Abuelma'atti Eq. (1) – corrected

RWN
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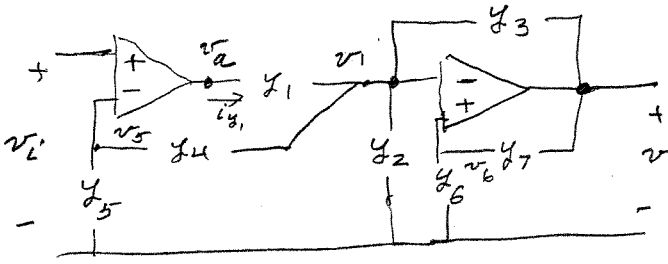

(will set $v_o = v_i$ later due to the feedback connection)

1) $v_5 = \dfrac{y_5}{y_4+y_5} v_1 = \dfrac{1/y_5}{1/y_4 + 1/y_5} v_1 = \dfrac{y_4}{y_4+y_5} v_1 = v_5$

2) $v_a = \dfrac{A_1 \omega_1}{s+\omega_1}\left[v_i - v_5\right] \overset{1)}{=} A_1(s)\left[v_i - \dfrac{y_4}{y_4+y_5} v_1\right]$

3) $i_{y_1} = y_1(v_a - v_1) = i_{y_2} + i_{y_3}$

$= y_2 v_1 + y_3(v_1 - v_o)$

3') $\Rightarrow$ $y_1\left(A_1(s)\left[v_i - \dfrac{y_4}{y_4+y_5} v_1\right] - v_1\right) = (y_2+y_3) v_1 - y_3 v_o$

4) $v_o = A_2(v_6 - v_1) = A_2\left[\dfrac{y_7}{y_6+y_7} v_o - v_1\right]$

4') $\Rightarrow$ $\left(1 - A_2 \dfrac{y_7}{y_6+y_7}\right) v_o = -A_2 v_1$

rewrite 3')

$$y_1 A_1(s) v_i - y_1 A_1(s) \frac{y_4}{y_4+y_5} v_1 - y_1 v_1 - (y_2+y_3) v_1 = -y_3 v_o$$

3'') or $y_1 A_1(s) v_i + y_3 v_o - \left\{ \dfrac{y_1 A_1(s) y_4}{y_4+y_5} + y_1 + y_2 + y_3 \right\} v_1 = 0$

4') $\rightarrow$ 3'')

5) $y_1 A_1(s) v_i + y_3 v_o - \left\{ \dfrac{y_1 A_1(s) y_4}{y_4+y_5} + y_1 + y_2 + y_3 \right\} \left\{ -\dfrac{1}{A_2}\left(1 - \dfrac{A_2 y_7}{y_6+y_7}\right) \right\} v_o = 0$

6) set $v_o = v_i$

7) $\left[y_1 A_1(s) + y_3 + \left\{ \dfrac{y_1 y_4}{y_4+y_5} A_1(s) + y_1 + y_2 + y_3 \right\} \left\{ \dfrac{1}{A_2}\left(1 - \dfrac{A_2 y_7}{y_6+y_7}\right) \right\} \right] v_o = 0$

$\Rightarrow$ $y_1(y_4+y_5)(y_6+y_7) A_1(s) A_2(s) + y_3(y_4+y_5)(y_6+y_7) A_2(s) +$

8) $+ \left[y_1 y_4 A_1(s) + (y_1+y_2+y_3)(y_4+y_5) \right]\left[y_6 + y_7 - A_2 y_7 \right] = 0$

all divided by $A_2(s)(y_4+y_5)(y_6+y_7)$