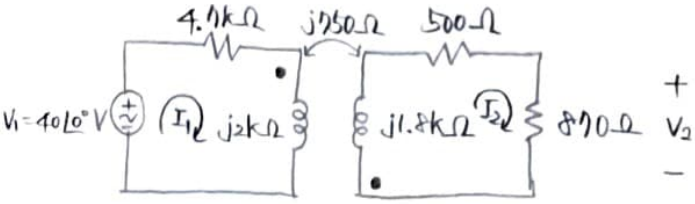
국방정보공학과 2학년 2020032306 송민정

회로이론 2 HW6

12. Find $I_1, I_2, \frac{V_2}{V_1}, \frac{I_2}{I_1}$



매쉬 분석법을 사용해 식을 세우면,

$(4.7k + j2k)I_1 + j750\, I_2 = 40\angle 0°$ ··· ①

$(500 + 870 + j1.8k)I_2 + j750 I_1 = 0$ ··· ②

크래머 공식에 따라,

$$I_1 = \frac{\begin{vmatrix} 40 & j750 \\ 0 & 1370+j1800 \end{vmatrix}}{\begin{vmatrix} 4700+j2000 & j750 \\ j750 & 1370+j1800 \end{vmatrix}} = 7.73\angle -20.38° \, mA$$

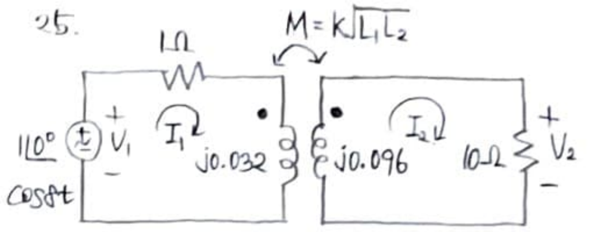
$$I_2 = \frac{\begin{vmatrix} 4700+j2000 & 40 \\ j750 & 0 \end{vmatrix}}{\begin{vmatrix} 4700+j2000 & j750 \\ j750 & 1370+j1800 \end{vmatrix}} = 2.56\angle -163.1° \, mA$$

$\therefore \frac{I_2}{I_1} = 0.33 \angle -142.72°$

또한 $870 I_2 = V_2$ 이므로

$$\frac{V_2}{V_1} = \frac{870 I_2}{40\angle 0°} = 0.056 \angle -163.1°$$

25. $M = k\sqrt{L_1 L_2}$



(a) 매쉬 분석법을 사용해 식을 세우면,

$(1 + j0.032)I_1 - MI_2 = 1\angle 0°$ ··· ①

$(10 + j0.096)I_2 - MI_1 = 0$ ··· ②

크래머 공식에 따라,

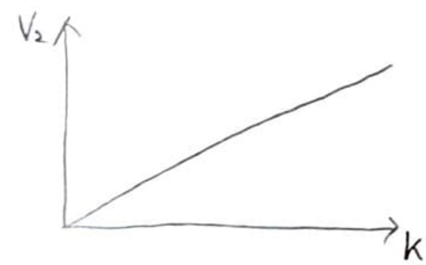
$$I_2 = \frac{\begin{vmatrix} 1+j0.032 & 1 \\ -M & 0 \end{vmatrix}}{\begin{vmatrix} 1+j0.032 & -M \\ -M & 10+j0.096 \end{vmatrix}} = \frac{M}{10 + j0.42 - M^2}$$

$M = k\sqrt{L_1 L_2} = k(6.93 \times 10^{-3})H \rightarrow jk0.055$

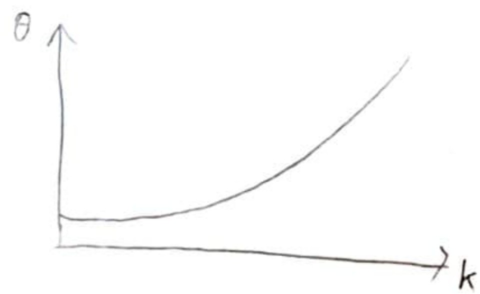
$$V_2 = 10 I_2$$

$$= \frac{jk0.055}{10 + j0.42 + k^2 0.055^2} \times 10$$

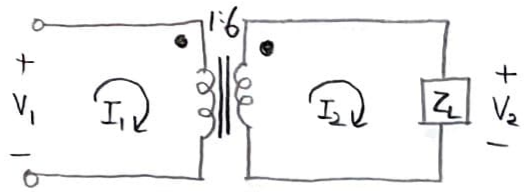
(b) V_2의 크기



V_2의 위상각



39.



(a) $V_1 = 4\angle 32^\circ\,V$, $Z_L = 1 - j\,\Omega$

ideal transformer 에서, $Z_{in} = \dfrac{Z_L}{a^2}$

$$Z_{in} = \frac{V_1}{I_1} = \frac{Z_L}{a^2}$$

$$\therefore I_1 = \frac{V_1 \times a^2}{Z_L} = \frac{144\angle 32^\circ}{1-j} = 101.82\angle 77^\circ\,A$$

$\dfrac{I_2}{I_1} = \dfrac{1}{a}$ 에서,

$$I_2 = \frac{I_1}{a} = \frac{101.82\angle 77^\circ}{6} = 16.97\angle 77^\circ\,A$$

$$V_2 = I_2 Z_L = (16.97\angle 77^\circ)(1-j) = 24\angle 32^\circ\,V$$

(b) $V_1 = 4\angle 32^\circ\,V$, $Z_L = 0$

$$I_1 = \frac{V_1 \times a^2}{Z_L} = \frac{144\angle 32^\circ}{0} = \infty$$

$$I_2 = \frac{I_1}{a} = \infty$$

$$V_2 = I_2 Z_L = \infty \times 0 = 0\,V$$

(c) $V_1 = 2\angle 118^\circ\,V$, $Z_L = 1.5\angle 10^\circ\,\Omega$.

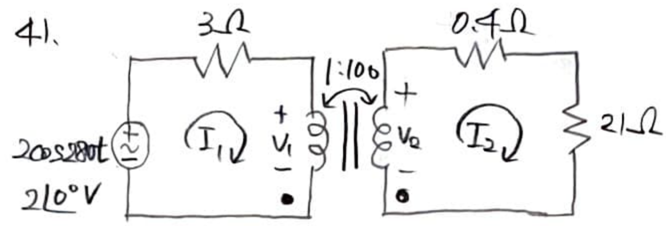
$$I_1 = \frac{V_1 \times a^2}{Z_L} = 48\angle 108^\circ\,A$$

$$I_2 = \frac{I_1}{a} = \frac{48\angle 108^\circ}{6} = 8\angle 108^\circ\,A$$

$$V_2 = I_2 Z_L = (8\angle 108^\circ)(1.5\angle 10^\circ)$$

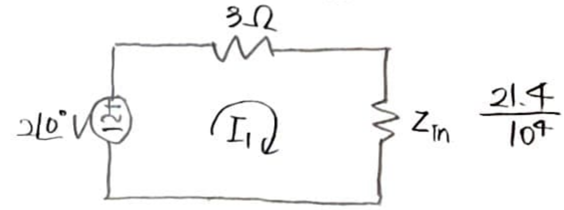
$$= 12\angle 118^\circ$$

41.



$Z_L = 21.4\,\Omega$, $a = 100$

$$Z_{in} = \frac{Z_L}{a^2} = \frac{21.4}{10^4}$$



$$I_1 = \frac{V_1}{3 + \frac{21.4}{10^4}} = \frac{2}{3}\angle 0^\circ\,A$$

$$I_2 = \frac{I_1}{a} = \frac{2}{300}\angle 0^\circ\,A$$

$$P_{0.4\Omega} = \frac{1}{2}|I_2|^2 (0.4\,\Omega)$$

$$= \frac{1}{2} \times \left(\frac{2}{300}\right)^2 \times 0.4$$

$$= 8.88 \times 10^{-6} = 8.89\,\mu W$$

$$P_{21\Omega} = \frac{1}{2}|I_2|^2 (21\,\Omega)$$

$$= \frac{1}{2} \times \left(\frac{2}{300}\right)^2 \times 21$$

$$= 4.67 \times 10^{-4}$$

$$= 0.467\,mW$$