ECE 614 - Lecture 17

Note Title 10/21/2014

S/H Buffer $\Rightarrow$ precision $\Rightarrow$ $A_v \Rightarrow \beta A_v$ loop-gain

$\omega_{un} \Rightarrow$

"SR" $\Rightarrow$ should slew for < 25% of settling time

gain $\Rightarrow 1$

$$\beta = \frac{C_H}{C_{in} + C_H}$$

$$\sqrt{\frac{KT}{C}}$$

$$\left(1 - \frac{1}{A\beta}\right) \cdot V_o$$

ϵ

Inverting Amplifier

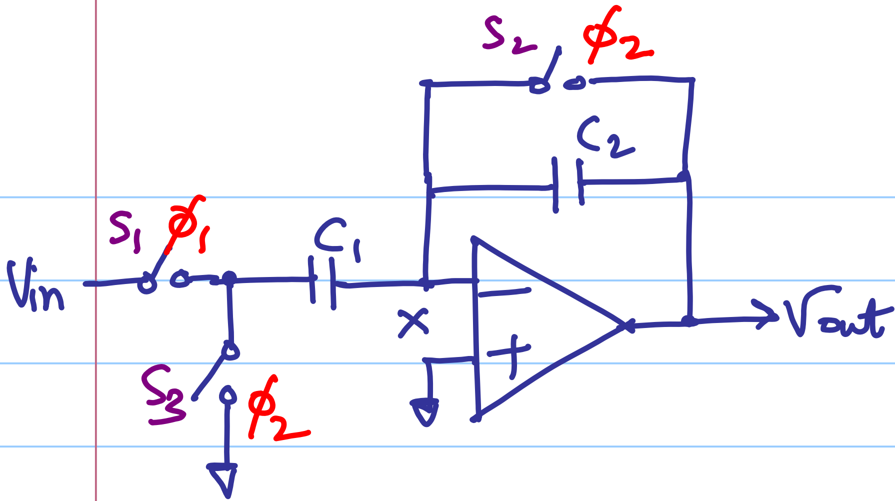
pss ⇒ .op

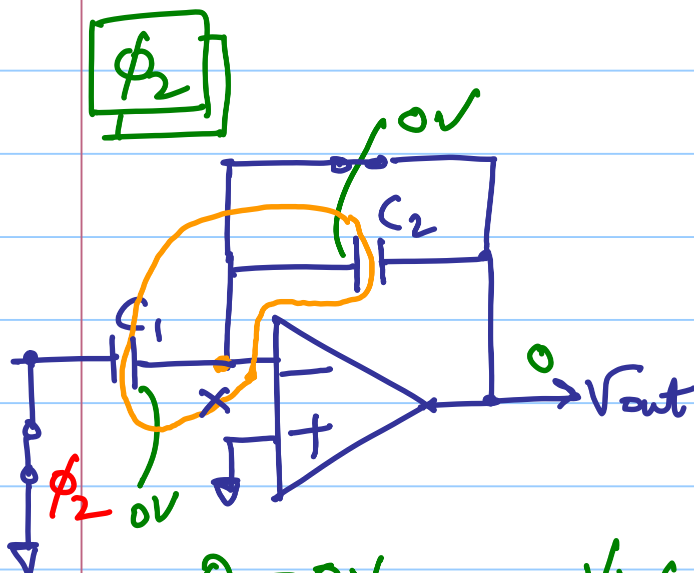
pac ⇒ ac

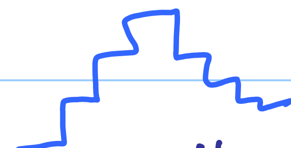
pstb ⇒ stb

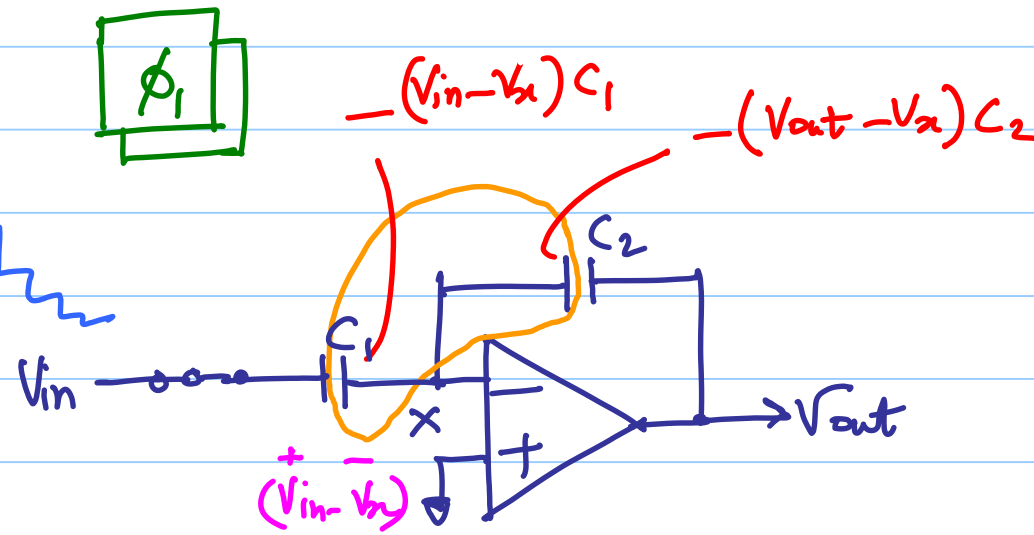
pnoise ⇒ noise

Inverting Amplifier









$$Q_x = 0V = -V_{in}C_1 + C_1V_x - V_{out}C_2 + C_2V_x = 0$$

$$V_{out} = A_v(0 - V_x) \Rightarrow V_x = \frac{V_{out}}{A_v}$$

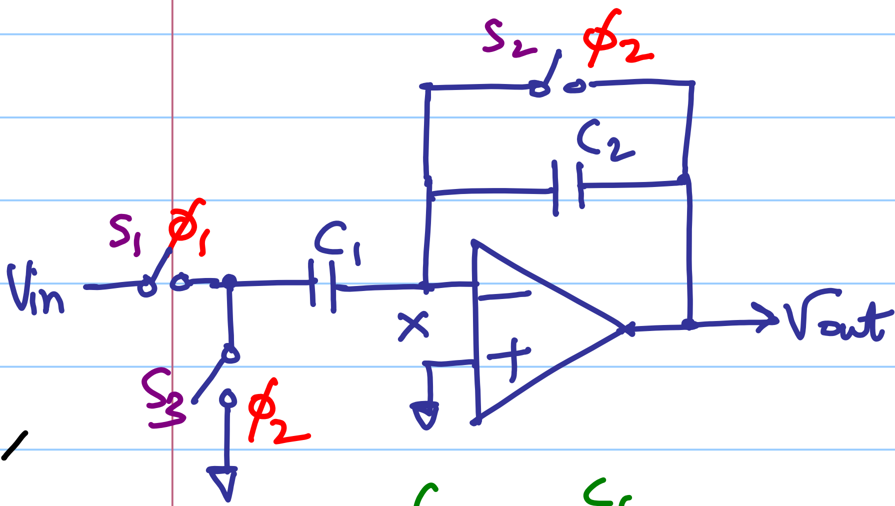
for finite $V_{out} \Rightarrow V_x \to 0$ as $A \to \infty$

$v_x = 0$

$$\Rightarrow \quad -V_{in} C_1 = V_{out} C_2$$

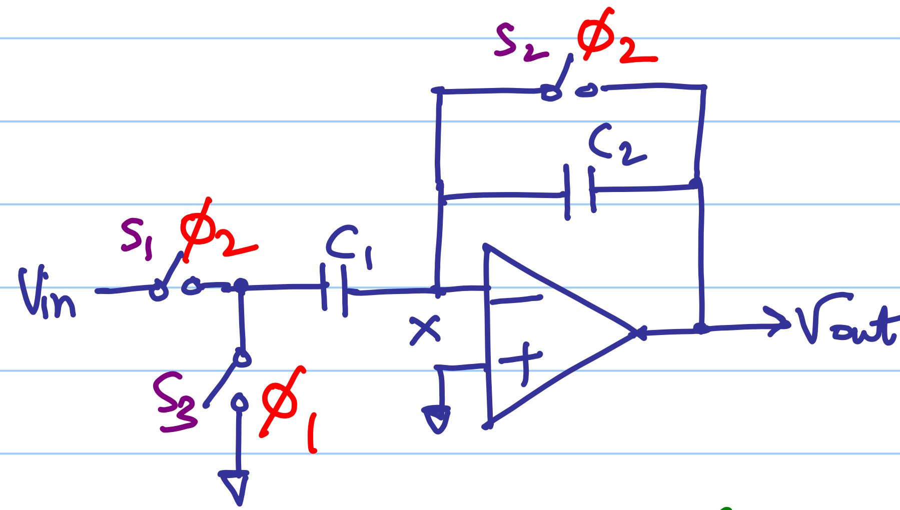
$$\Rightarrow \quad \boxed{\frac{V_{out}}{V_{in}} = -\frac{C_1}{C_2}}$$

Inverting

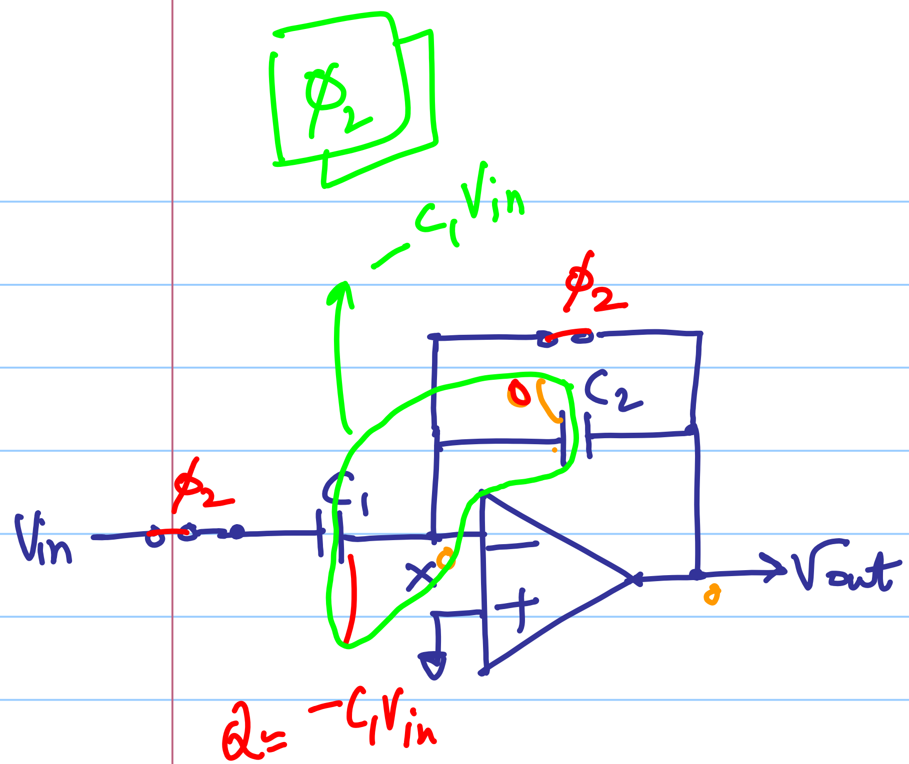


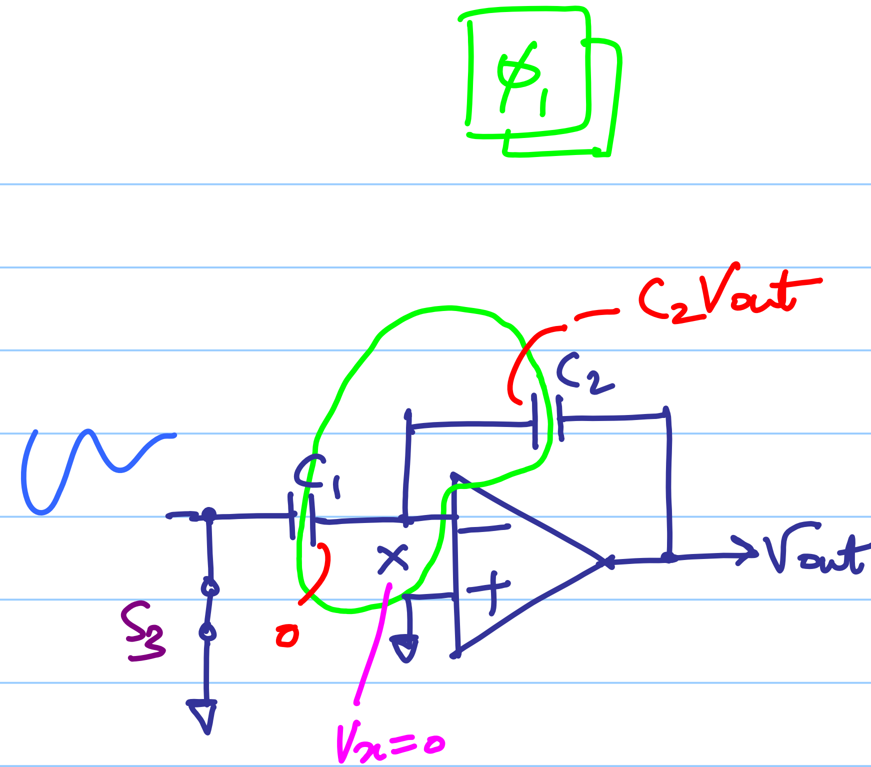
$$g = -\frac{C_1}{C_2}$$

Noninverting



$$g = +\frac{C_1}{C_2}$$





$$Q_x = -C_1 V_{in} = -C_2 V_{out}$$

$$\Rightarrow \frac{V_{out}}{V_{in}} = +\frac{C_1}{C_2}$$

S/H with amplification

* Same discussion for charge-injection techniques as in the S/H.

Precision:

$$\left|\frac{V_{out}}{V_{in}}\right| \simeq \frac{C_1}{C_2}\left[1-\frac{1}{A\beta}\right]$$

$$\beta = \frac{C_2}{C_1+C_2+C_{in}} \triangleq \frac{C_2}{C_1+C_2}$$

Speed considerations :

$C_{eq} = C_1 + C_{in}$

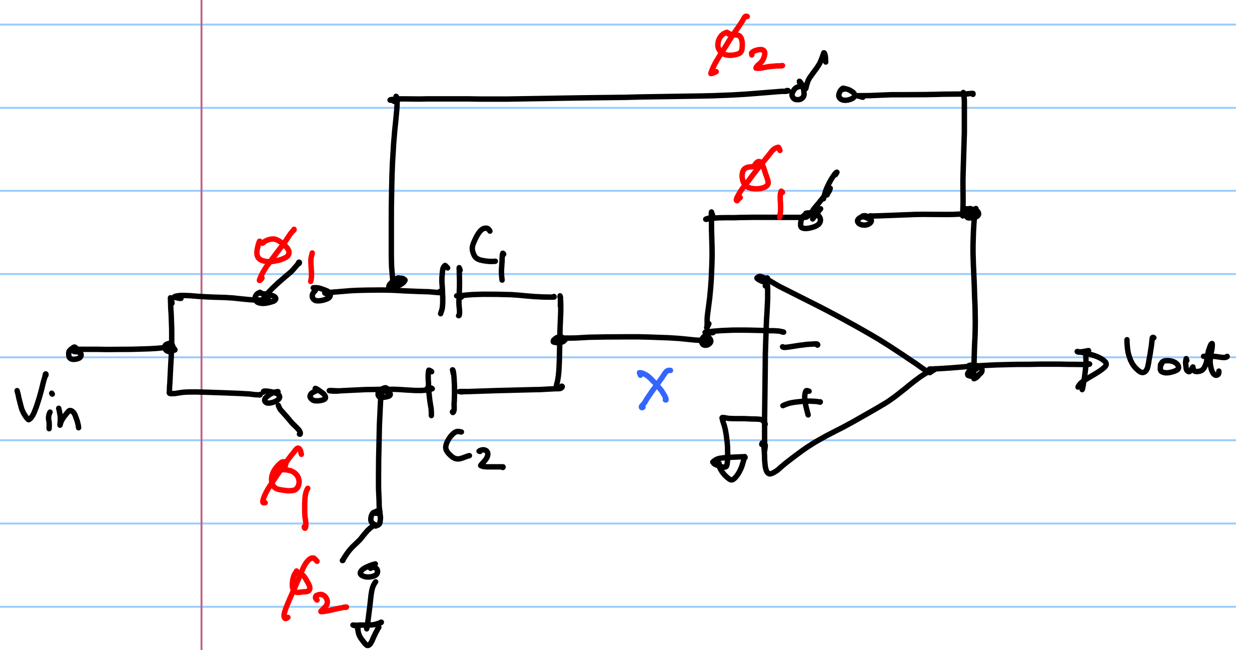
$$\tau_{amp} = \frac{C_L C_{eq} + C_L C_2 + C_{eq} C_2}{g_m C_2}$$

Same as the S/H if C_{in} is replaced by $(C_{in} + C_1)$

C_2 & C_1

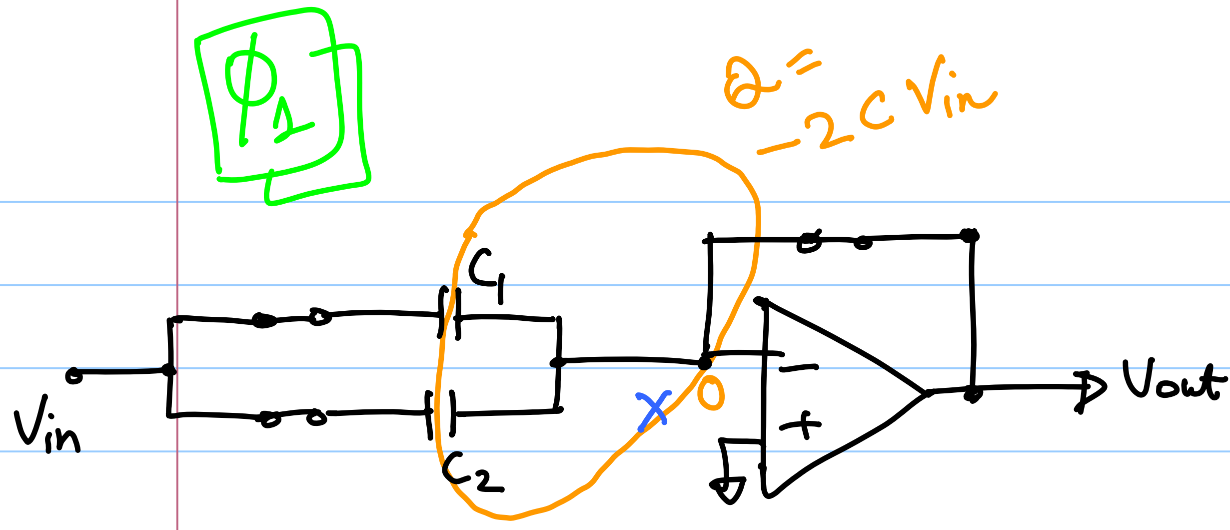
Precision Multiply ×2 Circuit : pipelined ADCs

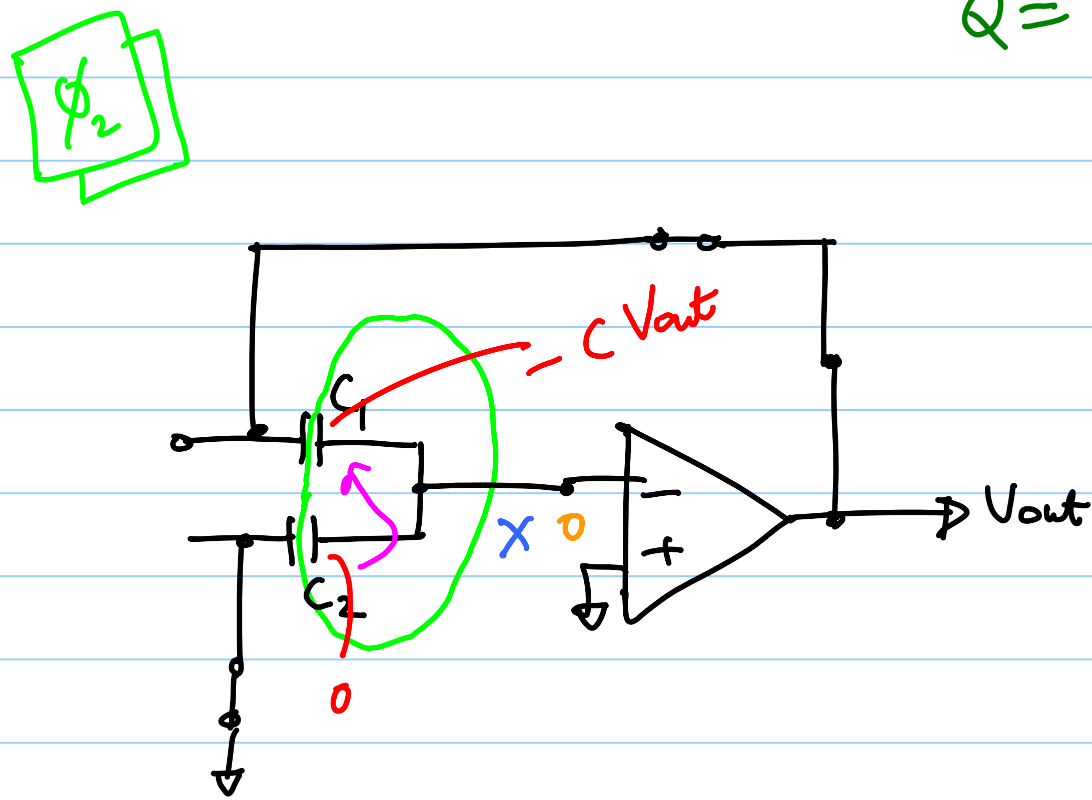
* previous circuit suffers from low β



$C_1 = C_2 = C$

$$\frac{C_1}{C_2} = \frac{2C}{C}$$





$$Q = -2CV_{in} = -CV_{out}$$

$$\Rightarrow \frac{V_{out}}{V_{in}} = 2$$

$$\beta = \frac{C_1}{C_1 + C_{in}}$$