EE 105 Discussion Session #1 Week Sept 08

1. Probability derivation for HW #2 Problem 2.

$$A_v = 1 + \frac{R_2}{R_1} = 1 + \frac{R_{20}}{R_{10}}\frac{y}{x}, \quad x, y \in [0.90, 1.10]$$

x, y independent and $f_X(x) = \begin{cases} 5, & x \in [0.9, 1.1] \\ 0, & \text{otherwise} \end{cases}$

$f_Y(y) = \begin{cases} 5, & y \in [0.9, 1.1] \\ 0, & \text{otherwise} \end{cases}$

$$F_{Y/X}(z) = \underline{P(Y/X \le z)} = \iint_{y/x \le z,\, x<0} f(x,y)\,dy\,dx + \iint_{y/x \le z,\, x>0} f(x,y)\,dy\,dx$$

$\frac{Y}{X} \le z \quad \begin{cases} Y \le Xz, & X>0 \\ Y \ge Xz, & X<0 \end{cases}$

$$= \int_{-\infty}^{0}\int_{xz}^{\infty} f(x,y)\,dy\,dx + \int_{0}^{\infty}\int_{-\infty}^{xz} f(x,y)\,dy\,dx$$

Let $y = xu$. $\rightarrow$

$$= \int_{-\infty}^{0}\int_{z}^{\frac{\infty}{x} \to -\infty} x f(x, xu)\,du\,dx + \int_{0}^{\infty}\int_{-\infty/x}^{z} x f(x,xu)\,du\,dx$$

$$= \int_{-\infty}^{0}\int_{z}^{-\infty} x f(x,xu)\,du\,dx + \int_{0}^{\infty}\int_{-\infty}^{z} x f(x,xu)\,du\,dx$$

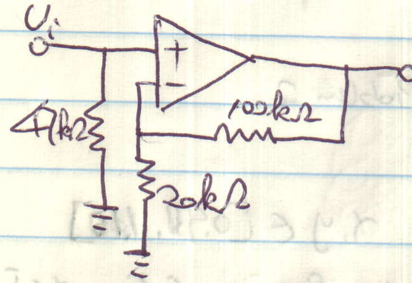
$$= \int_{-\infty}^{0}\int_{-\infty}^{z} (-x) f(x,xu)\,du\,dx + \int_{0}^{\infty}\int_{-\infty}^{z} x f(x,xu)\,du\,dx$$

$$= \int_{-\infty}^{\infty}\int_{-\infty}^{z} |x| f(x,xu)\,du\,dx$$

$$= \int_{-\infty}^{z} du \int_{-\infty}^{\infty} |x| f(x,xu)\,dx$$

$$f_Z(z) = \frac{dF_Z(z)}{dz} = \int_{-\infty}^{\infty} |x| f(x, xz)\,dx$$

2. Calculate A, Rin, Rout

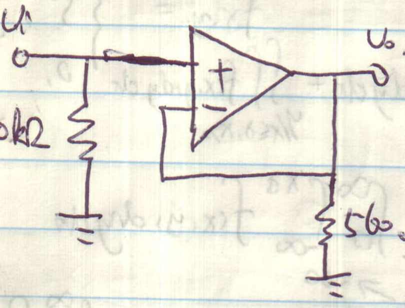


$A = \frac{R_1+R_2}{R_1} = \frac{100+20}{20} = 6$

$R_{in} = 47k\Omega$

$R_{out} = 0\Omega$

3. Calculate A, Rin, Rout.

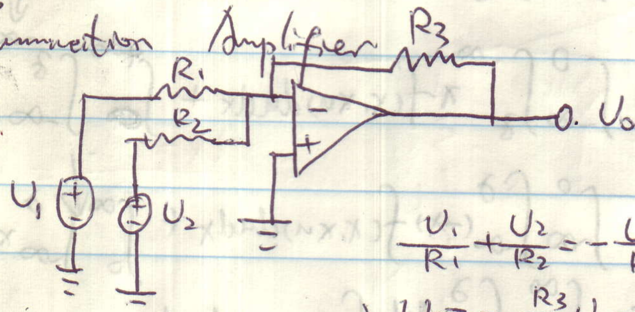


$R_{in} = 560k\Omega$

$A = 1$

$R_{out} = 0\Omega$

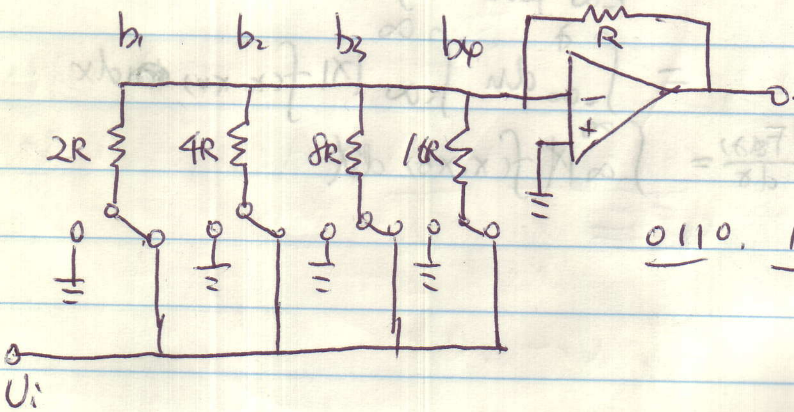
4. Summation Amplifier



$$\frac{U_1}{R_1} + \frac{U_2}{R_2} = -\frac{U_0}{R_3}$$

$$\therefore U_0 = -\frac{R_3}{R_1}U_1 - \frac{R_3}{R_2}U_2.$$

5.

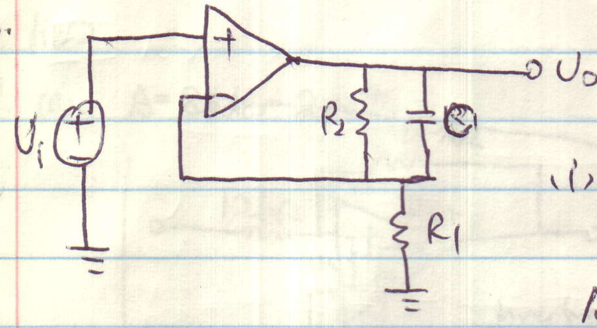


Ui

1V.

0110, 1011, 1101

6.



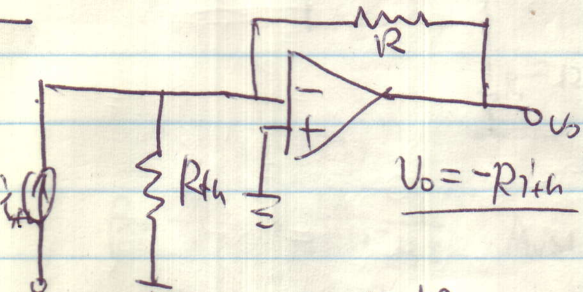
(i). no capacitor

$$A = \frac{R_2}{R_1}+1$$

(ii) $A(s) = 1 + \frac{Z_2}{Z_1}$, $\begin{cases} Z_2 = R_2 \| \frac{1}{sC} = \frac{R_2/sC}{R_2+1/sC} = \frac{R_2}{1+R_2 sC} \\ Z_1 = R_1 \end{cases}$

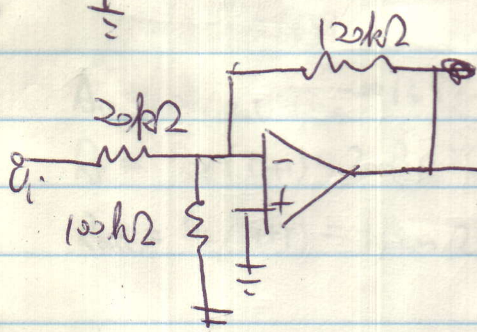
$\therefore A(s) = 1 + \frac{R_2}{R_1(1+R_2 sC)}$ Low Pass Filter

7.



$V_o = -R i_{th}$

8.



$\begin{cases} A = -\frac{120k\Omega}{20k\Omega} = -6 \\ R_{in} = 20k\Omega \\ R_{out} = \infty \end{cases}$