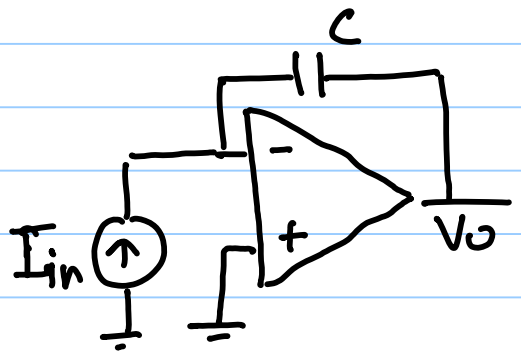
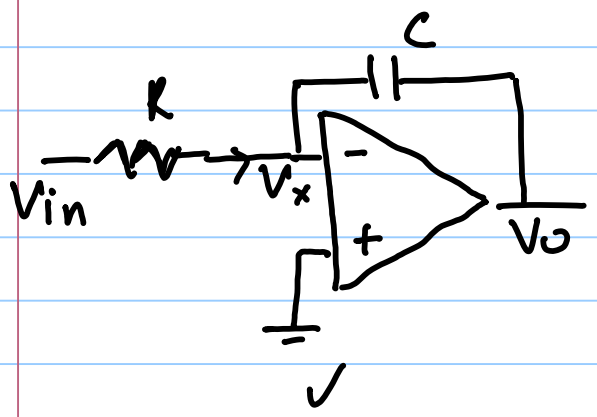
Lecture # 21

Note Title 02-03-2022



$$V_o = -\frac{I_{in} \cdot t}{C}$$



$V_x = 0$

$$\frac{V_{in}}{R} = -C\frac{dV_o}{dt}$$

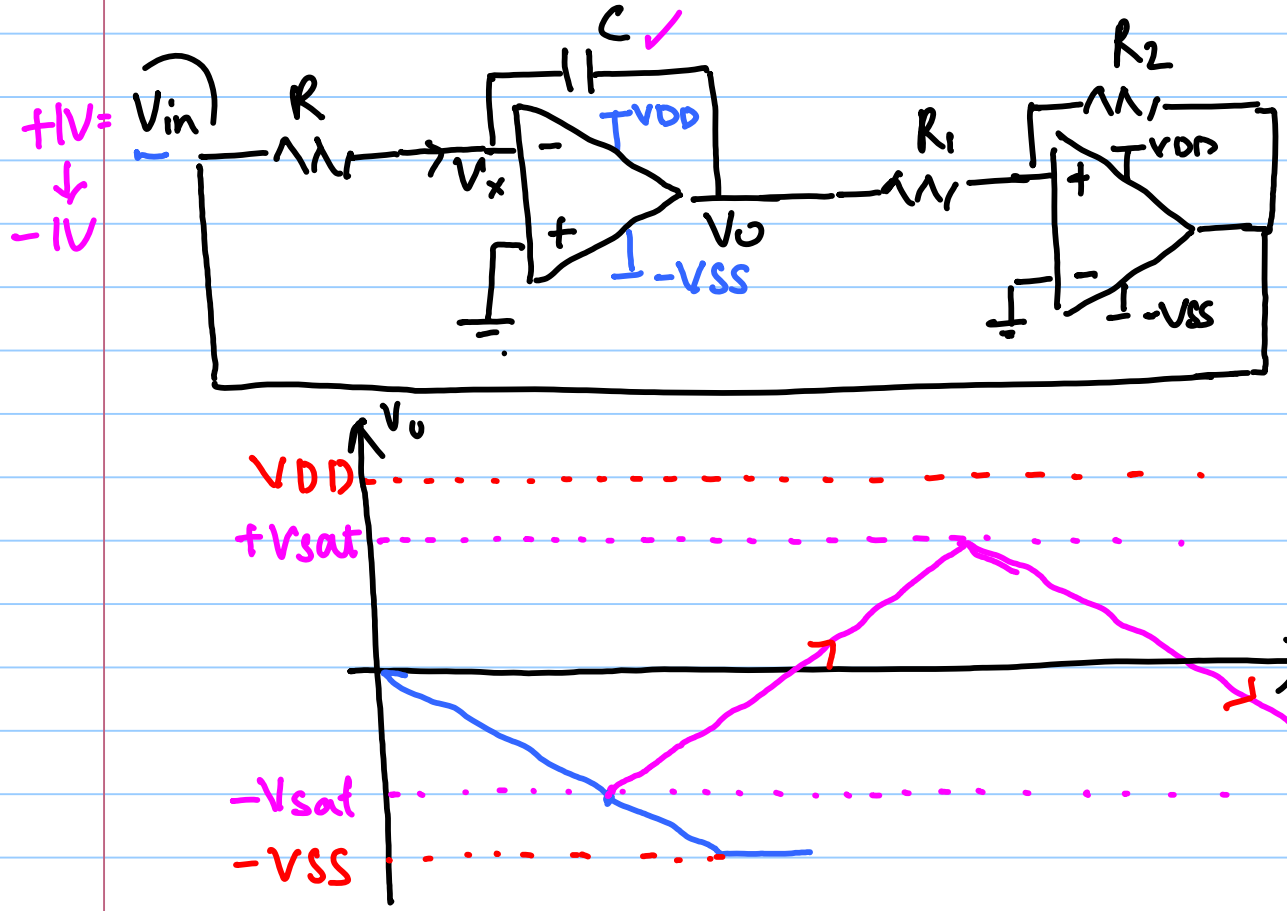
$$\frac{dV_o}{dt} = -\frac{V_{in}}{RC}$$

$$V_o(t) = -\frac{1}{RC}\int V_{in} \cdot dt$$

$$\frac{V_{in}}{R} = \frac{-V_o}{1/sC}$$

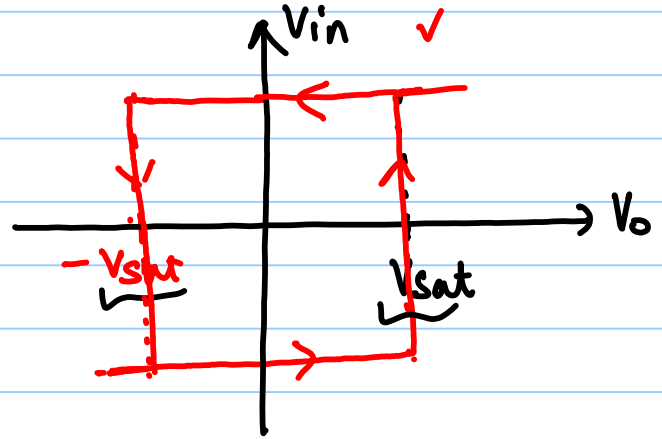
$$\frac{V_o}{V_{in}} = -\frac{1}{sRC} = -\frac{k_i}{s}$$

Ex:

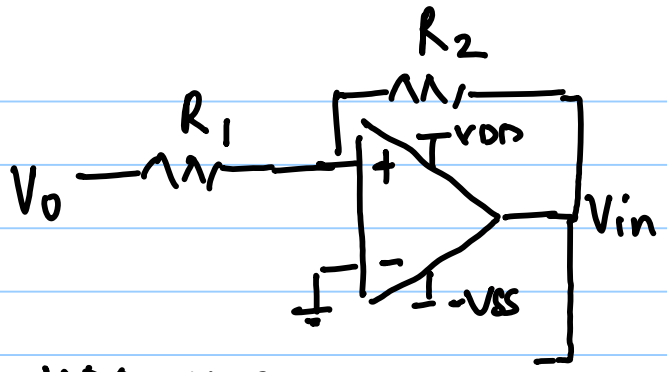


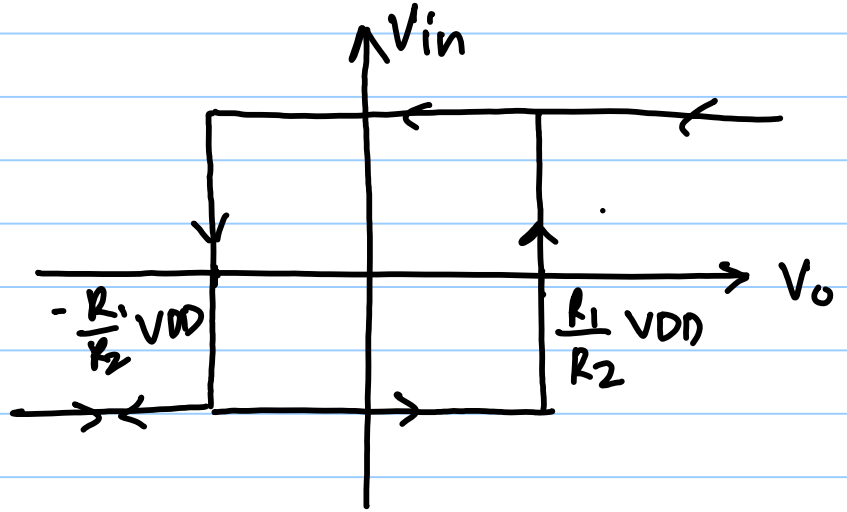
$V_o > V_{sat} \Rightarrow V_{in} = +1V$

$V_o < -V_{sat} \Rightarrow V_{in} = -1V$



$$V_{sat} = \frac{R_1}{R_2} VDD = \frac{R_1}{R_2} VSS$$





$VDD = VSS$

$R_1 = R_2 = R$

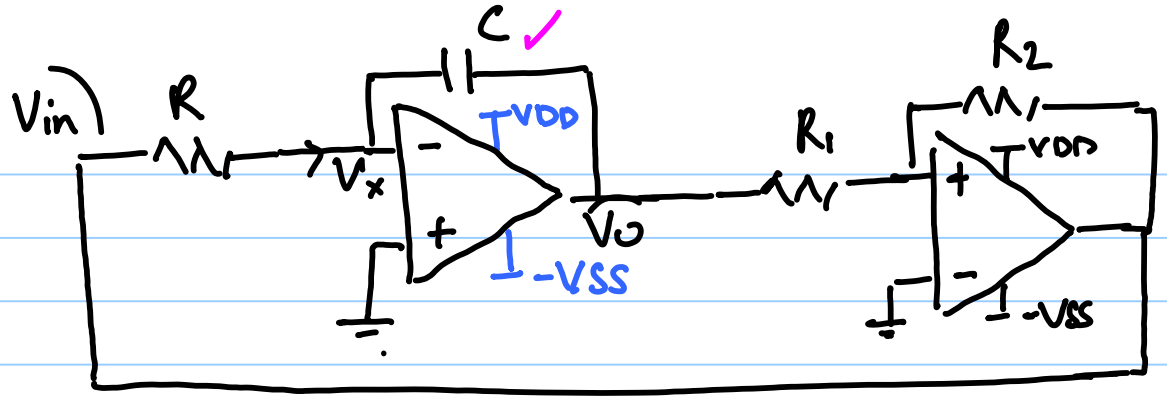
$$V_e = \frac{R_1}{R_1+R_2} V_{in} + \frac{R_2}{R_1+R_2} V_o \quad -0$$

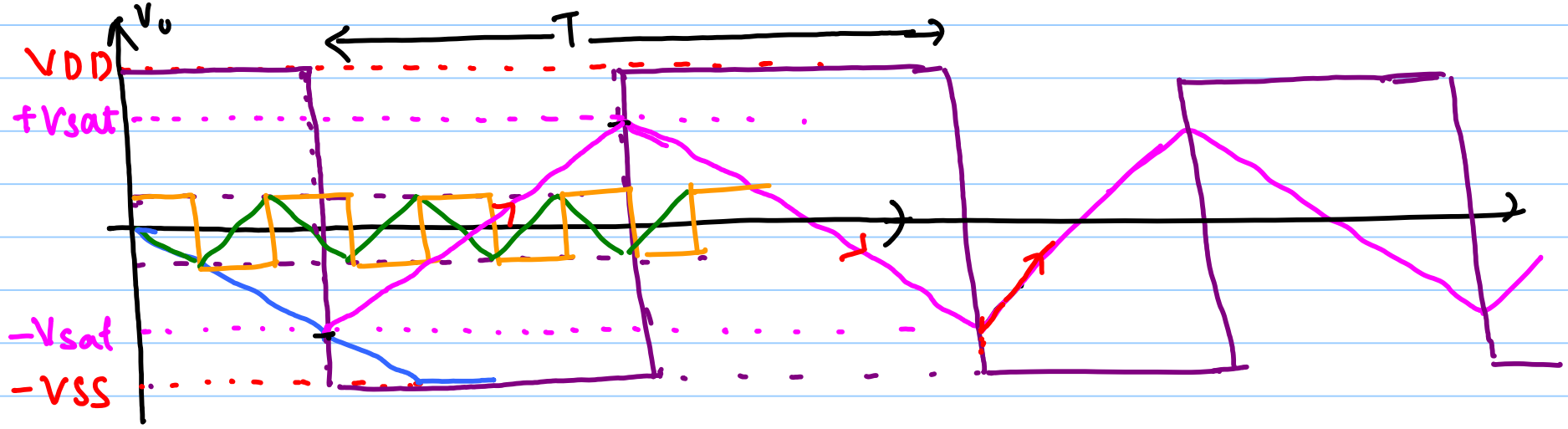
if $V_e > 0 \Rightarrow V_{in} = VDD$

$V_e < 0 \Rightarrow V_{in} = -VSS$

$$V_e = \frac{R_2}{R_1+R_2} V_o + \frac{R_1}{R_1+R_2} \cdot VDD \quad < 0$$

$$V_o = -\frac{R_1}{R_2} VDD$$





$$\frac{VDD}{R} = -C\frac{dV_o}{dt}$$

$$\int dV_o = \int -\frac{VDD}{RC}\,dt$$

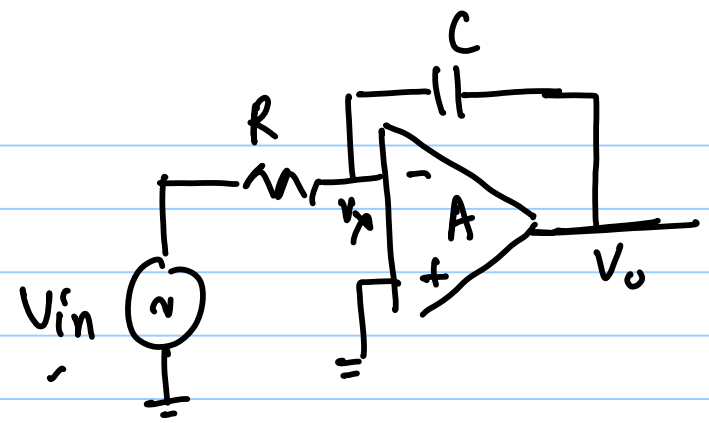
$$-2V_{sat} = -\frac{VDD}{RC}\cdot\frac{T}{2}$$

$$T = 4V_{sat}\cdot RC / VDD$$

$$f = \frac{1}{T} = \frac{VDD}{4RC.V_{sat}}$$

$$= \frac{VDD}{4RC.\frac{R_1}{R_2}VDD}$$

$$= \frac{R_2}{4RR_1C}$$



$$V_{in} = a \cdot \sin(\omega_0 t)$$

$$\frac{V_{in} - V_x}{R} = -C \frac{d(V_x - V_o)}{dt}$$

$$+\frac{V_{in}}{RC} = -\frac{d\left(-\frac{V_o}{A} - V_o\right)}{dt} + \frac{-V_o/A}{RC}$$

$$= +\left(1+\frac{1}{A}\right)\frac{dV_o}{dt} - \frac{V_o}{ARC}$$

$$\frac{V_o}{V_{in}} = -\frac{1}{sRC}$$

$$V_o(t) = a\,|H(j\omega_0)|\sin(\omega_0 t + \phi)$$

$$V_o(t) = -\frac{aRC\left(1+\frac{1}{A}\right)}{\frac{1}{A} + \omega_0 RC\left(1+\frac{1}{A}\right)^2}\sin(\omega_0 t) + \left\{\cos(\omega_0 t) - e^{-t/RC(1+A)}\right\}$$