국방정보공학과 2학년 20200227306 송민경

회로이론 과제

Q19. (a) $Z = r\angle\phi$

$= re^{j\phi} = r(\cos\phi + j\sin\phi) = r\cos\phi + jr\sin\phi$ 이므로.

$3(3\angle 30°) = 3[\cos(30°) + j3\sin(30°)]$

$= 3(2.598 + j1.5)$

$= 7.794 + j4.5$

(b) $2\angle 25° + 5\angle -10° = 2[\cos(25°) + j\sin(25°)] + 5[\cos(-10°) + j\sin(-10°)]$

$= 1.813 + j0.845 + 4.924 - j0.868$

$= 6.737 - j0.023$

(c) $(12 + j90) - 5\angle 30° = 12 + j90 - 5[\cos(30°) + j\sin(30°)]$

$= 12 + j90 - 4.330 - j2.5$

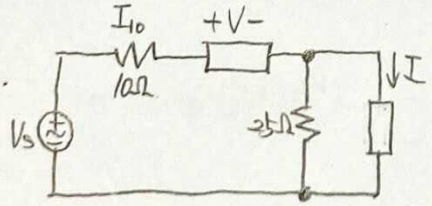
$= 7.67 + j87.5$

(d) $\frac{10+5j}{8-j} + 2\angle 60° + 1 = \frac{(10+5j)(8+j)}{(8-j)(8+j)} + 2[\cos(60°) + j\sin(60°)] + 1$

$= \frac{80 + 50j - 5}{64 + 1} + 1 + j\sqrt{3} + 1$

$= 3.154 + j2.501$

Q35.



Given, $I_{10} = 4\angle 35°A$, $V = 10\angle 35°V$

$I = 2\angle 35°A$

(a) 양단 전압이 V가 되는 회로 소자에서, 전류 ($I_{10} = 4\angle 35°A$)와 전압 ($V = 10\angle 35°V$)이 $\theta = \phi$로 in-phase 이다. 따라서, 이 소자는 '저항'이다. 또한 이는

$R = \frac{V}{I} = \frac{10\angle 35°}{4\angle 35°} = 2.5\Omega$의 값을 갖는다.

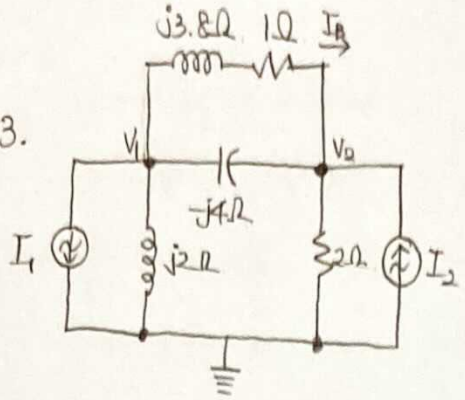
(b) 25Ω 저항에서 전류, 전압은 각각 $I_{25} = I_{10} - I = 2\angle 35°$, $V_{25} = I_{25} \times 25 = 50\angle 35°$ 이므로

KVL 에 의해, $-V_S + (I_{10})(10) + V + V_{25} = 0$ 이다.

$\therefore -V_S + (4\angle 35°)(10) + 10\angle 35° + 50\angle 35° = 0$, $V_S = 40\angle 35° + 60\angle 35°$

$V_S = 100\angle 35°$ 이다.

Q53.



Given, $I_1 = 5\angle -18°\ A$

$I_2 = 2\angle 5°\ A$

노드분석 기법을 사용하면

V_1에서, $5\angle -18° + \frac{V_1}{j2} + \frac{V_1 - V_2}{-j4} + \frac{V_1 - V_2}{1+j3.8} = 0$

$$V_1\left(\frac{1}{j2} + \frac{1}{-j4} + \frac{1}{1+j3.8}\right) + V_2\left(\frac{1}{j4} - \frac{1}{1+j3.8}\right) = -5\angle -18°$$

$$V_1(0.5\angle -82.5°) + V_2(0.065\angle -116.5°) = -5\angle -18° \quad \cdots (A)$$

V_2에서, $\frac{V_2 - V_1}{1+j3.8} + \frac{V_2 - V_1}{-j4} + \frac{V_2}{2} - 2\angle 5° = 0$

$$V_1\left(-\frac{1}{1+j3.8} + \frac{1}{j4}\right) + V_2\left(\frac{1}{1+j3.8} - \frac{1}{j4} + \frac{1}{2}\right) = 2\angle 5°$$

$$V_1(0.06\angle -116.5°) + V_2(0.56\angle 0.394°) = 2\angle 5° \quad \cdots (B)$$

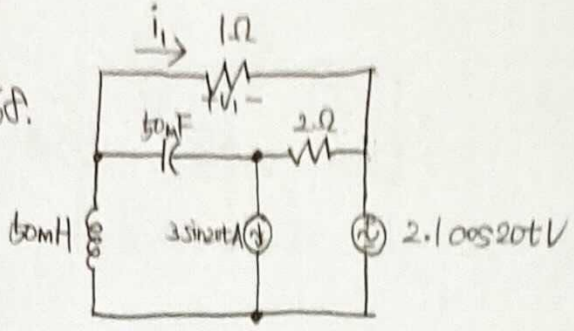
(A)와 (B)를 풀면, $V_1 = 9.6\angle -116.3°$, $V_2 = 3.22\angle -11.79°$

$$\therefore I_B = \frac{V_1 - V_2}{1+j3.8}$$

$$= \frac{9.6\angle -116.3° - 3.22\angle -11.79°}{1+j3.8}$$

$$= 2.76\angle 151.76°$$

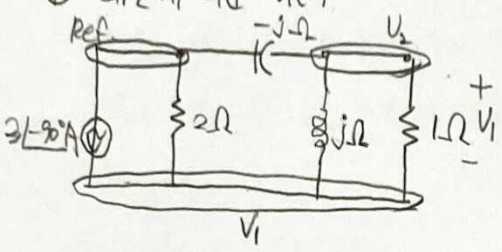
$$\boxed{I_B = 2.76\angle 151.76°\ A}$$

Q6). 

50mH 인덕터 : $Z_L = j\omega L = j(20)(50\times10^{-3}) = j1\Omega$

50mF 커패시터 : $Z_C = -\frac{j}{\omega C} = -\frac{j}{(20)(50\times10^{-3})} = -j1\Omega$

① 전류원에 의한 $V_1(t)$



Node1 : $I_S + \frac{(V_2-V_1)}{1} = \frac{V_1}{2} + \frac{(V_1-V_2)}{j1}$

$\Rightarrow V_1(1.5-j) + V_2(-1+j) = -j3 \cdots$ Ⓐ

Node 2 : $\frac{(V_1-V_2)}{-j1} - \frac{V_2}{-j} = \frac{(V_2-V_1)}{1}$

$\Rightarrow V_1(1-j) - V_2 = 0 \cdots$ Ⓑ

Ⓐ와 Ⓑ를 풀면, $V_{1I}(t) = -1.3846 + j0.9231 = 1.66\angle 146.3°\ V$

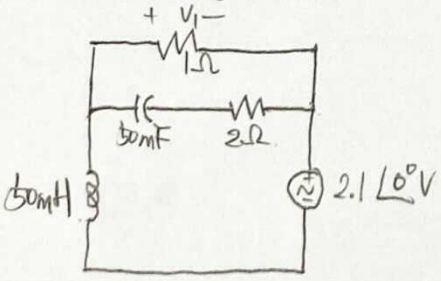
$= \boxed{1.66\cos(20t+146.3°)\ V}$

$V_1 = -0.9231 - j1.3846\ V$

$V_2 = -2.3077 - j0.4615\ V$

에서 $V_{1I} = V_2 - V_1$

② 전압원에 의한 $V_1(t)$



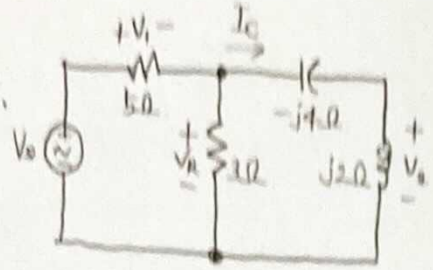
$I_S = \frac{V_S}{Z} = \frac{2.1}{\frac{2-j}{3-j}+j} = 1.1307 - j1.4538A$

$I_{1\Omega} = \frac{I_S \cdot Z_{eq}}{Z_R} = (1.1307 - j1.4538)(0.1-j0.1)$

$\therefore V_{1II} = -I_1 \cdot Z_R = -0.6461 + j1.1307 = 1.3\angle 119.74°\ V$

$V_{1II}(t) = \boxed{1.3\cos(20t+119.74°)\ V}$

Q15.



$I_C = 1\angle 0°\ A$

(a) 먼저 V_R의 값을 구하면, $V_R = I_C(-j4+j2) = (1\angle 0°)(-j4+j2) = (1\angle 0°)(2\angle -90°) = 2\angle -90°$

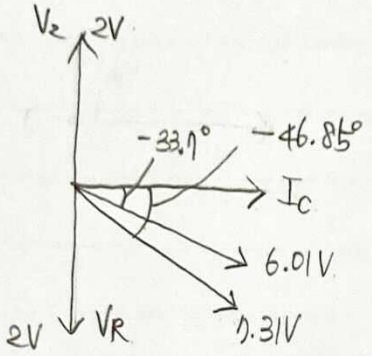
3Ω의 저항에 흐르는 전류는, $I_R = \frac{V_R}{3} = \frac{2\angle -90°}{3} = 0.667\angle -90°$

따라서, V_2는 $V_2 = I_C(j2) = (1\angle 0°)(2\angle 90°) = 2\angle 90°$

전원에 흐르는 전류는 $I_S = I_C + I_R = 1\angle 0° + 0.667\angle -90° = -j0.667 + 1 = 1.202\angle -33.7°\ A$

V_1은 $V_1 = 5I_S = 5\times(1.202\angle -33.7°) = 6.01\angle -33.7°$

V_S는 $V_S = V_1 + V_R = 6.01\angle 33.7° + 2\angle -90° = 5 - j5.335 = 7.31\angle -46.85°$



(b) $\frac{V_2}{V_1} = \frac{2\angle 90°}{6.01\angle -33.7°} = 0.3327\angle 123.7°$