



IIT ROORKEE



NPTEL ONLINE
CERTIFICATION COURSE

Computer aided power system analysis

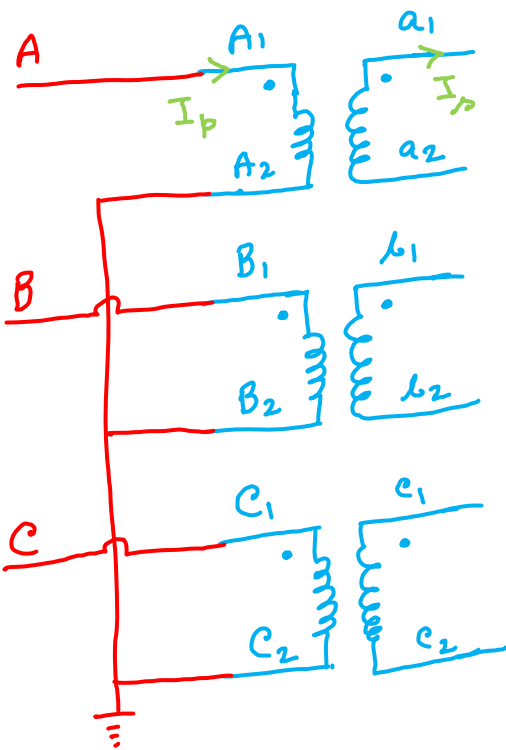
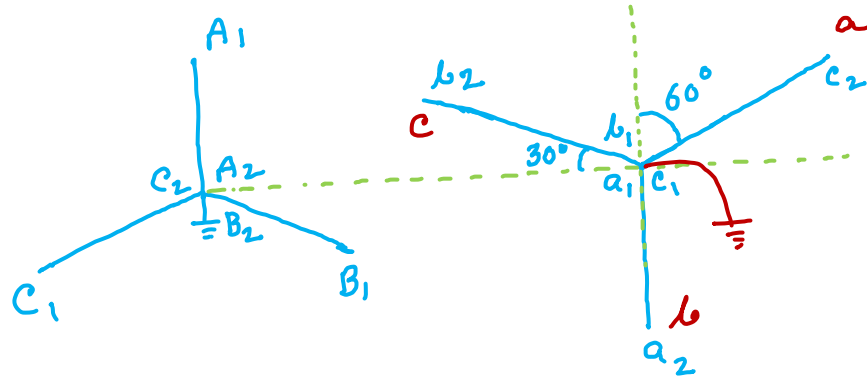
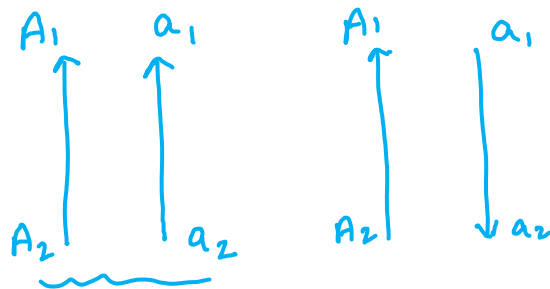
Fault Analysis (Contd.)

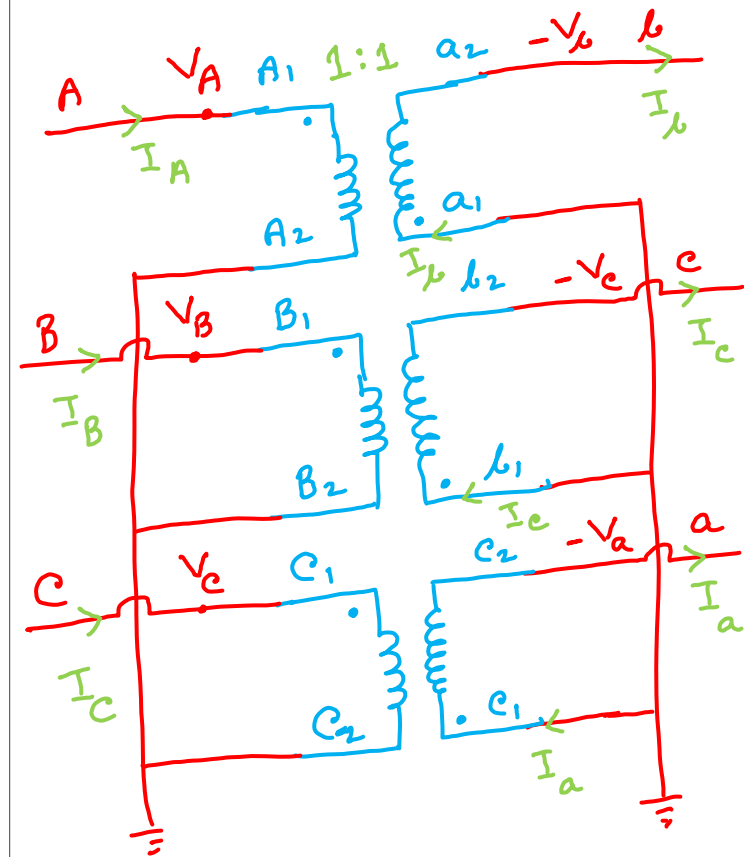
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$$\underline{Y_g Y_g^2}$$

$$\underline{2 \times 30^\circ = 60^\circ}$$





$$I_A = y[V_A - (-V_b)] = y(V_A + V_b)$$

$$I_B = y(V_B + V_c)$$

$$I_C = y(V_C + V_a)$$

$\rightarrow \} \} \leftarrow$

$$I_A = -I_b \Rightarrow I_b = -I_A = -y(V_A + V_b)$$

$$I_B = -I_c \Rightarrow I_c = -I_B = -y(V_B + V_c)$$

$$I_C = -I_a \Rightarrow I_a = -I_C$$

$$\Rightarrow I_a = -y(V_C + V_a)$$

$$I_p^{abc} = \begin{bmatrix} I_A & I_B & I_C \end{bmatrix}^T ; I_s^{abc} = \begin{bmatrix} -I_a & -I_b & -I_c \end{bmatrix}^T$$

$$V_p^{abc} = \begin{bmatrix} V_A & V_B & V_C \end{bmatrix}^T ; V_s^{abc} = \begin{bmatrix} V_a & V_b & V_c \end{bmatrix}^T$$

$$\begin{bmatrix} I_p^{abc} \\ I_s^{abc} \end{bmatrix} = Y \begin{bmatrix} V_p^{abc} \\ V_s^{abc} \end{bmatrix}$$

$$\begin{bmatrix} I_A \\ I_B \\ I_C \\ -I_a \\ -I_b \\ -I_c \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 1 & 1 & 0 & 0 \\ 1 & 0 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} V_A \\ V_B \\ V_C \\ V_a \\ V_b \\ V_c \end{bmatrix}$$

Annotations in the matrix:

- Y_I is written next to the element 1 in the second row, second column.
- Y_{II} is written next to the element 1 in the third row, fourth column.
- Y_{III} is written next to the element 1 in the fifth row, second column.
- Y_{IV} is written next to the element 1 in the sixth row, fifth column.

Red dashed lines separate the matrix into four quadrants.

$Y_I = I_3$
 $\downarrow$
 (3×3) identity matrix
 $Y_{IV} \rightarrow I_3$



$$Y_{\text{II}} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 1 & 0 & 0 \end{bmatrix}; \quad Y_{\text{III}} = \begin{bmatrix} 0 & 0 & 1 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \end{bmatrix}$$

$$Y_{\text{II}} = Y_{\text{III}}^T$$

