

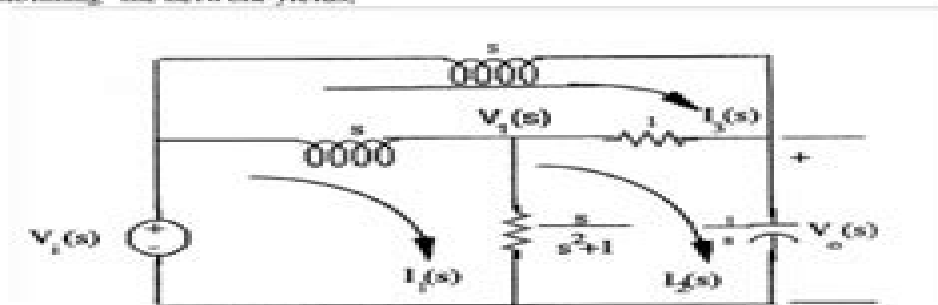
$$I_2(s) = \begin{vmatrix} 2s+1 & V_i(s) \\ -1 & 0 \\ 2s+1 & -1 \\ -1 & \frac{3s^2+s+2}{s} \end{vmatrix}$$

Solving for $I_2(s)/V_i(s)$,

$$\frac{I_2(s)}{V_i(s)} = \frac{s}{6s^2 + 5s^2 + 4s + 2}$$

But $V_o(s) = I_2(s)3s$. Therefore, $G(s) = 3s^2/(6s^2 + 5s^2 + 4s + 2)$.

b. Transforming the network yields,



Writing the loop equations,

$$\begin{aligned} (s + \frac{s}{s^2+1})I_1(s) - \frac{s}{s^2+1}I_2(s) - sI_3(s) &= V_i(s) \\ -\frac{s}{s^2+1}I_1(s) + (\frac{s}{s^2+1} + 1 + \frac{1}{s})I_2(s) - I_3(s) &= 0 \\ -sI_1(s) - I_2(s) + (2s+1)I_3(s) &= 0 \end{aligned}$$

Solving for $I_2(s)$,

$$I_2(s) = \frac{s(s^2 + 2s + 2)}{s^4 + 2s^3 + 3s^2 + 3s + 2} V_i(s)$$

But, $V_o(s) = \frac{I_2(s)}{s} = \frac{(s^2 + 2s + 2)}{s^4 + 2s^3 + 3s^2 + 3s + 2} V_i(s)$. Therefore,

$$\frac{V_o(s)}{V_i(s)} = \frac{s^2 + 2s + 2}{s^4 + 2s^3 + 3s^2 + 3s + 2}$$

19.

a. Writing the nodal equations yields,

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