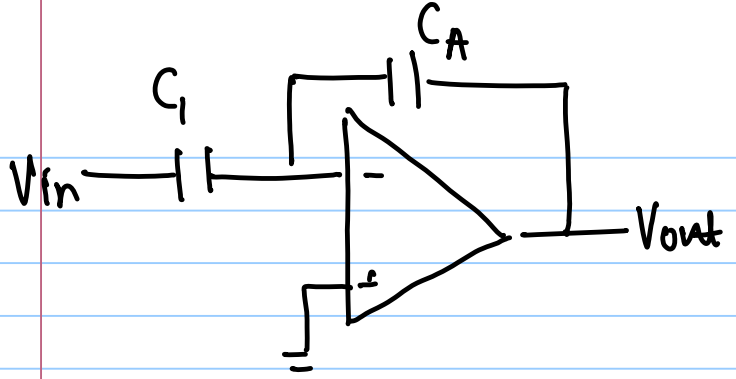
ϕ_1 is low:

ϕ_1 is high:

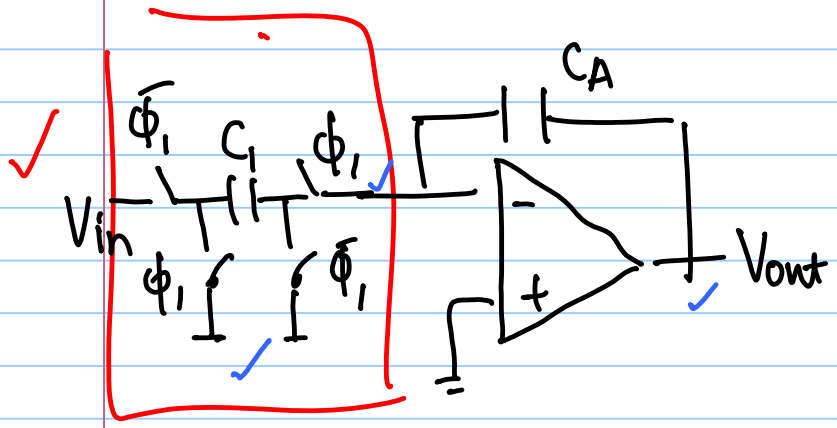
$$\underline{-C_A V_{out}(nT)} + \underline{0} = \underline{-C_1 V_{in}(\overline{n+1}\,T)} \underline{- C_A V_{out}(\overline{n+1}\,T)}$$

$$V_{out}(\overline{n+1}\,T) = V_{out}(nT) - \frac{C_1}{C_A} V_{in}(\overline{n+1}\,T)$$ ✓

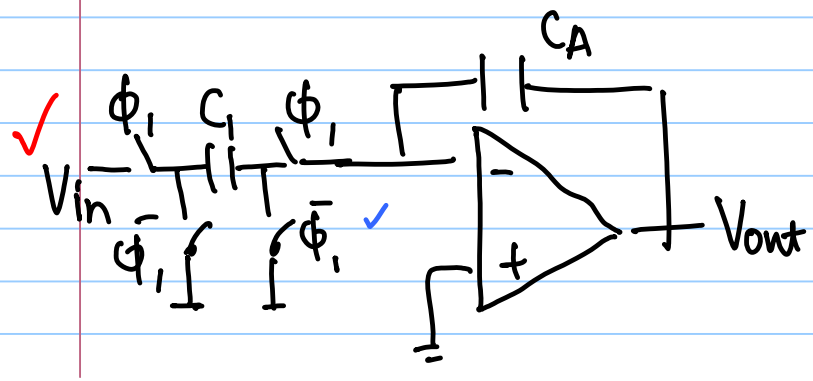




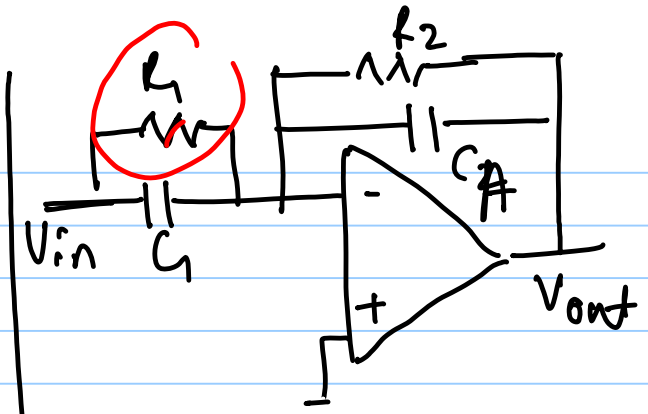
$$\frac{V_{out}(z)}{V_{in}(z)} = -\frac{C_1}{C_A}$$

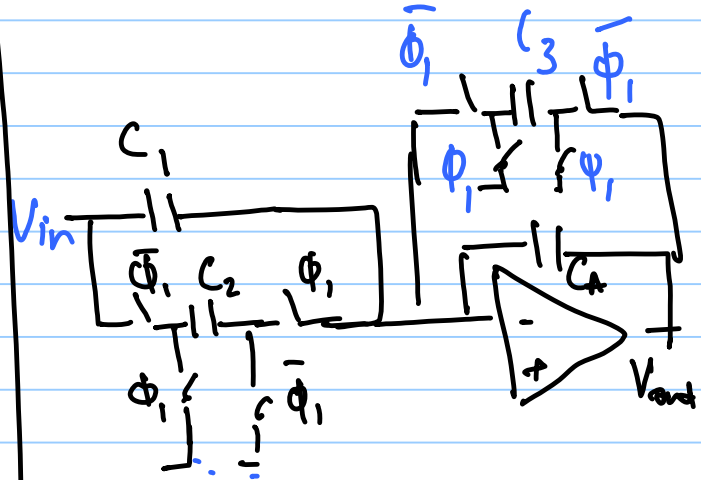


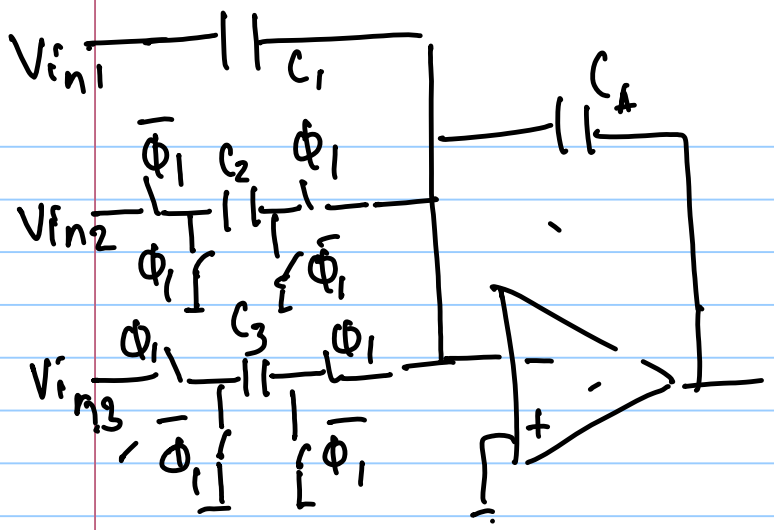
$$\frac{V_{out}(z)}{V_{in}(z)} = \frac{C_1}{C_A}\,\frac{1}{z-1}$$

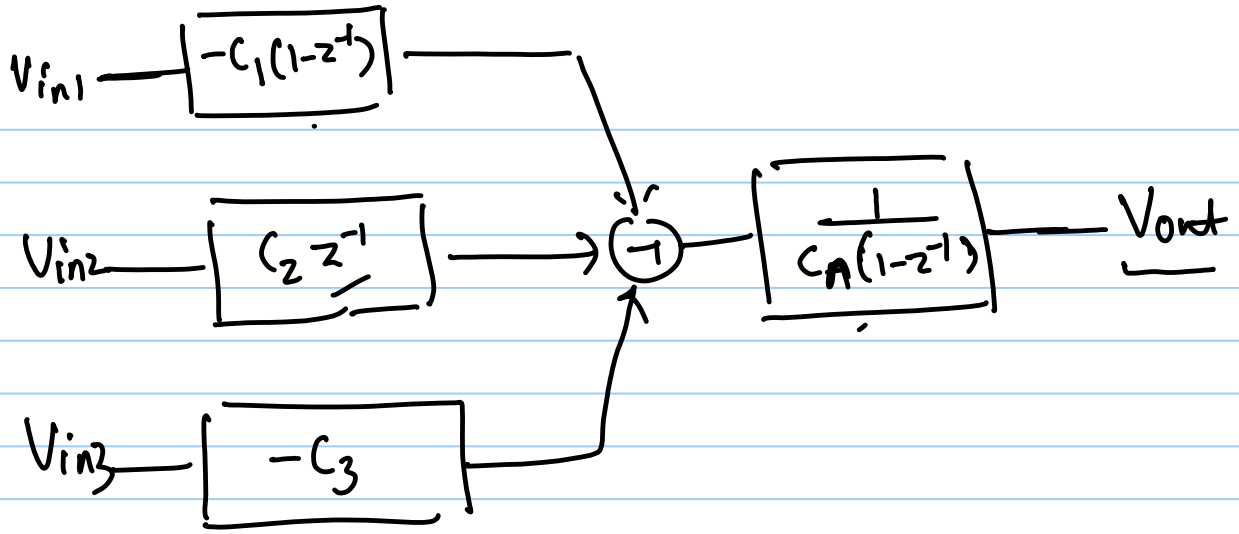


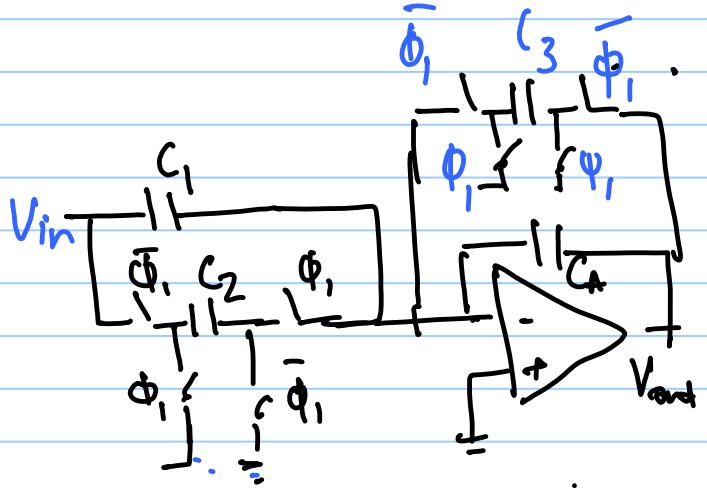
$$\frac{V_{out}(z)}{V_{in}(z)} = -\frac{C_1}{C_A}\,\frac{z}{z-1}$$

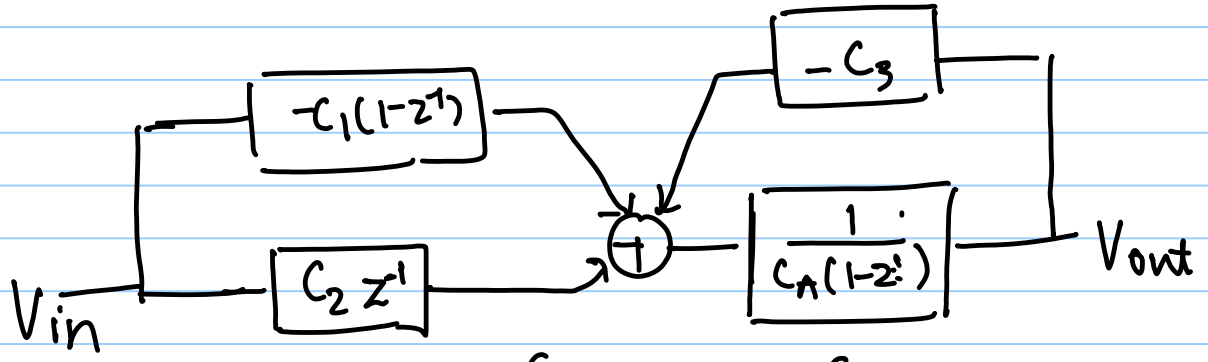












$$\frac{V_{out}(z)}{V_{in}(z)} = -\frac{\frac{C_1+C_2}{C_A}z - \frac{C_1}{C_A}}{\left(1+\frac{C_3}{C_A}\right)z - 1}$$ ✓

$$z_z = \frac{C_1 / C_A}{C_1 + C_2 / C_A} = \frac{C_1}{C_1 + C_2}$$

$$z_p = \frac{1}{1 + \frac{C_3}{C_A}}$$

$A_{DC} = 1, \quad f_{-3dB} = f_s/20 \qquad z = e^{j\omega T}$

$$\frac{V_{out}}{V_{in}} = \frac{k\,(z - z_z)}{(z - z_p)}$$

For dc gain: $\dfrac{V_{out}}{V_{in}} = \dfrac{k\,(1 - z_z)}{(1 - z_p)} = 1$ ✓

$V_{out}\left(z = e^{j2\pi f_s/2 \cdot 1/f_s}\right) = 0 \longrightarrow z_z$

$z = e^{j2\pi f_s/20 \cdot 1/f_s} = e^{j2\pi/20}$

$$\left|\frac{V_{out}}{V_{in}}\right|_{z = e^{j2\pi/20}} = \frac{1}{\sqrt{2}}$$

$$\frac{k\,(z-1)}{z - z_p} = \left|\frac{k\,(e^{j\pi/10} - 1)}{e^{j\pi/10} - z_p}\right| = \frac{1}{\sqrt{2}}$$