یا لطیف

مدار های الکتریکی ۱

نیم سال اول ۰۰-۹۹

دانشگاه صنعتی شاهرود
دانشکده مهندسی برق و رباتیک

پاسخ تمرین سری هشتم

حالت دائمی سینوسی

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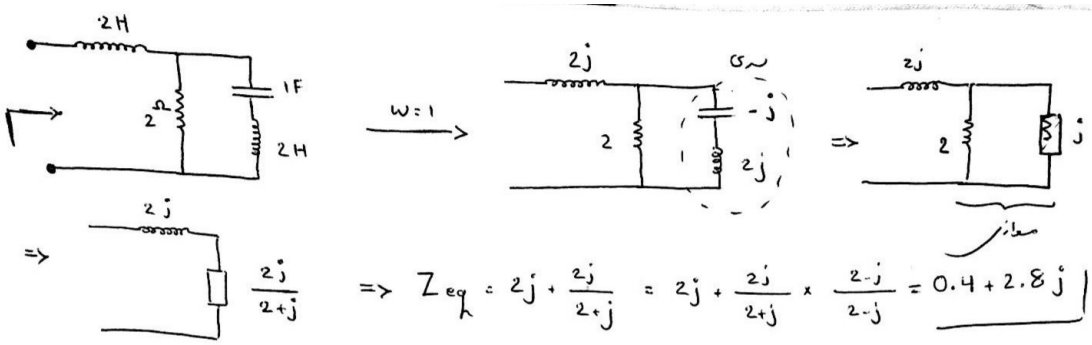

$$\Rightarrow Z_{eq} = 2j + \frac{2j}{2+j} = 2j + \frac{2j}{2+j} \times \frac{2-j}{2-j} = 0.4 + 2.8j$$

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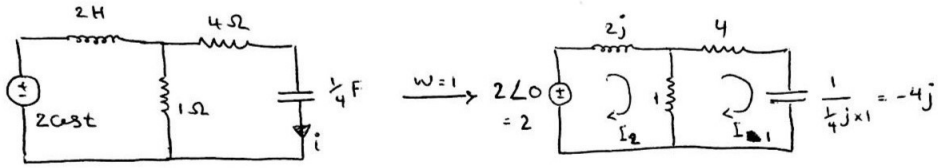

KVL in I_2: $-2 + 2jI_2 + 1(I_1 - I_2) = 0 \Rightarrow I_2(1+2j) - I_1 = 2$ (I)

KVL in I_1: $4I_2 - 4jI_2 + 1(I_2 - I_1) = 0 \Rightarrow I_1(5-4j) = I_2$ (II)

(II) in (I) $\Rightarrow I_1(5-4j)(1+2j) - I_1 = 2 \Rightarrow I_1(5+8+10j-4j-1) = 2 \Rightarrow I_1 = \frac{2}{12+6j}$

$$= \frac{2\angle 0}{13.4\angle 26} = 0.14\angle -26 \Rightarrow i_1(t) = 0.14\cos(t-26)$$

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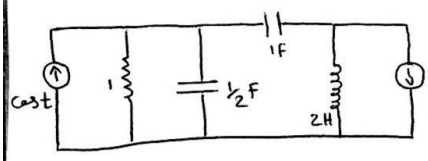
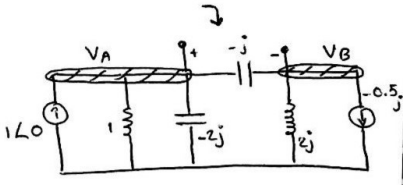


حوزه فازور



KCL in V_A : $-1+\frac{V_A-0}{1}+\frac{V_A-0}{-2j}+\frac{V_A-V_B}{-j}=0 \Rightarrow V_A(2+3j)-2jV_B=2$ (I)

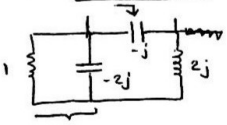
KCL in V_B : $\frac{V_B-V_A}{-j}+\frac{V_B-0}{2j}-0.5j=0 \Rightarrow V_B=1+2V_A$ (II)

(II) in (I) $\Rightarrow V_A(2+3j)-2j(1+2V_A)=2 \Rightarrow (2-j)V_A=2+2j \Rightarrow V_A=\frac{2+2j}{2-j}\times\frac{2+j}{2+j}$

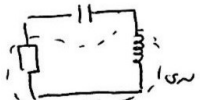
$\Rightarrow V_A=0.4+1.2j \xrightarrow{(II)} V_B=1+2(0.4+1.2j)=1.8+2.4j$

$\Rightarrow V_{TH}=V_A-V_B=0.4+1.2j-1.8-2.4j=-1.4-1.2j=1.8\angle -140^\circ \Rightarrow V_{TH}(t)=1.8\cos(t-140^\circ)$

$Z_{TH}=?$ ← منابع مستقل = ۰ ⇒

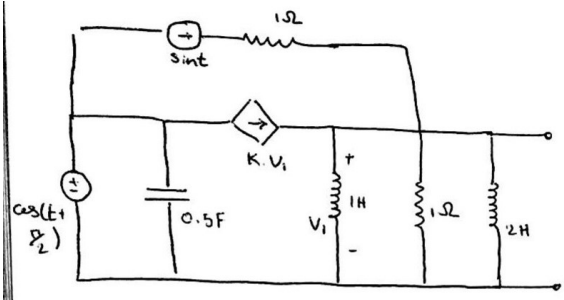


$\Rightarrow 1\|-2j=\frac{-2j}{1-2j}=0.8-0.4j$

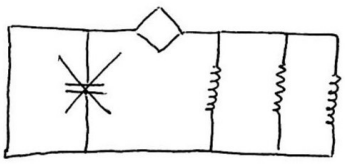


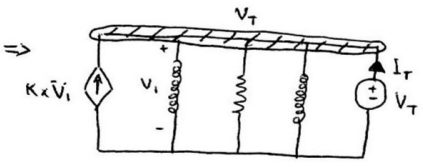
$\Rightarrow 2j+0.8-0.4j=0.8+1.6j \Rightarrow Z_{eq}=(0.8+1.6j)\|-j$

.۴



Z_{TH} بدست آوردن
۰ = منابع مستقل





KCL in V_T : $-I_T+\frac{V_T}{2j}+\frac{V_T}{1}+\frac{V_T}{j}-KV_T=0$

$\Rightarrow V_T\left(\frac{1}{2j}+1+\frac{1}{j}-K\right)=I_T$

$\Rightarrow \frac{V_T}{I_T}=\frac{1}{1-K-\frac{2}{3}j}=Z_{TH}=\frac{2}{3}j \Rightarrow K=1$

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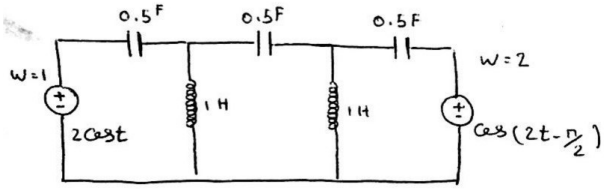
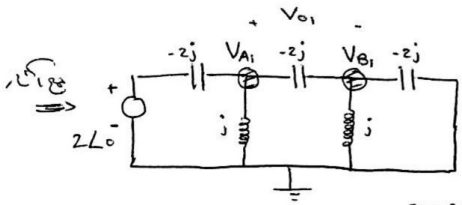
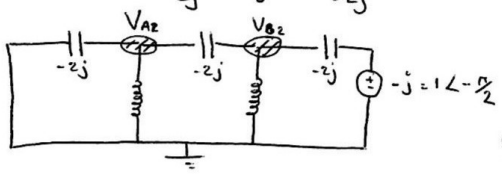




KCL in V_{A1}: $\frac{V_{A1}-2}{-2j}+\frac{V_{A1}}{j}+\frac{V_{A1}-V_{B1}}{-2j}=0 \Rightarrow V_{B1}=-2^{\mu}$ | $\mu \angle \pi \Rightarrow V_{B1}(t)=2\cos(t-\pi)$

KCL in V_{B1}: $\frac{V_{B1}}{-2j}+\frac{V_{B1}}{j}+\frac{V_{B1}-V_{A1}}{-2j}=0 \Rightarrow V_{A1}=0 \Rightarrow V_{o1}=V_{B1}=+2^{\mu}$



KCL in V_{A2}: $\Rightarrow \frac{3}{2}V_{A2}=V_{B2}$ (I)

KCL in V_{B2}: $\Rightarrow -3V_{B2}+2V_{A2}=2j$ (II)

(I) in (II) $\Rightarrow V_{A2}=\frac{-4}{5}j \Rightarrow V_{B2}=\frac{-6}{5}j$

$\Rightarrow V_{o2}=V_{A2}-V_{B2}=\frac{2}{5}j=\frac{2}{5}\angle 90^\circ=\frac{2}{5}\cos(2t+90^\circ)$

$\Rightarrow V_o(t)=V_{o1}(t)+V_{o2}(t)=2\cos t+0.4\cos(2t+90)$

* دقت شود که صفرها در حوزه زمان با هم جمع شوند؛ به هیچ عنوان در حوزه فرکانس با هم جمع نشوند *

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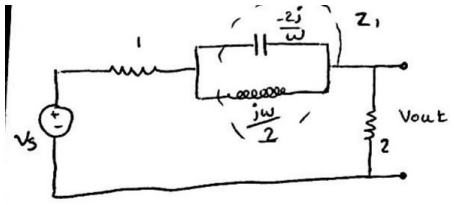


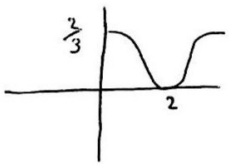
$\Rightarrow Z_1=\frac{\frac{-2j}{w}\times\frac{jw}{2}}{\frac{jw}{2}-\frac{2j}{w}}=\frac{2jw}{4-w^2}$

$\Rightarrow H(jw)=\frac{Vo}{Vs}(jw)=\frac{2}{2+Z_1+1}=\frac{2}{3+Z_1}$

$=\frac{2}{3+\frac{2jw}{4-w^2}}=\frac{8-2w^2}{12-3w^2+2jw} \Rightarrow |H(jw)|=\frac{8-2w^2}{\sqrt{(12-3w^2)^2+4w^2}}$

$\Rightarrow 8-2w^2=0 \Rightarrow w=2$

$\begin{cases}|H(jw)|_{w\to 0}=\frac{2}{3}\\ |H(jw)|_{w\to\infty}=\frac{2}{3}\end{cases}$



$|H(jw)|_{max}=\frac{2}{3} \Rightarrow |H(jw)|_{w=w_c}=\frac{8-2w_c^2}{\sqrt{(12-3w_c^2)^2+4w_c^2}}=\frac{1}{\sqrt{2}}\times\frac{2}{3}$

$\Rightarrow \begin{cases}w_{c\text{-}High}=2.36\ \frac{rad}{s}\\ w_{c\text{-}Low}=1.69\ \frac{rad}{s}\end{cases} \Rightarrow B.W=2.36-1.69=0.67$