

#4 $\{ A = D = 0.936 + j0.016 = 0.936 \angle 0.98$

$$B = 33.5 + j138 = 142 \angle 76.4^\circ$$

$$C = 10^{-6} (-5.18 + j 9.4)$$

میس فاز = 0.9 فریب دان

$$50 \text{ mW} = P$$

$$V_R = 220 \text{ kV}$$

$$I_R = \frac{P}{\sqrt{3} V_R \times \cos \phi} - \cos^{-1}(0.9)$$

$$= \frac{50 \times 1000}{\sqrt{3 \times 220 \times 0.9}} \quad \Delta - 25.84$$

$$= 145.8 \angle -25.84^\circ \text{ A}$$

$$V_{R_{\text{خطی}}'} = \frac{V_{R_{\text{خطی}}}}{\sqrt{3}} = \frac{220000}{\sqrt{3}} = 127000 \text{ V}$$

$$V_s = AV_R + BI_R = (0.936 \angle 0.98) \cdot (127000 \angle 0^\circ) + (142 \angle 76.4) \cdot (145.8 \angle -25.84)$$

$$= 133.23 \angle 7.77^\circ \text{ kV} \quad \Rightarrow |V_{S_{L-L}}| = \sqrt{3} V_s = 230.8 \text{ kV}$$

$$|V_{R-NL}| = \left| \frac{V_{S-L-L}}{A} \right| = \frac{230.8}{0.936} = 246.5 \text{ kV} \Rightarrow \%VR = \frac{|V_{RNL}| - |V_{RFL}|}{|V_{R-NL}|} \times 100$$

$$= \frac{246.5 - 220}{246.5} \times 106 = 10.7\%$$

#888 { $L = 175 \text{ mile}$
 $Z = 35 + j140 \Omega$
 $Y = 930 \times 10^{-6} \text{ } \cancel{\text{A}} \text{ } \Omega$
 casp: $\frac{90}{100} \text{ } \cancel{\text{A}} \text{ } \Omega$

$$I_R = \frac{P}{\sqrt{3} \cdot V_R \cdot \cos \phi} \quad \Delta = \cos^{-1} \left(\frac{90}{100} \right)$$

$$= \frac{40 \times 1000}{\sqrt{2} \times 220 \times 0.9} \angle - \cos^{-1}(0.9) = 116.6 \angle -25.8^\circ$$

$$V_{R_{\text{load}}} = \frac{V_{R_{\text{load}}}}{\sqrt{3}} = \frac{220000}{\sqrt{3}} = 127.01 \text{ V}$$

جواب) $A = FD = 1$, $B = Z$, $C = 0 \Rightarrow V_s = AV_R + B I_R = V_R + Z I_R = 13840 \angle 5.35^\circ$

$$\Rightarrow |V_{s-L-L}| = \sqrt{3} V_s = 293.73 \text{ kV}$$

$$\begin{aligned} \text{---} : \pi \text{ model: } V_s &= \left(1 + \frac{ZY}{2}\right) V_R + Z I_R = 130412 \angle 6.6^\circ \Rightarrow |V_{s-L-L}| = \sqrt{3} V_s \\ &= 225.88 \text{ kV} \end{aligned}$$

$$c) Z_c = \sqrt{\frac{Z}{Y}}, \gamma_d = \sqrt{ZY} \Rightarrow Z_c = \sqrt{\frac{144.3 \angle 75.96}{930 \times 10^{-6} \angle 90}} = 394 \angle -7.02$$

$$\gamma_d = \sqrt{(144.3 \angle 75.96) \times (930 \times 10^{-6} \angle 90)} = 0.3663 \angle 83^\circ = 0.0448 + j 0.364$$

$$\gamma_d = \alpha + j\beta \begin{cases} \alpha = 0.0448 \\ \beta = 0.364 \end{cases} \Rightarrow V_s = V_R \cdot \cosh(\gamma_d) + Z_c \cdot \sinh(\gamma_d) \cdot I_R$$

$$\cosh(\gamma_d) = \frac{e^{\gamma} + e^{-\gamma}}{2} = \frac{e^{\alpha + j\beta} + e^{-\alpha - j\beta}}{2} = \frac{e^{\alpha} \cdot e^{j\beta} + e^{-\alpha} \cdot e^{-j\beta}}{2} = 0.9354 + j 0.0160$$

$$\sinh(\gamma_d) = 0.6419 + j 0.3565 \Rightarrow V_s = 130153 \angle 6.5^\circ \text{ V}$$

$$\Rightarrow |V_{s-L-L}| = \sqrt{3} V_s = 225.4 \text{ kV}$$

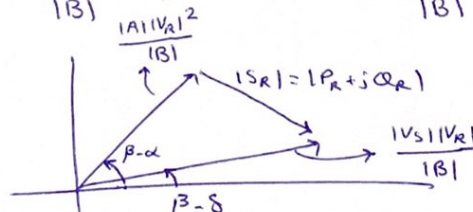
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$$V_s = A V_R + B I_R \rightarrow \begin{cases} A = 0.9354 + j 0.0160 = 0.936 \angle 0.98^\circ \rightarrow \alpha = 0.98 \\ B = Z_c \sinh(\gamma_d) = 141.4 \angle 76.28^\circ \rightarrow \beta = 76.28 \end{cases}$$

$$\beta - \alpha = 75.3^\circ$$

$$S_R = \frac{|V_s| |V_R|}{|B|} \angle \beta - \alpha - \frac{|A| |V_R|^2}{|B|} \angle \beta - \alpha \Rightarrow \frac{|A| |V_R|^2}{|B|} = \frac{0.9354 \times (220)^2}{141.4} = 320.2 \text{ MVA}$$

$$\cos^{-1}(0.9) = 25.8$$



$$\frac{|V_s| |V_R|}{|B|} = 7.65 \times 50 \Rightarrow |V_s| = \frac{352.5 \times 141.4}{220} = 226.5 \text{ kV}$$

#17

$$\begin{cases}
 L = 300 \text{ mile} \\
 400 \text{ MVA} = S \\
 \cos \phi = 0.8 \text{ مس } \\
 V = 345 \text{ KV} \\
 A = D = 0.8180 \angle 1.3^\circ \\
 B = 172.2 \angle 84.2, C = 0.001933 \angle 90.4
 \end{cases}$$

$$\text{ا) } V_{R, \text{FL}} = \frac{V_{R, \text{FL}}}{\sqrt{3}} = \frac{345000}{\sqrt{3}} = 199186 \angle 0^\circ \text{ V}$$

$$I_R = \frac{S}{\sqrt{3} \times V_{R, \text{FL}}} \angle -\cos^{-1}(0.8) = \frac{400000}{\sqrt{3} \times 345} \angle -36.87 = 669.4 \angle -36.87^\circ \text{ A}$$

$$\begin{aligned}
 V_S &= AV_R + BI_R = (0.8180 \angle 1.3) \cdot (199186 \angle 0) + (172.2 \angle 84.2) \cdot (669.4 \angle -36.87) \\
 &= 256738 \angle 20.15^\circ \text{ V}
 \end{aligned}$$

$$\text{ب) } I_S = CV_R + DI_R = 447.7 \angle 8.54^\circ \text{ A}$$

$$\Rightarrow \frac{V_S - V_R}{V_S} \times 100 = \frac{256738 - 199186}{256738} \times 100 = 22.4 \%$$

$$\text{ج) } V_{R, \text{NL}} = \frac{V_S}{A} = \frac{256738 \angle 20.15}{0.813 \angle 1.3} = 313861 \angle 18.85^\circ$$

$$I_{S, \text{NL}} = C \cdot V_{R, \text{NL}} = (0.001933 \angle 90.4) \times (313861 \angle 18.85) = 606.7 \angle 109.25$$

$$\Rightarrow \%VR = \frac{V_{R, \text{NL}} - V_{R, \text{FL}}}{V_{R, \text{FL}}} \times 100 = \frac{313861 - 199186}{199186} \times 100 = 57.6 \%$$

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$$\begin{cases}
 A = D = 0.9534 \angle 0.3 \\
 B = 90.33 \angle 84.1 \\
 C = 0.001014 \angle 90.1 \\
 \text{مس } A = D = 1 \angle 0 \\
 C = 0 \\
 B = 146.6 \angle 90
 \end{cases}$$

$$\text{ا) } A' = \begin{bmatrix} 0.9534 \angle 0.3 & 90.33 \angle 84.1 \\ 0.001014 \angle 90.1 & 0.9534 \angle 0.3 \end{bmatrix}$$

$$\Rightarrow A_{\text{eq}}^s = A' \cdot \begin{bmatrix} 1 \angle 0 & 146.6 \angle 90 \\ 0 & 1 \angle 0 \end{bmatrix}$$

$$= \begin{bmatrix} 0.9597 \angle 1.18 & 42.30 \angle 64.5 \\ 0.002084 \angle 90.4 & 0.9597 \angle 1.18 \end{bmatrix}$$

$$V_s = A \cdot V_R + B I_R = 216870 \Delta 4.5^\circ$$

$$I_s = C \cdot V_R + D I_R = 520.4 \Delta 4.44^\circ$$

$$\% \text{Error} = \frac{V_s - V_R}{V_s} \times 100 = 8.15\% \Rightarrow V_{R,NL} = \frac{V_s}{A} = 225977 \Delta 3.32^\circ$$

$$I_{s,NL} = C \cdot V_{R,NL} = 470.9 \Delta 93.7^\circ A \Rightarrow \% V_R = \frac{V_{R,NL} - V_{R,FL}}{V_{R,FL}} \times 100 = 13.45\%$$

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$$\begin{bmatrix} A_{eq} & B_{eq} \\ C_{eq} & D_{eq} \end{bmatrix} = \begin{bmatrix} A & B \\ C & D \end{bmatrix} \begin{bmatrix} 1 & 0 \\ -0.0021 & 1 \end{bmatrix} = \begin{bmatrix} 1.1177 \Delta -0.88 & 172.2 \Delta 84.2 \\ 0.000217 \Delta 83.25 & 0.818 \Delta 1.3^\circ \end{bmatrix}$$

$$V_s = 256738 \Delta 20.15^\circ \Rightarrow V_{R,NL} = \frac{V_s}{A_{eq}} = 2.7499 \Delta 21.03^\circ$$

$$I_{s,NL} = C_{eq} V_{R,NL} = 47.3 \Delta 104.28^\circ A$$

$$V_{R,FL} = 19186 \Delta 0^\circ \Rightarrow \% V_R = \frac{V_{R,NL} - V_{R,FL}}{V_{R,FL}} \times 100 = 9.45\%$$

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$$P_A = \frac{Z_R - Z_C}{Z_R + Z_C} = \frac{10 - 30}{10 + 30} = \frac{-1}{2}$$

$$P_S = \frac{Z_S - Z_C}{Z_S + Z_C} = \frac{0 - 30}{0 + 30} = -1$$

$$V^- = \left(\frac{-1}{2}\right) \times 120 = -60 \Rightarrow V_R = 120 - 60 = 60 V$$

