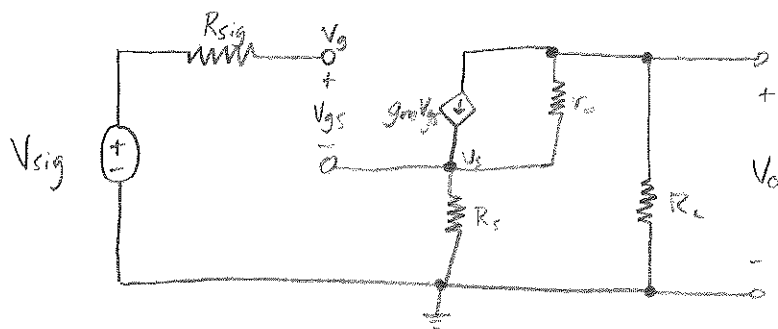


1.



$$\textcircled{1} \frac{V_o - 0}{R_L} = g_m V_{gs} + \frac{V_o - V_s}{r_o}$$

$$\textcircled{2} V_{gs} = V_g - V_s = V_{sig} - V_s$$

$$\textcircled{3} \frac{V_s - 0}{R_s} = - \frac{V_o}{R_L}$$

$$\textcircled{2} \rightarrow \textcircled{1}: \frac{V_o}{R_L} = g_m (V_{sig} - V_s) + \frac{V_o - V_s}{r_o}$$

$$\text{Plug into } \textcircled{3}: \frac{V_s}{R_s} = - \left( g_m (V_{sig} - V_s) + \frac{V_o - V_s}{r_o} \right)$$

$$\frac{V_s}{R_s} = - \left( g_m V_{sig} - g_m V_s + \frac{V_o}{r_o} - \frac{V_s}{r_o} \right)$$

$$\frac{V_s}{R_s} = -g_m V_{sig} + g_m V_s - \frac{V_o}{r_o} + \frac{V_s}{r_o}$$

$$\frac{V_s}{R_s} + \frac{V_o}{r_o} = -g_m V_{sig} + g_m V_s + \frac{V_s}{r_o}$$

$$\frac{V_o}{r_o} = -g_m V_{sig} + g_m V_s + \frac{V_s}{r_o} - \frac{V_s}{R_s}$$

$$\frac{V_o}{V_{sig}}$$