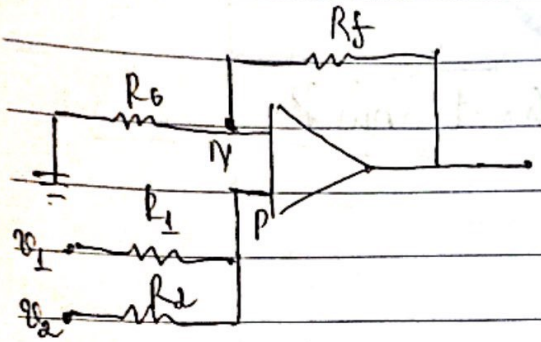
Bài 6.1



* tại nút N, có $i_N = 0$

coi R_0 nt R_f

$$\Rightarrow v_N = \frac{R_0}{R_0 + R_f} \cdot v_0$$

$$\Rightarrow v_0 = \left(1 + \frac{R_f}{R_0}\right) \cdot v_N$$

* Xét tại nút P $\quad i_1 + i_2 = i_p \quad (i_p = 0)$

$$\Rightarrow i_1 + i_2 = 0$$

$$\Leftrightarrow \frac{v_1 - v_N}{R_1} + \frac{v_2 - v_n}{R_2} = 0$$

đặt $R_{eq} = (R_1 // R_2) \Rightarrow \frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2}$

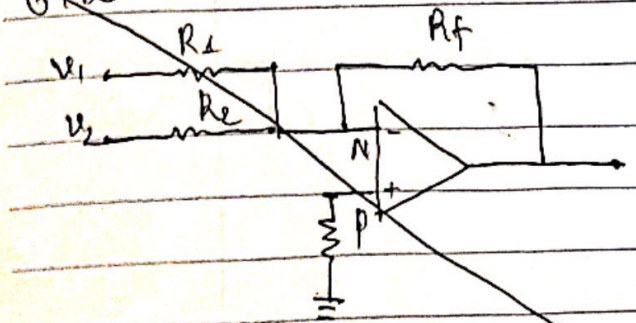
thay vào ta được $v_N = \left(\frac{v_1}{R_1} + \frac{v_2}{R_2}\right) \cdot R_{eq}$

$$\Rightarrow v_0 = \left(1 + \frac{R_f}{R_0}\right)\left(\frac{v_1}{R_1} + \frac{v_2}{R_2}\right) \cdot R_{eq}$$

mà $R_1 = R_2 \Rightarrow R_{eq} = R_1/m = R_2/m \quad (m = 2)$

$$\Rightarrow v_0 = \left(1 + \frac{R_f}{R_0}\right)\left(\frac{v_1 + v_2}{2}\right)$$

6.2



Xét tại nút N,

Theo ĐL KCI tại nút

$$i_1 + i_2 = i_N + i_f$$

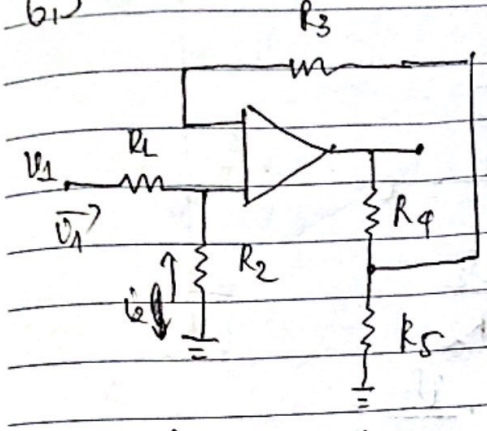
mà $v_N = 0$

$$\Rightarrow i_1 + i_2 = v_f$$

$$\Leftrightarrow \frac{v_1 - v_N}{R_1} + \frac{v_2 - v_N}{R_2} = \frac{v_N - v_0}{R_f} \quad (1)$$

Mà P có nối đất $\Rightarrow v_N = v_P = 0$

6.3



+) tại nút P

$i_1 + i_2 = 0$

$\Leftrightarrow \frac{V_1 - V_P}{R_1} + \frac{V_2 - V_P}{R_1} = 0$ mà $V_P = V_n$

đặt $R_{12} = \frac{1}{R_1}(R_1 \| R_2) \Leftrightarrow \frac{V_P}{R_{12}} = \frac{V_1}{R_1} + \frac{V_2}{R_2} \Rightarrow V_P = R_{12}\left(\frac{V_1}{R_1} + \frac{V_2}{R_2}\right)$

+) tại nút N

$i_3 = i_4 + i_5$

$\Leftrightarrow \frac{V_n - V_3}{R_3} = \frac{V_3 - V_0}{R_4} + \frac{V_3 - 0}{R_5}$

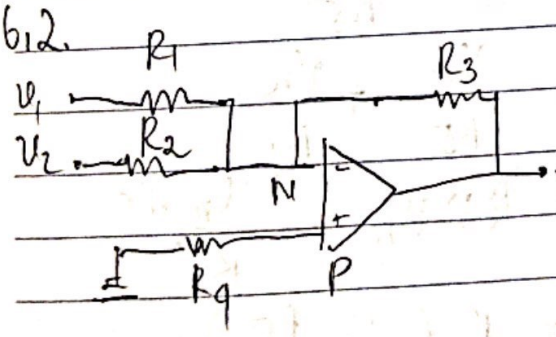
$\Leftrightarrow \frac{-V_0}{R_4} + \frac{V_3}{R_4} + \frac{V_3}{R_5} = \frac{V_n}{R_3} - \frac{V_3}{R_3}$

Có $i_3 = 0 \Rightarrow$ mà $V_3 = V_n$

$\Rightarrow V_0 = \frac{V_3}{R_4} + \frac{V_3}{R_5} - \frac{V_n}{R_3} + \frac{V_n}{R_3} = \frac{V_3}{R_4} + \frac{V_3}{R_5}$

đặt $R_{45} = (R_4 \| R_5)$ $= \frac{V_n}{R_{45}} = \frac{V_P}{R_{45}}$

6.2.



+ tại nút P

$i_4 = 0 \Leftrightarrow \frac{0 - V_P}{R_4} = 0 \Rightarrow V_P = 0$

+ tại nút N

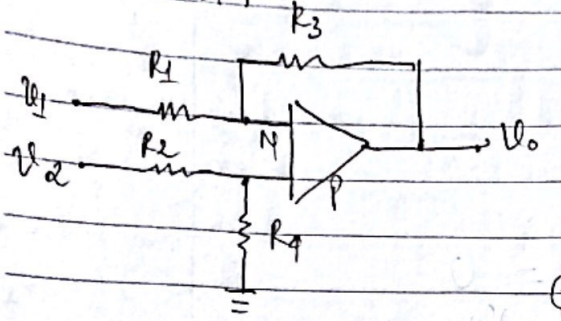
$i_1 + i_2 = i_n + i_3$

Có $i_n = 0 \Leftrightarrow \frac{V_1 - V_n}{R_1} + \frac{V_2 - V_n}{R_2} = \frac{V_n - V_0}{R_f}$

mà $V_n = V_P \Leftrightarrow \frac{V_1}{R_1} + \frac{V_2}{R_2} = \frac{0 - V_0}{R_f}$

$\Rightarrow V_0 = -R_f\left(\frac{V_1}{R_1} + \frac{V_2}{R_2}\right)$

Bt 6.4



* tại nút P

$$i_2 + i_4 = 0$$

$$\frac{V_2 - V_P}{R_2} + \frac{0 - V_P}{R_4} = 0$$

$$\Leftrightarrow \frac{V_P}{R_2} + \frac{V_P}{R_4} = \frac{V_2}{R_2}$$

đặt $R_{24} = R_2 // R_4 \Rightarrow V_P = R_{24} \cdot \frac{V_2}{R_2}$

+ tại nút N

$$i_1 = i_n + i_3$$

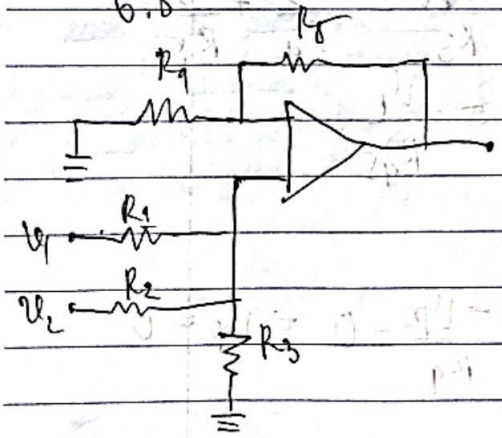
mà $i_n = 0 \Leftrightarrow i_1 = i_3$

$$\Leftrightarrow \frac{V_1 - V_n}{R_1} = \frac{V_n - V_o}{R_3}$$

$$\Leftrightarrow \frac{V_o}{R_3} = \frac{V_1 - V_n}{R_1} - \frac{V_n}{R_3}$$

mà $V_P = V_n \Rightarrow V_o = R_3 \left(\frac{V_1 - V_P}{R_1} \right) - V_P$

6.5



+ tại nút N

$$i_4 = i_5 + i_n$$

$$V_n = 0 \Leftrightarrow \frac{0 - V_n}{R_4} = \frac{V_n - V_o}{R_5}$$

$$\Rightarrow \frac{V_o}{R_5} = \frac{V_n}{R_5} + \frac{V_n}{R_4}$$

$$\Rightarrow V_o = V_n + \frac{V_n \cdot R_5}{R_4}$$

$$= V_n \left(1 + \frac{R_5}{R_4} \right)$$

+ tại nút P

$$i_1 + i_2 + i_3 = 0$$

$$\frac{V_1 - V_P}{R_1} + \frac{V_2 - V_P}{R_2} + \frac{0 - V_P}{R_3} = 0$$

$$\Rightarrow \frac{V_1}{R_1} + \frac{V_2}{R_2} = \frac{V_P}{R_1} + \frac{V_P}{R_4} + \frac{V_P}{R_3}$$

đặt $R_{123} = R_1 // R_2 // R_3 \Rightarrow V_P = R_{123} \left(\frac{V_1}{R_1} + \frac{V_2}{R_2} \right)$

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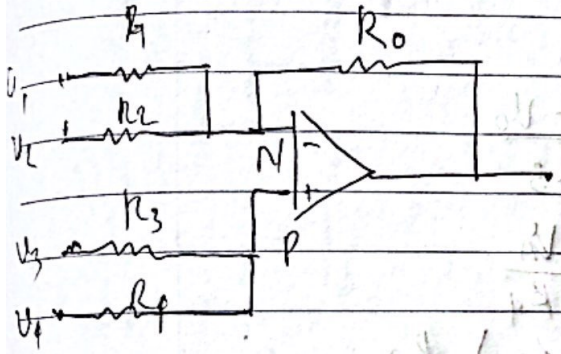
mà $U_p = U_n$

$\Rightarrow U_0 = R_{123}\left(\frac{U_1}{R_1} + \frac{U_2}{R_2}\right)\left(1 + \frac{R_5}{R_4}\right)$

Bài 6.6



+ Xét tại nút N

$i_1 + i_2 = i_n + i_0$

$\Leftrightarrow \frac{U_1 - U_n}{R_1} + \frac{U_2 - U_n}{R_2} = 0 + \frac{U_n - U_0}{R_0}$

$\frac{-U_0}{R_0} = \frac{U_1}{R_1} + \frac{U_2}{R_2} - U_n\left(\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_0}\right)$

$U_0 = -R_0\left(\frac{U_1}{R_1} + \frac{U_2}{R_2}\right) + U_n\left(\frac{R_0}{R_1} + \frac{R_0}{R_2} + 1\right)$

+ Xét tại nút P

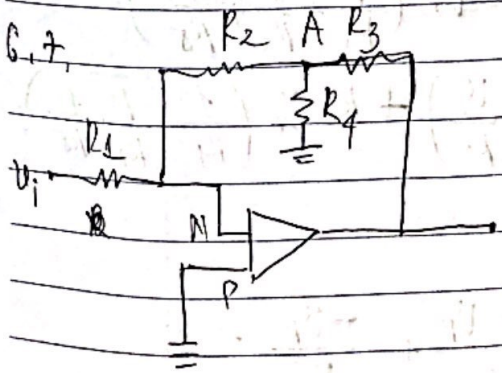
$i_3 + i_4 = 0$

$\frac{U_3 - U_p}{R_3} + \frac{U_4 - U_p}{R_4} = 0$

$\Leftrightarrow U_p\left(\frac{1}{R_3} + \frac{1}{R_4}\right) = \frac{U_3}{R_3} + \frac{U_4}{R_4}$

Đặt $R_3 // R_4 = R_{34} \Rightarrow U_p = R_{34}\left(\frac{U_3}{R_3} + \frac{U_4}{R_4}\right)$

6.7



~~$i_4 + i_2 + i_4 = i_3 + i_4$~~

$i_1 = i_n + i_2$

$\pm) i_1 = -i_4 + i_3$

+) Xét tại nút A

$i_3 = (R_3 + R_4)\, i_2 + i_4 = I_3$

$\Leftrightarrow -\frac{V_A}{R_2} + \frac{V_A - V_0}{R_4} =$

Xét tại nút N. $\Rightarrow i_1 = i_n + i_2$

mà $I_n = 0 \Leftrightarrow I_1 = I_2$

$\Leftrightarrow \frac{v_i - v_n}{R_1} = \frac{-v_A}{R_2}$

$\Rightarrow v_A = \frac{-R_2(v_i - v_n)}{R_1}$

mà $v_n = v_p = 0 \Rightarrow v_A = \frac{-R_2 v_i}{R_1}$

tại nút A:

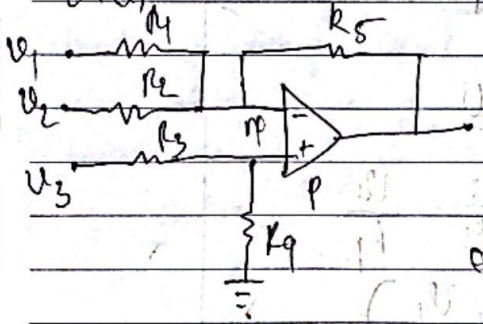
$i_2 + i_4 = i_3$

$\Rightarrow \frac{-v_A}{R_2} + \frac{0 - v_A}{R_4} = \frac{v_A - v_0}{R_3}$

$\frac{v_0}{R_3} = \frac{v_A}{R_3} + \frac{v_A}{R_2} + \frac{v_A}{R_4}$

$\Rightarrow v_0 = v_A\left(\frac{1}{R_4} + \frac{1}{R_2} + \frac{1}{R_3}\right) \cdot R_3$

6.8/



cho $v_0 = -2v_1 - 8v_2 + v_3$

tìm giá trị $R_1\ R_2\ R_3\ R_4\ R_5$

tại nút N:

có $i_1 + i_2 = i_n + i_5$

$\Leftrightarrow \frac{v_1 - v_n}{R_1} + \frac{v_2 - v_n}{R_2} = \frac{v_n - v_0}{R_5}$

$\Rightarrow \frac{v_0}{R_5} + \frac{v_1}{R_1} + \frac{v_2}{R_2} = v_n\left(\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_5}\right)$

$\Rightarrow v_0 = -R_5\left(\frac{v_1}{R_1} + \frac{v_2}{R_2}\right) + R_5 v_n\left(\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_5}\right)$

tại nút P:

$\Rightarrow i_3 + i_4 = 0 \Leftrightarrow \frac{v_3 - v_p}{R_3} + \frac{-v_p}{R_4} = 0$

$\Rightarrow \frac{v_3}{R_3} = v_p\left(\frac{1}{R_3} + \frac{1}{R_4}\right)$

$R_{34} = R_3 \parallel R_4 \Rightarrow v_p = v_3 \cdot \frac{R_{34}}{R_3}$

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HÀI TIẾN

có $\begin{cases} \frac{-R_5}{R_1} = -2 \Rightarrow 2R_1 = R_5 \\ \frac{-R_5}{R_2} = -8 \Rightarrow 8R_2 = R_5 \end{cases}$ $\rightarrow R_1 = 4R_2$

$R_5\left(\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_5}\right) \cdot \frac{R_{34}}{R_3} = 1 \quad (*)$

giải (*) thay $R_5 = 8R_2$, $R_5 = 2R_1$

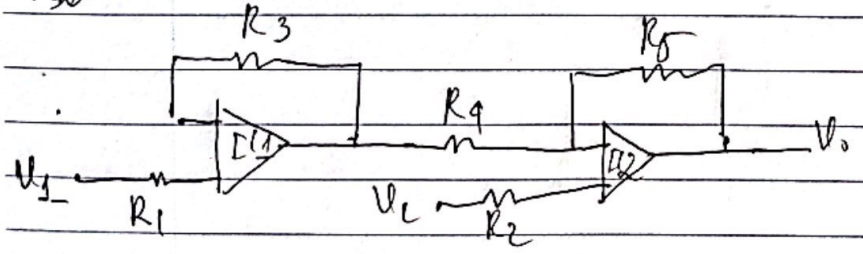
$\Rightarrow (2 + 8 + 1)\frac{1}{R_3} \cdot \frac{R_3 \cdot R_4}{R_3 + R_4} = 1$

$= \frac{11R_4}{R_3 + R_4} = 1$

$\Leftrightarrow R_3 = 10R_4$

$\Rightarrow$ Các tỷ lệ: $\begin{cases} 2R_1 = R_5 = 8R_2 \\ R_3 = 10R_4 \end{cases}$

b/ 30



+)

$K = K_1 \cdot K_2 = \frac{V_0}{V_i}$ $\quad K_1 = \left(1 + \frac{R_3}{\infty}\right) = 1$ (mạch lặp điện áp)

$K_2 = \left(1 + \frac{R_5}{R_4}\right)$ mạch khuếch đại không đảo)

$\Rightarrow V_0 = V_i K_1 \cdot K_2 = V_i\left(1 + \frac{R_5}{R_4}\right)$

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