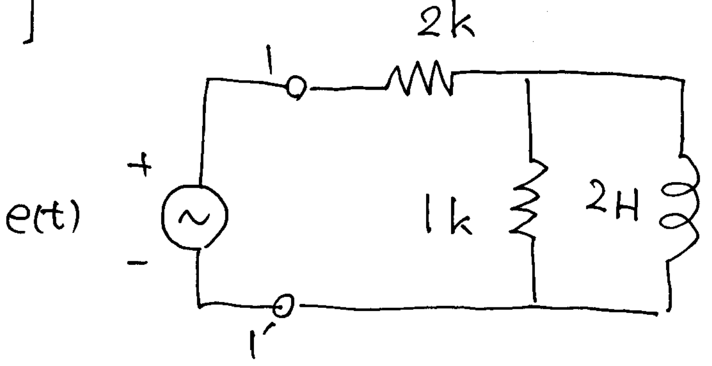
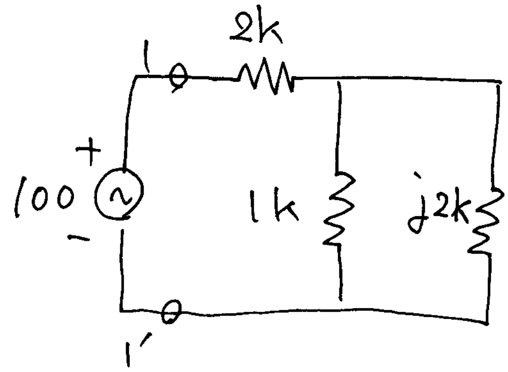
中間しけんの解答　H27．回路理論Ⅱ

[1]



$\Rightarrow$



$e(t) = 100\sqrt{2}\cos 10^3 t$

(a)　1-1'から右側をみた合成 $\dot{Z}$

$$\dot{Z} = 2k + \frac{1k \cdot \dot{j}2k}{1k + \dot{j}2k}$$

$$= 2k + \frac{4k}{5} + \dot{j}\frac{2k}{5}$$

$$= \underline{\frac{14k}{5} + \dot{j}\frac{2k}{5}}$$ (答) $\rightarrow$ $\underline{\frac{2}{5}(7+\dot{j})\ [k\Omega]}$ (答)

(b)

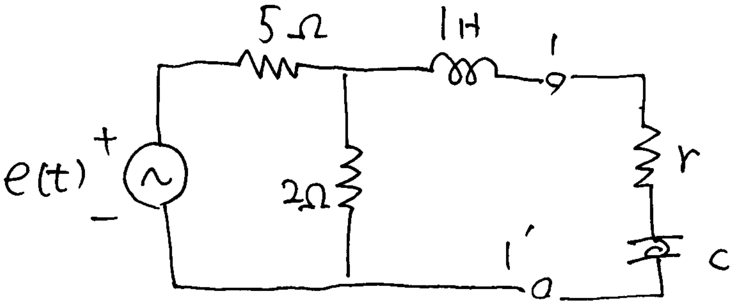
$$\dot{W} = \dot{V}\bar{\dot{I}} = \frac{|\dot{V}|^2}{\bar{\dot{Z}}} = 100^2 \times \frac{1}{\frac{2}{5}(7-\dot{j})\times 10^3}$$

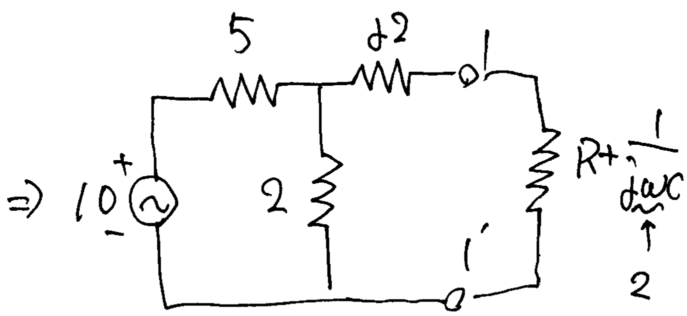
$$= \frac{7}{2} + \dot{j}\frac{1}{2}$$

$$\therefore\ \underline{P = \frac{7}{2}\ [W],\quad Q = \frac{1}{2}\ [var]}$$ (答)

$$\cos\phi = \frac{\frac{7}{2}}{\sqrt{\left(\frac{7}{2}\right)^2 + \left(\frac{1}{2}\right)^2}} \fallingdotseq \underline{0.99}$$ (答)

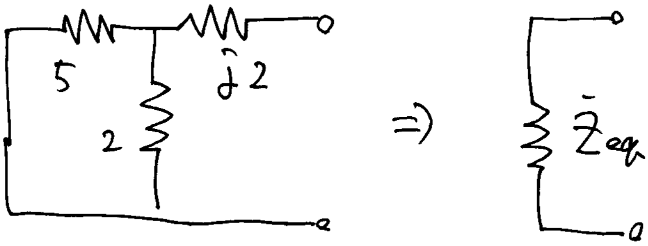
[2]



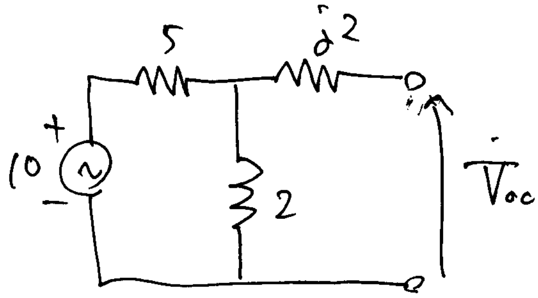


$e(t) = 10\sqrt{2}\sin 2t$

(a) 1−1'から左を見て、テブナンの方法で

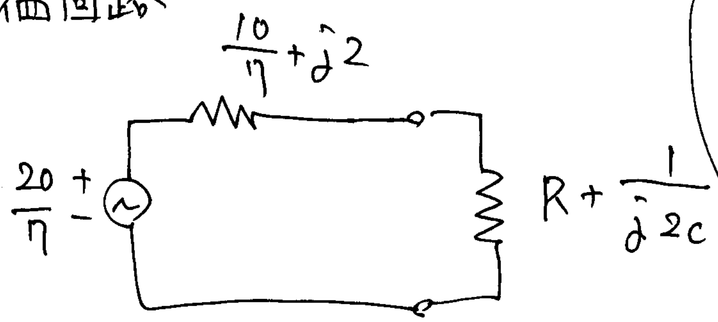


$$\dot{Z}_{eq} = j2 + \frac{5\cdot 2}{5+2} = \underline{\frac{10}{7} + j2}$$



$$\dot{V}_{oc} = 10 \times \frac{2}{5+2} = \underline{\frac{20}{7}}$$

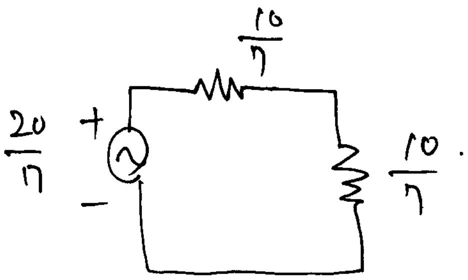
等価回路



$$\therefore\ R = \frac{10}{7},\quad \frac{-1}{j2c} = j2$$

$$\therefore\ \underline{r = \frac{10}{7}\,\Omega,\quad c = \frac{1}{4}\,F}\ (答)$$

(b) このとき、

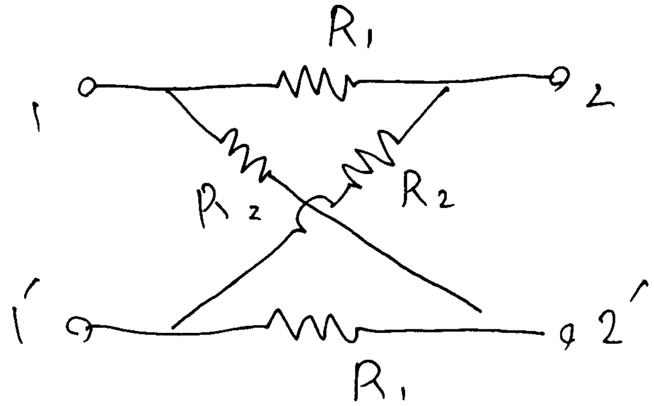


$$\therefore\ P_r = \frac{\left(\frac{20}{7}\right)^2}{\frac{20}{7}} \times \frac{1}{2}$$

$$= \underline{\frac{10}{7}\ [W]}$$

(答)

[3]



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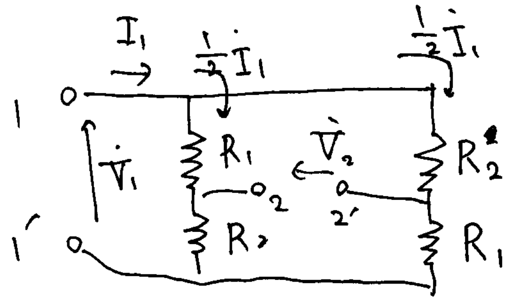


左図より. $\dot{V}_1 = \dfrac{R_1+R_2}{2}\dot{I}_1$

$$\therefore \dot{Z}_{11} = \left.\frac{\dot{V}_1}{\dot{I}_1}\right|_{\dot{I}_2=0} = \frac{R_1+R_2}{2}$$

$$\dot{V}_2 = \frac{R_2-R_1}{2}\dot{I}_1$$

$$\therefore \dot{Z}_{21} = \left.\frac{\dot{V}_2}{\dot{I}_1}\right|_{\dot{I}_2=0} = \frac{R_2-R_1}{2}$$

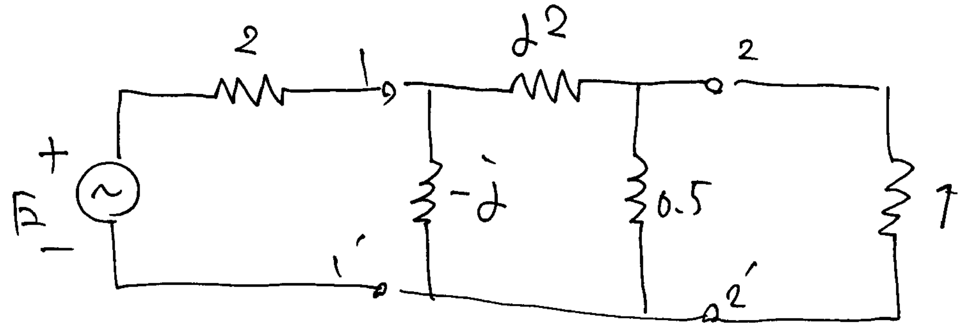
対称性より.

$$\mathbb{Z} = \begin{bmatrix} \frac{R_1+R_2}{2} & \frac{R_2-R_1}{2} \\ \frac{R_2-R_1}{2} & \frac{R_1+R_2}{2} \end{bmatrix}$$ (答)

$$\mathbb{Y} = \mathbb{Z}^{-1} = \frac{1}{\left(\frac{R_1+R_2}{2}\right)^2 - \left(\frac{R_2-R_1}{2}\right)^2}\begin{bmatrix} \frac{R_1+R_2}{2} & \frac{R_1-R_2}{2} \\ \frac{R_1-R_2}{2} & \frac{R_1+R_2}{2} \end{bmatrix}$$

$$= \begin{bmatrix} \frac{R_1+R_2}{2R_1R_2} & \frac{R_1-R_2}{2R_1R_2} \\ \frac{R_1-R_2}{2R_1R_2} & \frac{R_1+R_2}{2R_1R_2} \end{bmatrix}$$ (答)

[4] フェーザ表現にして



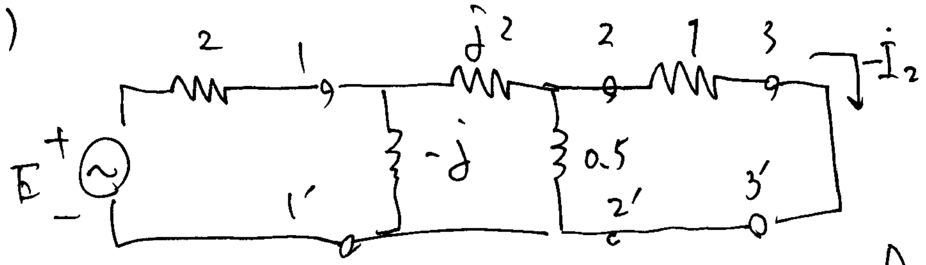
(a)
$$F = \begin{bmatrix} 1 & 0 \\ j & 1 \end{bmatrix}\begin{bmatrix} 1 & j2 \\ 0 & 1 \end{bmatrix}\begin{bmatrix} 1 & 0 \\ 2 & 1 \end{bmatrix} = \underline{\begin{bmatrix} 1+j4 & j2 \\ -2+j & -1 \end{bmatrix}}$$ (答)

(b)
$$\dot{Z}_{in} = \frac{\dot{A}\dot{Z}_e + \dot{B}}{\dot{C}\dot{Z}_e + \dot{D}} = \frac{(1+j4)\cdot 1 + j2}{(-2+j)\cdot 1 - 1} = \underline{\frac{1+j6}{-3+j}}$$ (答)

$$\uparrow \ \underline{\frac{1}{10}(3-j19)}$$

(c)
$$\dot{I}_1 = \frac{E}{2 + \frac{1+j6}{-3+j}} = \frac{-3+j}{-5+j8}E = \underline{\frac{1}{89}(23+j19)E}$$ (答)

(d)



上図のように考えると、1-1′ − 3-3′間で

$$F = \begin{bmatrix} 1+j4 & j2 \\ -2+j & -1 \end{bmatrix}\begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix}$$

↓

$$D = \underline{-3+j}$$

$$D = \left.\frac{\dot{I}_1}{-\dot{I}_2}\right|_{\dot{V}_2=0}$$ より

$$\dot{I} = -\dot{I}_2 = \frac{\dot{I}_1}{D}$$

$$= \frac{1}{-3+j}\cdot\frac{-3+j}{-5+j8}E$$

$$= \frac{1}{-5+j8}E = \underline{\frac{E}{89}(-5-j8)}$$ (答)