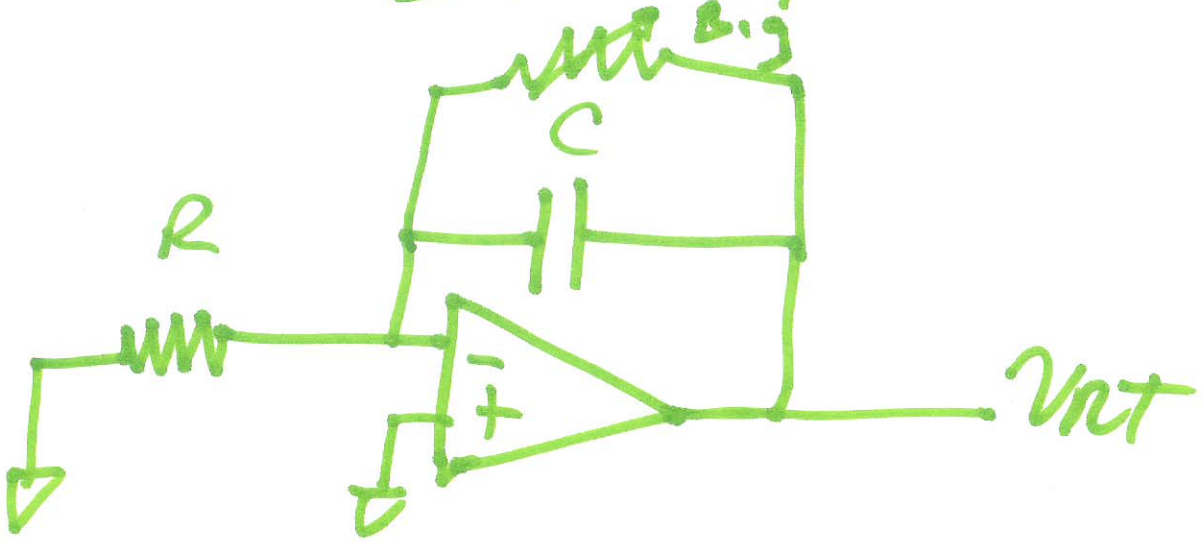
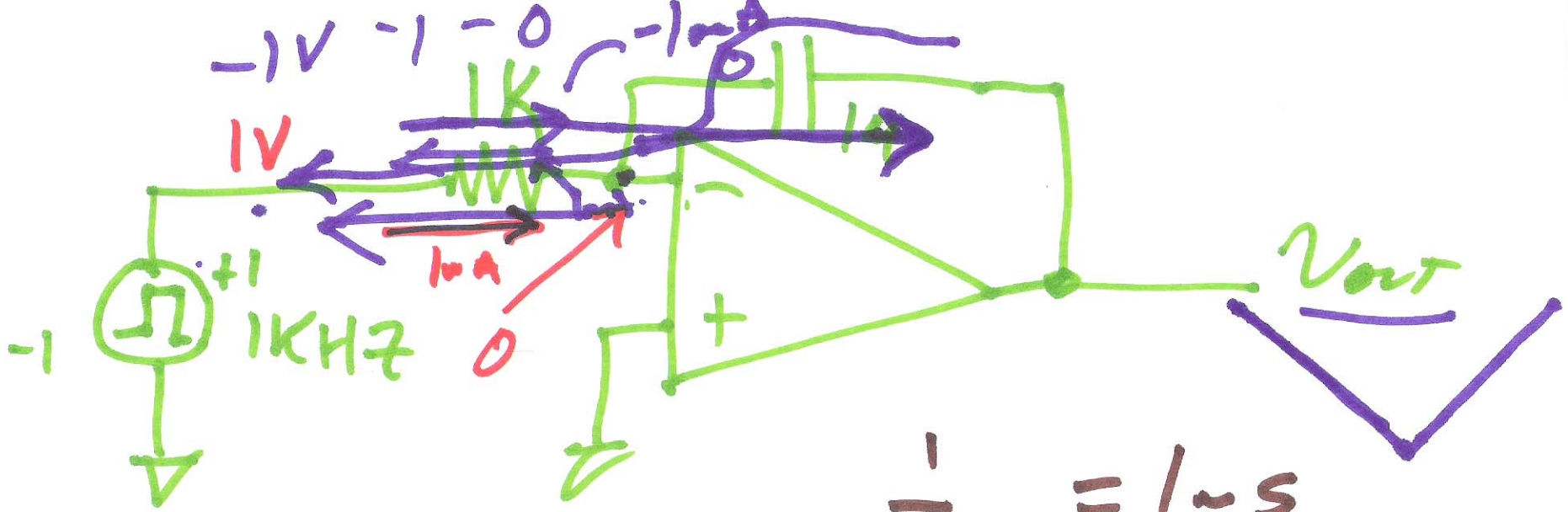
EE 320

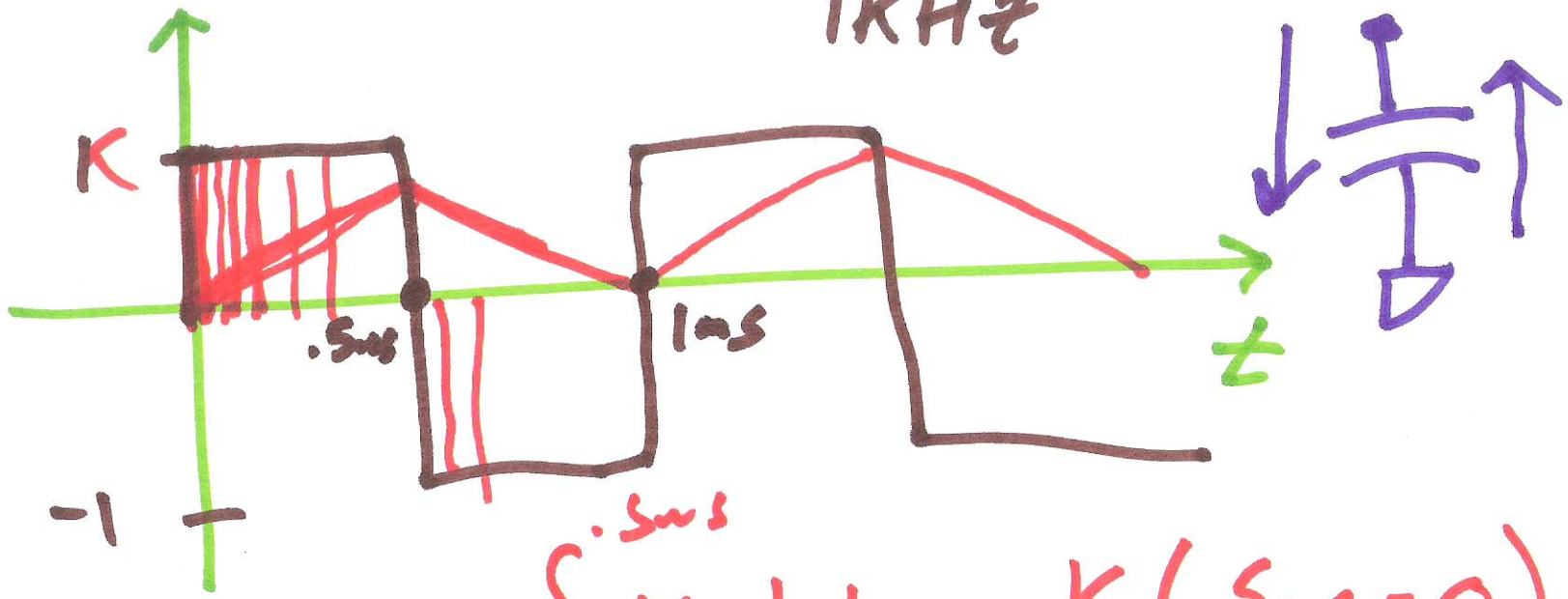
Lecture 4

January 28



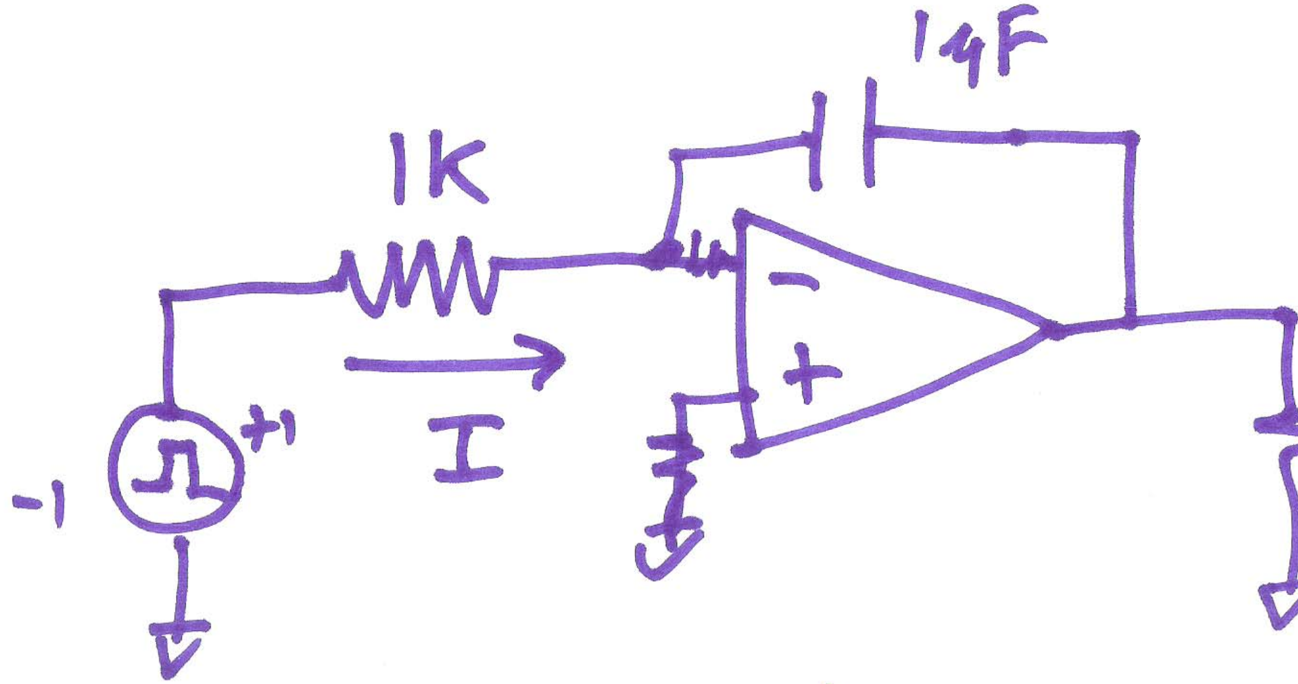


$\frac{1}{1KHz} = 1\,ms$

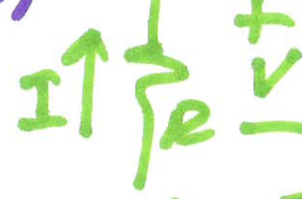


$$\int_0^{.5ms} K \cdot dt = K(.5ms - 0)$$

$$\int_{.5ms}^{1ms} -K \cdot dt$$



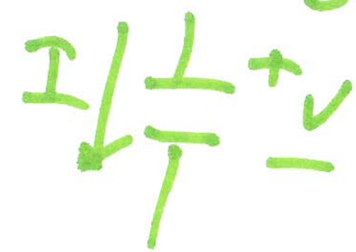
$V = IR$



$V = -IR$

$I = C\frac{dV}{dt}$

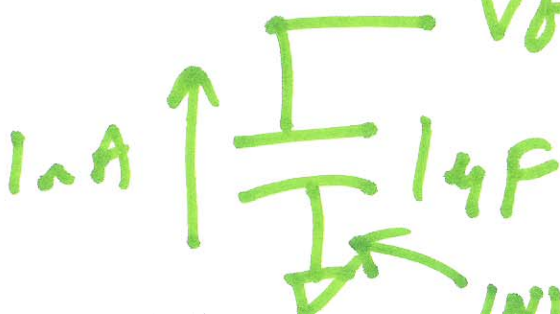
$0 \rightarrow .5ms \quad V_{IN} = 1$



$I = \frac{1}{1K} = 1mA$

$V_{OUT} = \frac{-1}{1\mu F}\int_0^{.5ms} 1mA\, dt$

$I = C\frac{dV}{dt}$



Inverting ("-") input

3)

$$V_{OUT} = \frac{-1}{C}\int_0^{.5ns} I\,dt$$

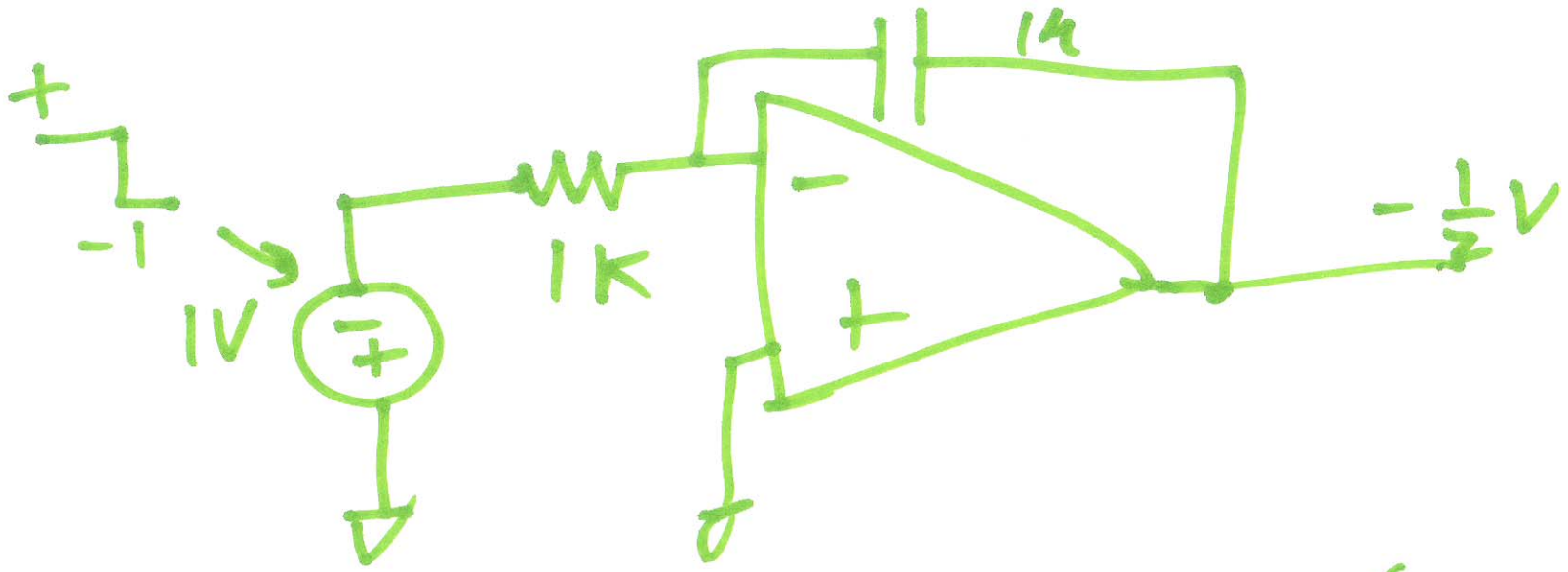
I: 1mA ÷ 10^{-3}

$$V_{OUT} = -\frac{10^{-3}}{10^{-6}}\,t\Big|_0^{.5ns}$$

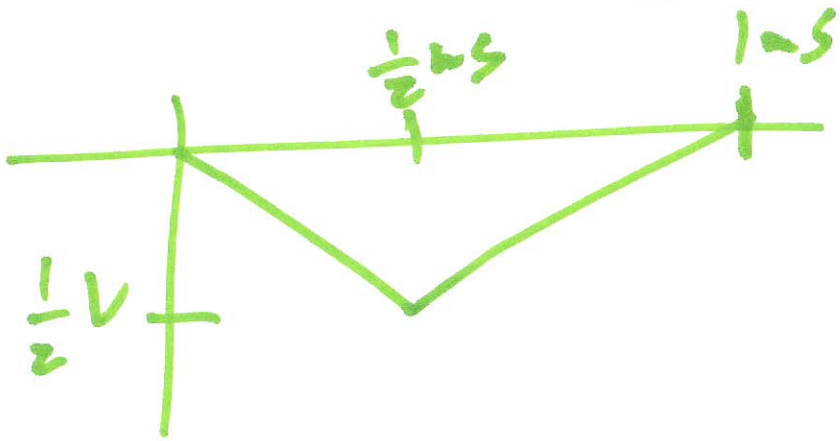
$$V_{OUT} = -10^{3}\cdot t\Big|_0^{.5ns}$$

@ 0 $V_{OUT} = 0$

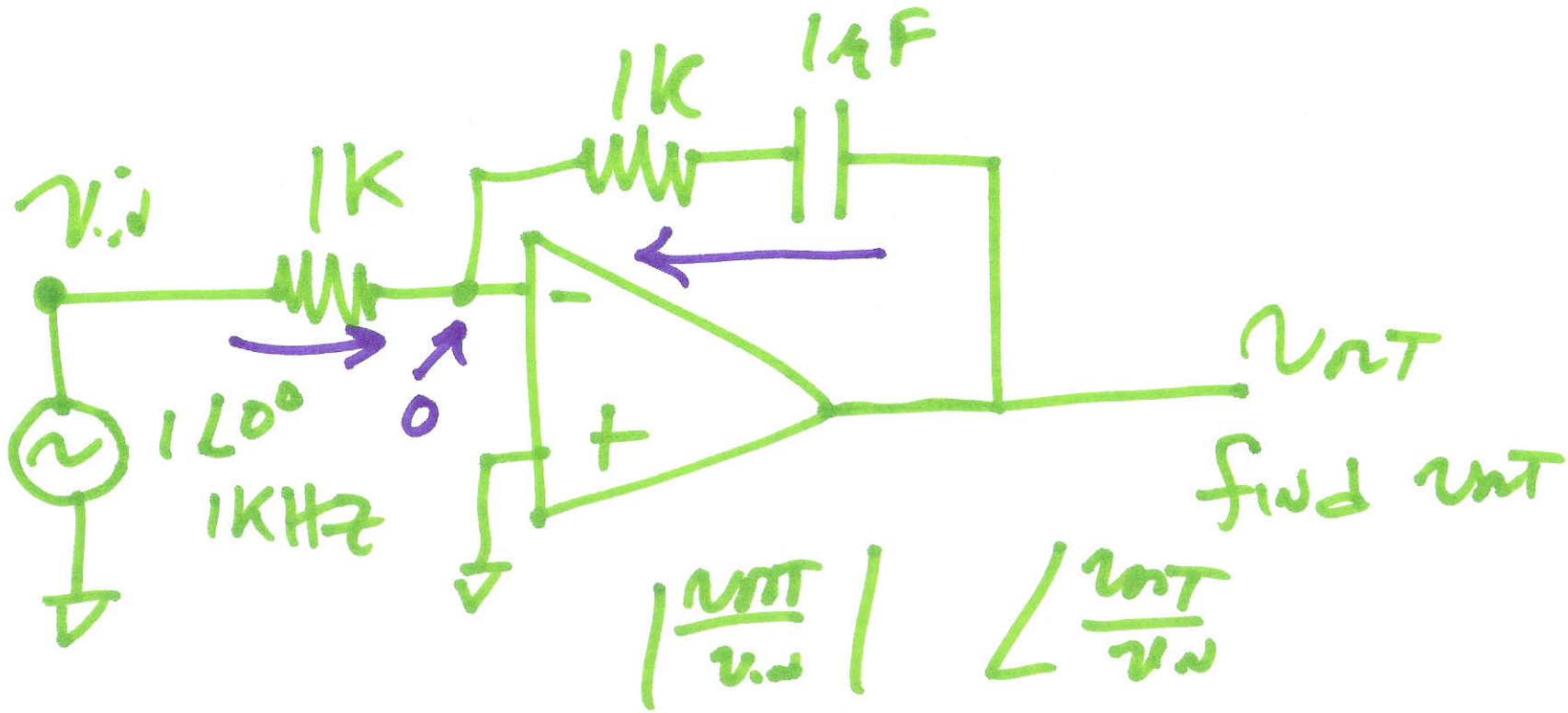
@ .5ns $V_{OUT} = -\frac{1}{2}V$



$$V_{OUT} = -\frac{1}{2} + 10^3 \cdot \left(t - \frac{1}{2}ms\right)_{\frac{1}{2}ms}^{1ms}$$



$$V_{OUT} = \frac{1}{C}\int I \cdot dt$$



$$\frac{V_{in}}{1K} + \frac{V_{out}}{1K + \frac{1}{j\omega 10^6}} = 0$$

$$\frac{V_{out}}{V_{in}} = \left(\frac{-\left(1K + \frac{1}{j\omega 10^{-6}}\right)}{1K}\right) \frac{V_{out}}{1K + \frac{1}{j\omega 10^6}} = -\frac{V_{in}}{1K}$$

b)

$$\frac{v_{out}}{v_{in}} = -\frac{1K + \frac{1}{j\omega 10^{-3}}}{1K}$$

$$= -\left(1 + \frac{1}{j2\pi f \cdot 10^{-3}}\right)$$

Active PI filter

$\frac{R_f}{R_I}$ ← proportional

integrator ↑

$$\frac{v_{out}}{v_{in}} = -\left(1 + j\,\frac{-1}{2\pi f \cdot 10^{-3}}\right)$$

$$\left|\frac{v_{out}}{v_{in}}\right| = \sqrt{1 + \left(\frac{1}{2\pi f \cdot 10^{-3}}\right)^2}$$

$$\left|\frac{v_{out}}{v_{in}}\right| = \sqrt{1 + \left(\frac{159}{f}\right)^2}$$

$$-20\,dB \quad 159 = \frac{1}{2\pi \cdot 10^{-3}}$$