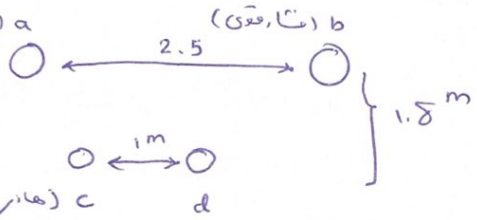
یا لطیف

رضا دینی نیو
۹۸۱۴۳۰۶۳

تمرین سری ۳ تحلیل سیستم

#4



$$\begin{cases} I_a = -I_b = I \\ I_c = I_d = 0 \end{cases}$$

$$D_{ac} = D_{bd} = \sqrt{(1.25-0.5)^2 + 1.8^2} = 1.95\ m \quad , \quad D_{ad} = D_{bc} = \sqrt{(1.25+0.5)^2 + 1.8^2} = 2.51\ m$$

$$\lambda_{cda} = 2\times10^{-7} I_a \ln \frac{D_{ad}}{D_{ac}} = 2\times10^{-7} I_a \ln \frac{2.51}{1.95}$$

$$\lambda_{cdb} = -2\times10^{-7} I_b \ln \frac{D_{bc}}{D_{bd}} = -2\times10^{-7} \ln \frac{2.51}{1.95}$$

$$\lambda_{cdT} = \lambda_{cda} + \lambda_{cdb} = 2\times10^{-7} I_a \ln \frac{2.51}{1.95} - 2\times10^{-7} I_b \ln \frac{2.51}{1.95} \xrightarrow{I_a = -I_b = I}$$

$$= 2\times10^{-7} I \left(\ln \frac{2.51}{1.95} + \ln \frac{2.51}{1.95} \right) = 2\times10^{-7} I \ln \left(\frac{2.51}{1.95} \right)^2 = 4\times10^{-7} I \ln \frac{2.51}{1.95}$$

$$\Rightarrow M = \frac{\lambda}{I} = 4\times10^{-7} \ln \frac{2.51}{1.95} = 1.01\times10^{-7} \left(\frac{H}{m}\right)$$

$$E_{cd} = j\omega M I = 2\pi \times 60 \times 1.01\times10^{-7} \times 150\times10^{3} = 5.71\ \frac{V}{km}$$

#5

$$\begin{cases} I_a = I \\ I_b = -I_a = I \end{cases}$$

$$\lambda_{cd_a} = 2\times10^{-7} I_a \ln\frac{D_{ad}}{D_{ac}} = 2\times10^{-7} I_a \ln\frac{21.5}{20.5}$$

$$\lambda_{cd_b} = -2\times10^{-7} I_b \ln\frac{D_{bd}}{D_{bc}} = -2\times10^{-7} I_b \ln\frac{19}{18}$$

$$\Big) \rightarrow \lambda_{cd_T} = \lambda_{cda} + \lambda_{cdb}$$

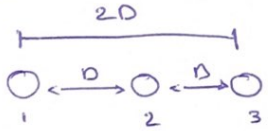
$$= 2\times10^{-7} I_a \ln\frac{21.5}{20.5} - 2\times10^{-7} I_b \ln\frac{19}{18} \xrightarrow{I_a = -I_b = I} \lambda_{cd_T} = 2\times10^{-7} I \ln\frac{21.5}{20.5} - 2\times10^{-7} I \ln\frac{19}{18}$$

$$= 2\times10^{-7} I \ln\frac{21.5\times18}{19\times20.5} = -0.0128\times10^{-7} I$$

$$\Rightarrow M = \frac{\lambda_{cd_T}}{I} = -0.0128\times10^{-7}\ \left(\frac{H}{M}\right) \Rightarrow E_{cd} = \omega M I = 2\pi\times60\times0.0128\times10^{-7}\times150\times10^{3}$$

$$= 0.0728\ \frac{V}{km}$$

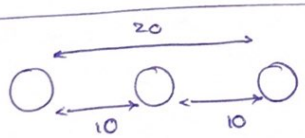
#12



$$\begin{cases} D_{13} = 2D \\ D_{12} = D \\ D_{23} = D \end{cases} \qquad D_{eq} = 16\ ft$$

$$\Rightarrow D_{eq} = \sqrt[3]{D_{12}\times D_{13} D_{23}} = \sqrt[3]{D\times2D\cdot D} = \sqrt[3]{2D^3} = D\sqrt[3]{2} = 16 \Rightarrow D = 12.7\ ft$$

#14



$$D_{eq} = \sqrt[3]{10\times10\times20} = 12.6\ ft$$

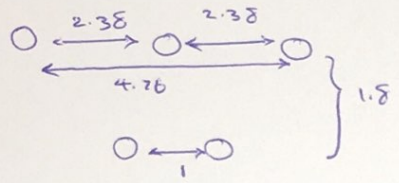
$$X_L = 2\times10^{-7} \ln\frac{D_{eq}}{GMR} \times 2\pi f$$

$$= 2\pi\times60\times2\times10^{-7} \ln\frac{12.6}{0.0133}\times10^{3} = 5.17\ \frac{\Omega}{km}$$

$$D_S = \frac{0.013}{0.3048} = 0.0436\ ft$$

#17

$$\begin{cases} D_{12} = D_{23} = D \rightarrow D_{13} = 2D \\ D_{eq} = 3^m = \sqrt[3]{D_{12} D_{13} D_{23}} \Rightarrow 3 = \sqrt[3]{D \times 2D \times D} \\ \Rightarrow D = 2.38^m \end{cases}$$



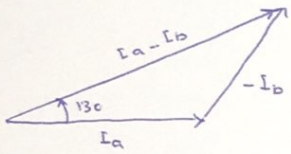
$$D_{ad} = D_{be} = \sqrt[3]{1.8^2 + (2.38 - 0.5)^2} = 2.6^m$$

$$D_{ac} = D_{bd} = \sqrt[3]{1.8^2 + (2.38 + 0.5)^2} = 3.4^m$$

$$\lambda_{df_a} = 2\times10^{-7} I_a \ln \frac{D_{ae}}{D_{ad}} = 2\times10^{-7} I_a \ln \frac{3.4}{2.6}$$

$$\lambda_{de_b} = 2\times10^{-7} I_b \ln \frac{D_{bd}}{D_{be}} = 2\times10^{-7} I_b \ln \frac{3.4}{2.6}$$

$$\rightarrow \lambda_{de_T} = \lambda_{df_a} + \lambda_{de_b} = 2\times10^{-7}(I_a - I_b) \ln \frac{3.4}{2.6}$$

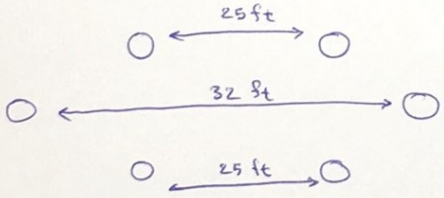


$$I_a - I_b = \sqrt{3}\, I_a \angle 30$$

$$\Rightarrow I_{de_T} = 2\times10^{-7} \times \sqrt{3}\, I_a \ln \frac{3.4}{2.6}$$

$$M = \frac{\lambda_{de_I}}{I_a} = 9.29\times10^{-8} \frac{H}{m} \Rightarrow E = \omega M I = 2\pi \times 60 \times 9.29\times10^{-8} \times 150\times10^3 = 5.25 \frac{V}{km}$$

#20



$$D_{ab} = D_{a'b'} = \sqrt{14^2 + 3.5^2} = 14.43$$

$$D_{ab'} = D_{a'b} = \sqrt{14^2 + 28.5^2} = 31.75$$

$$D_{aa',bb'} = \left[(D_{ab} \cdot D_{ab'})(D_{a'b}) \cdot D_{a'b'}\right]^{1/2}$$

$$= \sqrt{14.43 \times 31.75} = 21.04 \quad , \quad D_{cb} = D_{c'b'} = \sqrt{14^2 + 3.5^2} = 14.43$$

$$D_{cb'} = D_{c'b} = \sqrt{14^2 + 28.5^2} = 31.75 \quad , \quad D_{bb',cc'} = \sqrt[4]{(D_{bc} \cdot D_{bc'}) \cdot (D_{b'c} \cdot D_{c'b'})} = 21.04$$

$$D_{ac} = D_{a'c} = 28 \quad , \quad D_{ac'} = D_{ca'} = 25 \Rightarrow D_{aa',cc'} = \sqrt[4]{(D_{ac} D_{ac'}) \cdot (D_{a'c} D_{a'c'})} = \sqrt[4]{28^2 \times 25^2} = 26.46$$

$$D_{eq} = \sqrt[3]{(D_{aa',bb'})(D_{aa',cc'})(D_{bb',cc'})} = \sqrt[3]{(21.04 \times 26.46 \times 21.04)} = 22.71 \text{ ft}$$

$$D_{aa'} = \sqrt{25^2 + 28^2} = 37.54 \text{ ft} \qquad D_{bb'} = 32 \text{ ft} \quad , \quad D_{cc'} = D_{aa'} = 37.54 \text{ ft}$$

$$D_s = GMR = 0.0373 \qquad D_{s,aa'} = \sqrt[2]{(D_s \cdot D_{aa'})} = \sqrt[2]{(0.0373 \times 32)}$$

$$D_{sd,a} = (D_{s,aa'} \cdot D_{s,bb'} \cdot D_{s,cc'})^{1/3} = \left((0.0373 \times 37.54)^{1/2} \times (0.0373 \times 32)^{1/2} \times (0.0373 \times 37.54)^{1/2}\right)^{1/3}$$

$$= 1.152 \text{ ft} \Rightarrow L = 2\times10^{-7} \ln \frac{D_{eq}}{D_{sd,a}} = 2\times10^{-7} \ln \frac{22.71}{1.152} = 5.693\times10^{-7} \frac{H}{m}$$

$$\Rightarrow L = 5.693\times10^{-7} \times 10^{-3} \times 1609 = 0.959 \quad , \quad X_L = 2\pi f_L = 2\pi \times 60 \times 0.959 \times 10^{-3} = 0.362$$