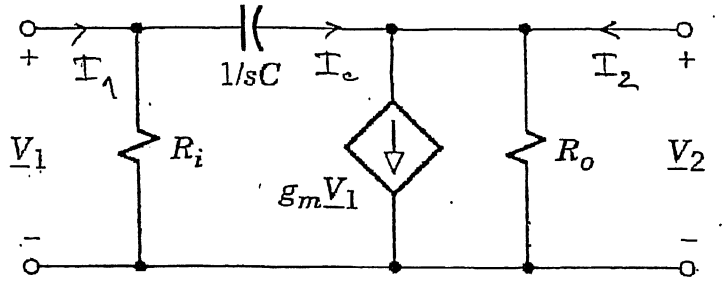


Figure 1.

SOLUTIONE:

(a.) $Y_{11} = \left.\frac{I_1(s)}{V_1(s)}\right|_{V_2=0}$ $\quad Y_{22} = \left.\frac{I_2(s)}{V_2(s)}\right|_{V_1=0}$ $\quad Y_{21} = \left.\frac{I_2(s)}{V_1(s)}\right|_{V_2=0}$

$I_1 = \frac{V_1}{R_i} + sCV_1$ $\quad I_2 = sCV_2 + \frac{1}{R_o}V_2$ $\quad I_2 = -sCV_1 + g_m V_1$

$Y_{11} = \frac{1}{R_i} + sC$ $\quad Y_{22} = sC + \frac{1}{R_o}$ $\quad Y_{21} = g_m - sC$

$Y_{12} = \left.\frac{I_1(s)}{V_2(s)}\right|_{V_1=0}$

$I_1 = -sCV_2$

$Y_{12} = -sC$

$$\Rightarrow \underline{Y} = \begin{bmatrix} Y_{11} & Y_{12} \\ Y_{21} & Y_{22} \end{bmatrix} = \begin{bmatrix} sC + \frac{1}{R_i} & -sC \\ -sC + g_m & sC + \frac{1}{R_o} \end{bmatrix}$$ 2p

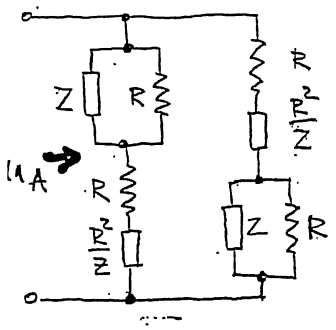
(b.) $H_v(s) = \frac{V_2}{V_1} = \frac{-Y_{21}}{Y_{22} + Y_L} = \frac{sC - g_m}{sC + \frac{1}{R_o} + \frac{1}{R_L}}$

$$H_v(s) = \frac{s - \frac{g_m}{C}}{s + \frac{\frac{1}{R_o \| R_L}}{C}}$$ 2p

Solution

$$\begin{cases} z_{11_A} = \left(z \| R + R + \frac{R^2}{z}\right) \| \left(z \| R + R + \frac{R^2}{z}\right) = \frac{1}{2}\left(\frac{Rz}{R+z} + R + \frac{R^2}{z}\right) \\ z_{11_B} = (2z + R) \| R + z_x = \frac{(2z+R)\cdot R}{2(R+z)} + z_x \end{cases}$$

$$z_{11_A} = z_{11_B} \Rightarrow \quad z_x = \cancel{\frac{R \cdot z}{2(R+z)}} + \frac{R}{2} + \frac{R^2}{2z} - \cancel{\frac{(2z+R)\cdot R}{2(R+z)}}$$



$$\rightarrow \boxed{z_x = \frac{R^2}{2z}}$$

$$z_{12_A} \overset{?}{=} z_{12_B}$$

$$z_{22} \equiv z_{11}, \quad z_{12} \equiv z_{21}$$