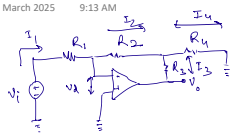
Graded Assignment

Saturday, 15 March 2025 9:13 AM



$V_o = A_s \cdot V_d$

$V_o = A(s) \cdot [V_+ - V_-]$

$V_o = A(s) \cdot [0 - V_1] = -A(s) \cdot V_1$

$I_1 = I_2 \quad -(1)$

$I_2 = I_3 + I_4 \quad -(2)$

$\frac{V_i - V_1}{R_1} = \frac{V_1 - V_2}{R_2} \quad -(1)$ $\qquad \frac{V_1 - V_2}{R_2} = \frac{V_2 - V_o}{R_3} + \frac{V_2}{R_4} \quad -(2)$

$V_i = 2V_1 - V_2$

V_1

$\frac{V_1 - V_2}{R} = \frac{V_2 - V_o}{R} + \frac{4V_2}{R} \quad (3)$

$V_1 - V_2 = V_2 - V_o + 4V_2$

$V_o + V_1 = 6V_2 \Rightarrow V_o = 6V_2 - V_1$

$V_1 = 6V_2 - V_o$

$V_i = 2V_1 - V_2$

$V_i = 2(6V_2 - V_o) - V_2 \quad -(5)$

$V_i = 11V_2 - 2V_o$

$V_i = 11\left(2V_1 - V_i\right) - 2V_o$

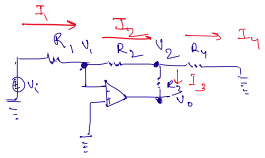
$12V_i = 22V_1 - 2V_o$

$12V_i = -22\cdot\frac{V_o}{A_s} - 2V_o \Rightarrow 12V_i = -\left[2 + \frac{12}{A_s}\right]V_o$

$\Rightarrow \frac{V_o}{V_i} = \frac{-12}{\left[2 + \frac{12}{A_s}\right]} = \frac{-6}{2 + \frac{6}{A_s}} = \left[\frac{-6}{1 + \frac{s}{\omega_u}}\right]$

$\left|\frac{V_o}{V_i}\right| = \frac{6}{\sqrt{1 + \frac{35\omega^2}{\omega_u^2}}} = \frac{6}{\sqrt{1 + 26\times 4}} = 0.136$

③



$V_o = A_s \cdot V_d$

$V_o = A_s \cdot (V_+ - V_-) \Rightarrow V_o = -A_s V_1$

$V_1 = -\frac{V_o}{A_s}$

$\frac{V_i - V_1}{R_1} = \frac{V_1 - V_2}{R_2} \quad -(1)$

$V_i = 2V_1 - V_2 \Rightarrow V_2 = V_i - 2V_1$

$\frac{V_2 - V_o}{R_3} + \frac{V_2}{R_4} = \frac{V_1 - V_2}{R_2} \quad -(2)$

$\frac{V_2 - V_o}{R} + \frac{V_2}{R_4} = \frac{V_1 - V_2}{R}$

$V_o = \left[V_i - 2V_1\right]\left[\frac{2R_4 + R}{R_4}\right] - V_1$

$\frac{V_o}{R} = \frac{V_2}{R} + \frac{V_2}{R_4} + \frac{V_2}{R} - \frac{V_1}{R}$

$\left[\frac{2R_4 + R}{R_4}\right]V_i = V_o - \frac{V_o}{A_s} + \frac{2V_o}{A_s}\left[\frac{2R_4 + R}{R_4}\right]$

$\frac{V_o}{R} = \frac{2V_2}{R} + \frac{V_2}{R_4} - \frac{V_1}{R}$

$\frac{V_i}{\left[\frac{2R_4 + R}{R_4}\right]} = V_o\left[1 - \frac{1}{A_s} + \frac{2}{A_s}\left[\frac{2R_4 + R}{R_4}\right]\right]$

$\frac{V_o}{R} = \frac{2V_2R_4 + V_2R}{RR_4} - \frac{V_1}{R}$

$\frac{V_o}{V_i} = \frac{\left[\frac{2R_4 + R}{R_4}\right]}{1 - \frac{1}{A_s} + \frac{2}{A_s}\left[\frac{2R_4 + R}{R_4}\right]}$

$\frac{V_o}{R} = V_2\left[\frac{2R_4 + R}{RR_4}\right] - \frac{V_1}{R} \Rightarrow V_o = V_2\left[\frac{2R_4 + R}{R_4}\right] - V_1$

$\frac{V_o}{V_i} = \frac{\left[\frac{2R_4 + R}{R_4}\right]}{1 + \frac{1}{A_s}\left[\frac{4R_4 + 2R - R_4}{R_4}\right]}$ $\Rightarrow$ $\boxed{\frac{V_o}{V_i} = -\frac{\left[\frac{2R_4 + R}{R_4}\right]}{1 + \frac{s}{\omega_u}\left[\frac{2R_4 + 2R}{R_4}\right]}}$

$\frac{2R_4 + R}{R_4} = \frac{\frac{2R}{3} + R}{\frac{R}{3}} = \frac{5R}{R} = 5$