

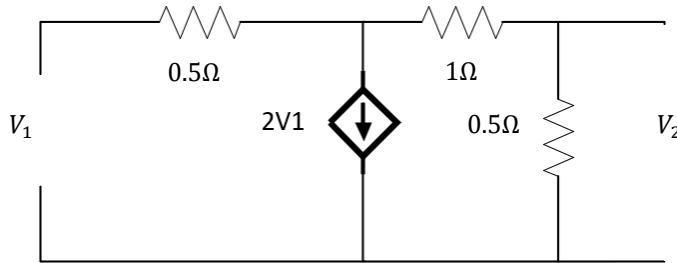
الزمن: ساعة ونصف

ربيع 2024/2023

التاريخ: 2024/06/09

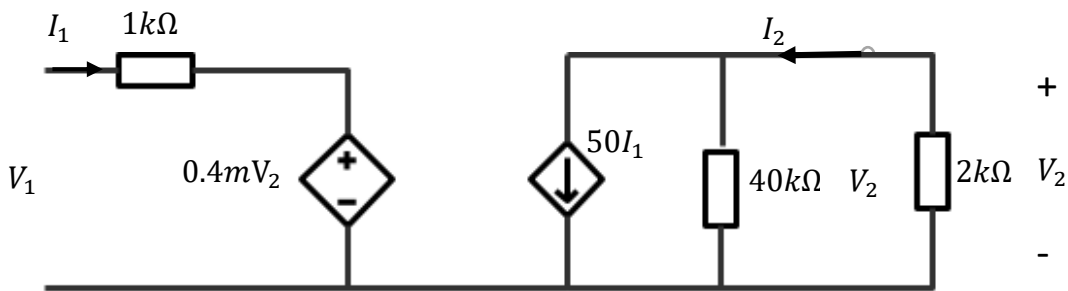
السؤال الأول: (5 درجات)

أوجد Z parameters للدائرة بالشكل التالي:



الشكل 1

السؤال الثاني: (5 درجات)

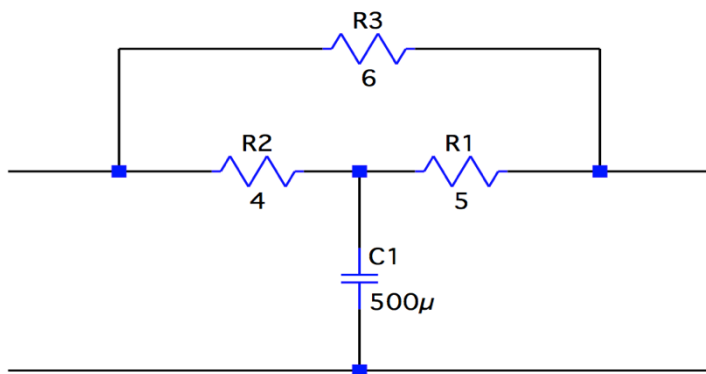
بالنسبة للدائرة المكافئة لمقادير h أوجد الموضحة بالشكل رقم 2 أوجد A_v , A_i 

الشكل 2

السؤال الثالث (5 درجات)

أوجد Z parameters للدائرة

المبينة بالشكل 3 عند تردد

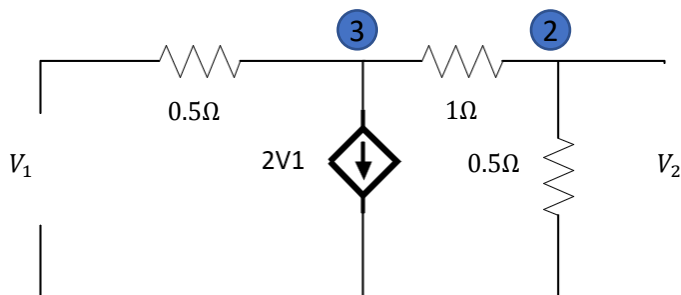
 $w=1\text{kHz}$ 

الشكل 3

انتهت الأسئلة

مع تمنياتي للجميع بالتوفيق والنجاح

السؤال الأول: (5 درجات)
أوجد Z parameters للدائرة بالشكل التالي:



KCL at node 3

$$I_1 = 2V_1 + \frac{V_3 - V_2}{1}$$

$$I_1 = 2V_1 + \frac{V_2}{3} - V_2$$

$$I_1 = 2V_1 - \frac{2}{3}V_2$$

$$V_3 = \frac{V_2}{3}$$

KCL at node 2

$$I_2 = 2V_2 + \frac{V_2 - V_3}{1}$$

$$I_2 = 3V_2 + \frac{V_2}{3}$$

$$I_2 = \frac{8}{3}V_2$$

$$Y = \begin{bmatrix} 2 & -\frac{2}{3} \\ 0 & \frac{8}{3} \end{bmatrix} \quad | \text{--- From Table ---} \rightarrow Z = \begin{bmatrix} \frac{1}{2} & \frac{1}{8} \\ 0 & \frac{3}{8} \end{bmatrix}$$

حل آخر

$$Z_{12} = \frac{V_1}{I_2} \Big|_{I_1=0}$$

$$I_2 = 2V_1 + \frac{V_2}{0.5}$$

$$V_1 = -2V_1 + V_2 \rightarrow 3V_1 = V_2$$

$$I_2 = 2V_1 + 6V_1 = 8V_1$$

$$V_1 = \frac{1}{8}I_2$$

$$Z_{22} = \frac{V_2}{I_2} \Big|_{I_1=0}$$

$$I_2 = 2V_1 + \frac{V_2}{0.5}$$

$$I_2 = 2\left(\frac{1}{8}\right)I_2 + 2V_2$$

$$I_2 = \frac{8}{3}V_2 \rightarrow V_2 = \frac{3}{8}I_2$$

$$Z_{11} = \frac{V_1}{I_1} \Big|_{I_2=0}$$

$$V_1 = 0.5I_1 + 1.5(I_1 - 2V_1)$$

$$V_1 = 2I_1 - 3V_1$$

$$V_1 = 0.5I_1$$

$$Z_{21} = \frac{V_2}{I_1} \Big|_{I_2=0}$$

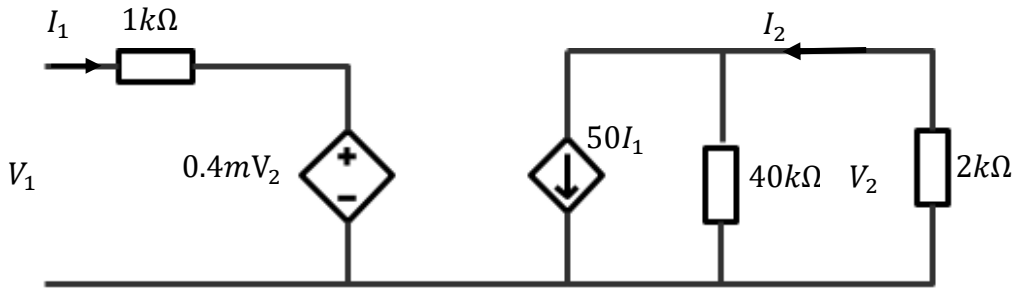
$$V_2 = 0.5(I_1 - 2V_1)$$

$$V_2 = 0$$

$$Z = \begin{bmatrix} \frac{1}{2} & \frac{1}{8} \\ 0 & \frac{3}{8} \end{bmatrix}$$

السؤال 2:
السؤال الثاني: (5 درجات)

بالنسبة للدائرة المكافئة لمقادير h أوجد الموضحة بالشكل رقم 2 أوجد A_v , A_i



$$V_1 = 1kI_1 + 0.4mV_2$$

$$V_2 = (I_2 - 50I_1)40k = 40kI_2 - 2MI_1$$

$$I_2 = -\frac{V_2}{2k}$$

$$V_2 = -20V_2 - 2MI_1$$

$$V_2 = -95.24kI_1$$

$$V_1 = 1k\left(\frac{-1}{95.24k}\right)V_2 + 0.4mV_2 = -0.0101V_2$$

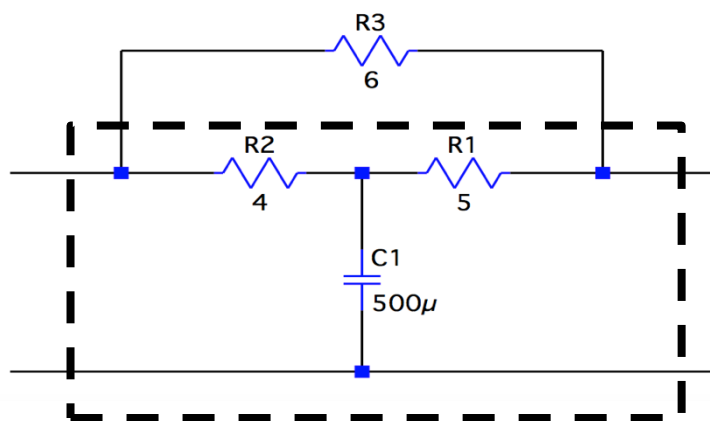
$$A_v = \frac{V_2}{V_1} = -99$$

$$V_2 = 40kI_2 - 2MI_1$$

$$I_2 = -\frac{V_2}{2k} \rightarrow V_2 = -2kI_2$$

$$-2kI_2 = 40kI_2 - 2MI_1$$

$$A_i = \frac{I_2}{I_1} = 47.62$$



$$XC = \frac{1}{j\omega C} = \frac{1}{j1k * 500\mu} = -2j$$

$$Y_{11} = \frac{I_1}{V_1}$$

$$V_1 = I_1 * \left(4 + \left(\frac{5 * -2j}{5 - 2j} \right) \right) \left(\frac{20 - 8j - 10j}{5 - 2j} \right) = \left(\frac{20 - 18j}{5 - 2j} \right) I_1$$

$$Y_{11} = 0.188 + 0.069i$$

$$Y_{22} = \frac{I_2}{V_2} \Big|_{V_1=0}$$

$$V_2 = I_2 \left(5 + \left(\frac{-8i}{4 - 2i} \right) \right) = I_2 \left(\frac{20 - 18i}{4 - 2i} \right)$$

$$Y_{22} = \frac{4 - 2i}{20 - 18i} = 0.16 + 0.0442i$$

$$I_1 = -I_2 * \left(\frac{-2i}{4 - 2i} \right) = I_2 * \left(\frac{2i}{4 - 2i} \right)$$

$$\rightarrow V_2 = I_2 \left(\frac{20 - 18i}{4 - 2i} \right) = I_1 * \left(\frac{4 - 2i}{2i} \right) * \left\{ \left(\frac{20 - 18i}{4 - 2i} \right) \right\} = (-9 - 10i)I_1$$

$$Y_{12} = Y_{21} = -0.049 + 0.0552j$$

$$Y_a = \begin{bmatrix} 0.188 + 0.069i & -0.049 + 0.0552j \\ -0.049 + 0.0552j & 0.16 + 0.0442i \end{bmatrix} S$$

$$Y_b = \begin{bmatrix} \frac{1}{6} & -\frac{1}{6} \\ -\frac{1}{6} & \frac{1}{6} \end{bmatrix} S$$

$$Y = \begin{bmatrix} 0.355 + 0.069i & -0.2157 + 0.0552i \\ -0.2157 + 0.0552i & 0.3267 + 0.0442i \end{bmatrix}$$

From The Table:

$$Z = \begin{bmatrix} 2.9323 - 1.9833i & 1.3323 - 1.985i \\ 1.3323 - 1.985i & 3.3363 - 1.9872i \end{bmatrix}$$

	Z		Y		h		g		T	
Z	Z_{11}	Z_{12}	$\frac{Y_{22}}{D_{YY}}$	$\frac{-Y_{12}}{D_{YY}}$	$\frac{D_{hh}}{h_{22}}$	$\frac{h_{12}}{h_{22}}$	$\frac{1}{g_{11}}$	$\frac{-g_{12}}{g_{11}}$	$\frac{A}{C}$	$\frac{D_{TT}}{C}$
	Z_{21}	Z_{22}	$\frac{-Y_{21}}{D_{YY}}$	$\frac{Y_{11}}{D_{YY}}$	$\frac{-h_{21}}{h_{22}}$	$\frac{1}{h_{22}}$	$\frac{g_{21}}{g_{11}}$	$\frac{D_{gg}}{g_{11}}$	$\frac{1}{C}$	$\frac{D}{C}$
Y	$\frac{Z_{22}}{D_{zz}}$	$\frac{-Z_{12}}{D_{zz}}$	Y_{11}	Y_{12}	$\frac{1}{h_{11}}$	$\frac{-h_{12}}{h_{11}}$	$\frac{D_{gg}}{g_{22}}$	$\frac{g_{12}}{g_{22}}$	$\frac{D}{B}$	$\frac{-D_{TT}}{B}$
	$\frac{-Z_{21}}{D_{zz}}$	$\frac{Z_{11}}{D_{zz}}$	Y_{21}	Y_{22}	$\frac{h_{21}}{h_{11}}$	$\frac{-D_{nn}}{h_{11}}$	$\frac{-g_{21}}{g_{22}}$	$\frac{1}{g_{22}}$	$\frac{-1}{B}$	$\frac{A}{B}$
h	$\frac{D_{zz}}{Z_{22}}$	$\frac{Z_{12}}{Z_{22}}$	$\frac{1}{Y_{11}}$	$\frac{-Y_{12}}{Y_{11}}$	h_{11}	h_{12}	$\frac{g_{22}}{D_{gg}}$	$\frac{g_{12}}{D_{gg}}$	$\frac{B}{D}$	$\frac{D_{TT}}{D}$
	$\frac{-Z_{21}}{Z_{22}}$	$\frac{1}{Z_{22}}$	$\frac{Y_{21}}{Y_{11}}$	$\frac{D_{yy}}{Y_{11}}$	h_{21}	h_{22}	$\frac{g_{21}}{D_{gg}}$	$\frac{g_{11}}{D_{gg}}$	$\frac{-1}{D}$	$\frac{C}{D}$
g	$\frac{1}{Z_{11}}$	$\frac{-Z_{12}}{Z_{11}}$	$\frac{D_{YY}}{Y_{22}}$	$\frac{Y_{12}}{Y_{22}}$	$\frac{h_{22}}{D_{hh}}$	$\frac{-h_{12}}{D_{hh}}$	g_{11}	g_{12}	$\frac{C}{A}$	$\frac{-D_{TT}}{A}$
	$\frac{Z_{21}}{Z_{11}}$	$\frac{D_{ZZ}}{Z_{11}}$	$\frac{-Y_{21}}{Y_{22}}$	$\frac{1}{Y_{22}}$	$\frac{-h_{21}}{D_{hh}}$	$\frac{h_{11}}{D_{hh}}$	g_{21}	g_{22}	$\frac{1}{A}$	$\frac{B}{A}$
T	$\frac{Z_{11}}{Z_{21}}$	$\frac{D_{ZZ}}{Z_{21}}$	$\frac{-Y_{22}}{Y_{21}}$	$\frac{-1}{Y_{21}}$	$\frac{-D_{hh}}{h_{21}}$	$\frac{-h_{11}}{h_{21}}$	$\frac{1}{g_{21}}$	$\frac{g_{22}}{g_{21}}$	A	B
	$\frac{1}{Z_{21}}$	$\frac{Z_{22}}{Z_{21}}$	$\frac{-D_{YY}}{Y_{21}}$	$\frac{-Y_{11}}{Y_{21}}$	$\frac{-h_{22}}{h_{21}}$	$\frac{-1}{h_{21}}$	$\frac{g_{11}}{g_{21}}$	$\frac{D_{gg}}{g_{21}}$	C	D

$D_{PP} = P_{11}P_{22} - P_{12}P_{21}$ is the determinant of Z-, Y-, h-, g-, or T-parameters.

$$\begin{bmatrix} V_1 \\ V_2 \end{bmatrix} = Z \cdot \begin{bmatrix} I_1 \\ I_2 \end{bmatrix} \quad - \quad \begin{bmatrix} I_1 \\ I_2 \end{bmatrix} = Y \cdot \begin{bmatrix} V_1 \\ V_2 \end{bmatrix} \quad - \quad \begin{bmatrix} V_1 \\ V_2 \end{bmatrix} = h \cdot \begin{bmatrix} I_1 \\ I_2 \end{bmatrix} \quad - \quad \begin{bmatrix} I_1 \\ V_2 \end{bmatrix} = g \cdot \begin{bmatrix} V_1 \\ I_2 \end{bmatrix} \quad - \quad \begin{bmatrix} V_1 \\ I_1 \end{bmatrix} = T \cdot \begin{bmatrix} V_1 \\ V_2 \end{bmatrix}$$