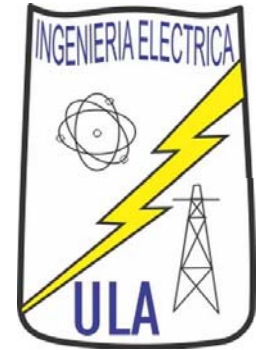




INGENIERIA
UNIVERSIDAD DE LOS ANDES
MÉRIDA VENEZUELA



Circuito Trifásico Balanceado

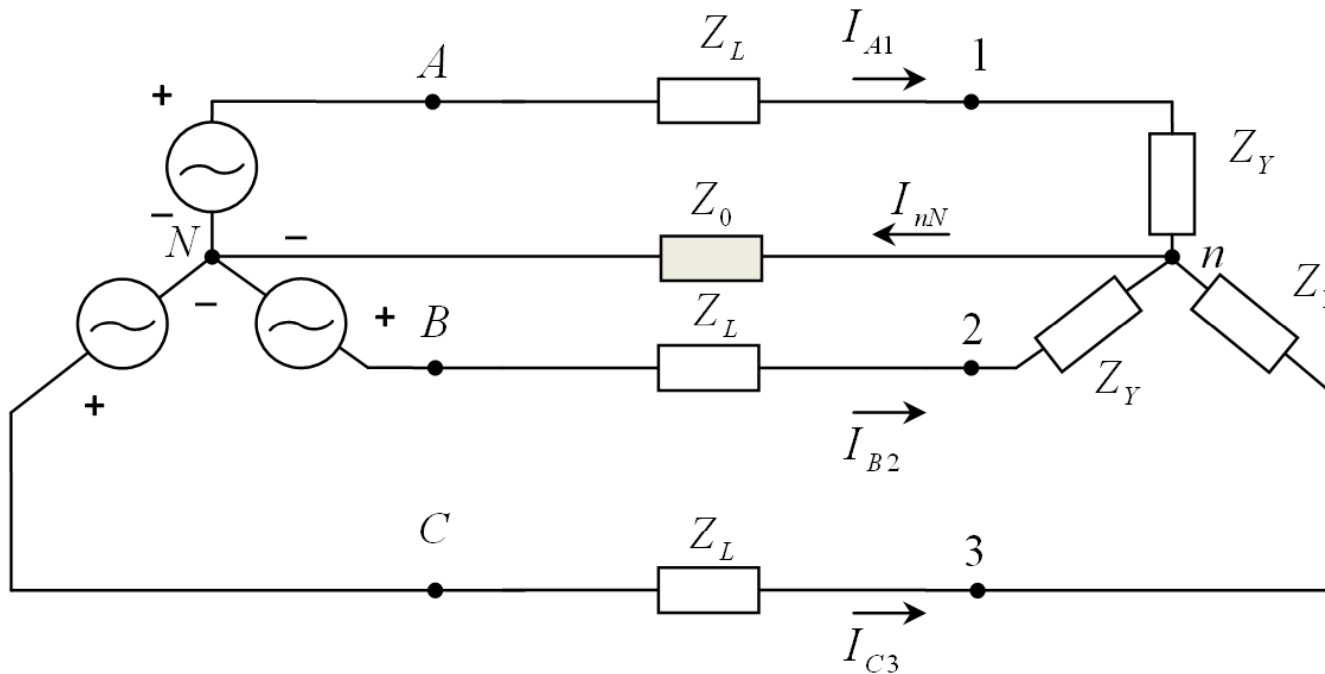
Prof. Gerardo Ceballos



Circuito Trifásico Balanceado

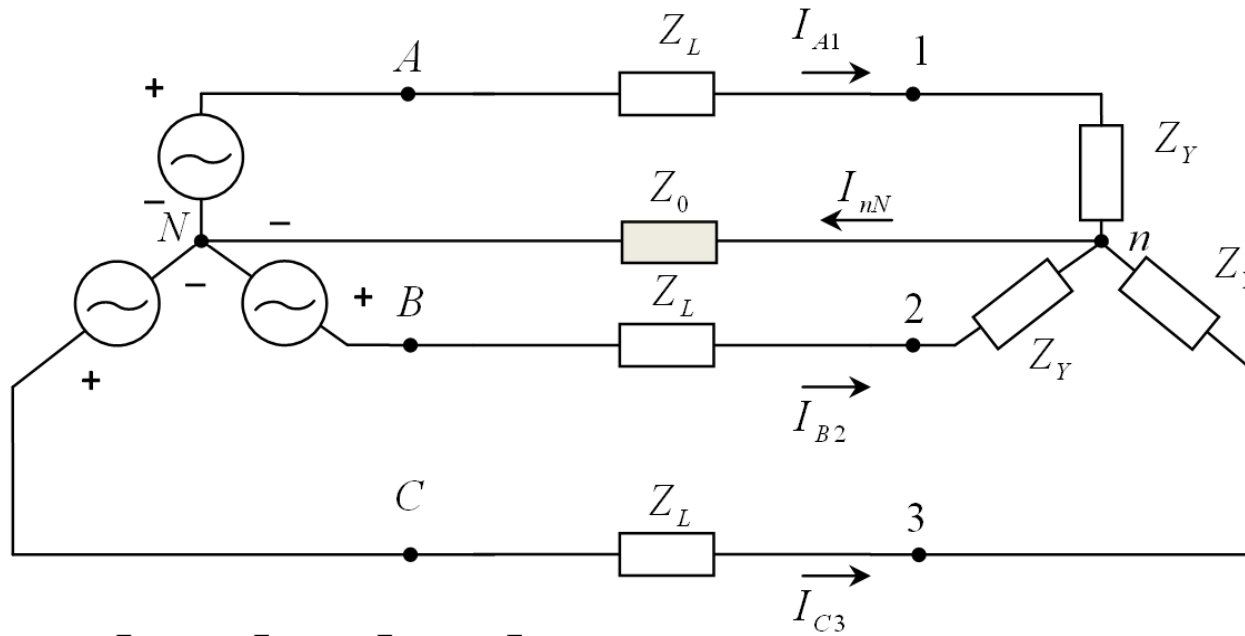


- Generador balanceado
- Z_L iguales para las 3 líneas
- Z_Y ó Z_{Δ} iguales en la carga





Circuito Trifásico Balanceado



$$I_{nN} = I_{A1} + I_{B2} + I_{C3}$$

$$\frac{V_{nN}}{Z_0} = \frac{V_{AN} - V_{nN}}{Z_L + Z_Y} + \frac{V_{BN} - V_{nN}}{Z_L + Z_Y} + \frac{V_{CN} - V_{nN}}{Z_L + Z_Y}$$

$$V_{nN} \left(\frac{1}{Z_0} + \frac{3}{Z_L + Z_Y} \right) = \frac{V_{AN} + V_{BN} + V_{CN}}{Z_L + Z_Y} \Rightarrow V_{nN} = 0$$

$$V_{nN} = 0$$

↓

Z_0 Cualquier valor, $0, \infty$

↓

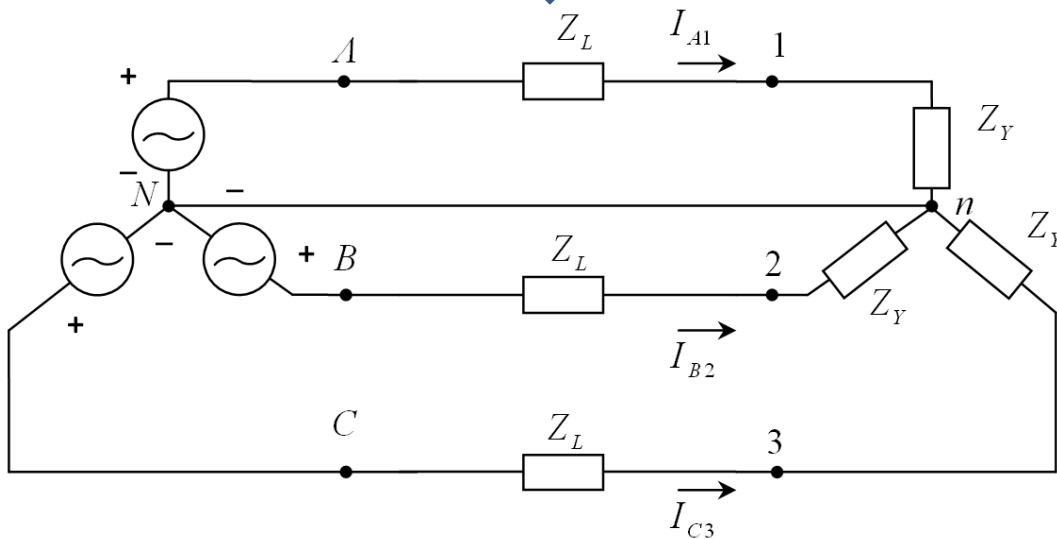
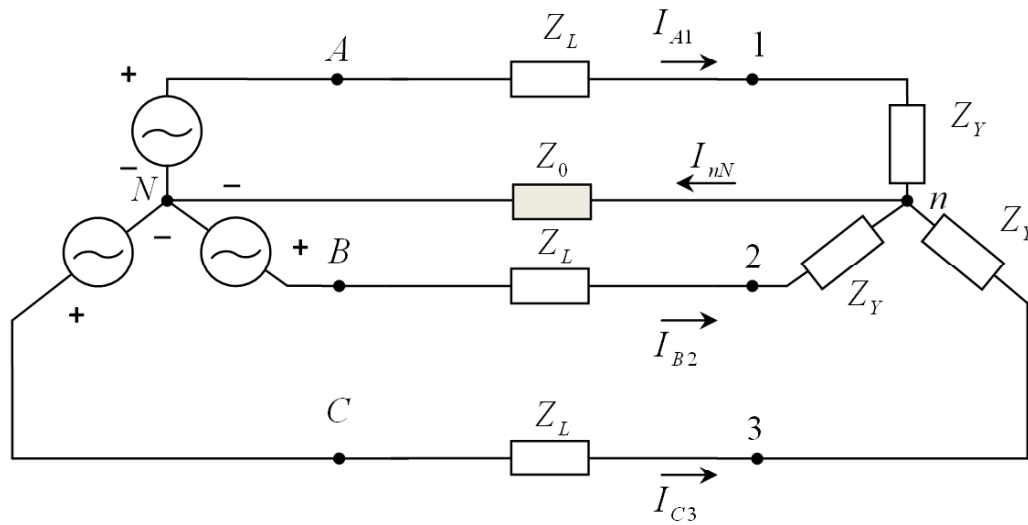
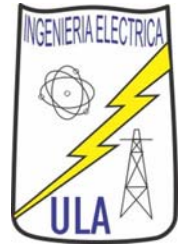
$$I_{nN} = 0$$

↓

$$I_{A1} + I_{B2} + I_{C3} = 0$$



Circuito Trifásico Balanceado

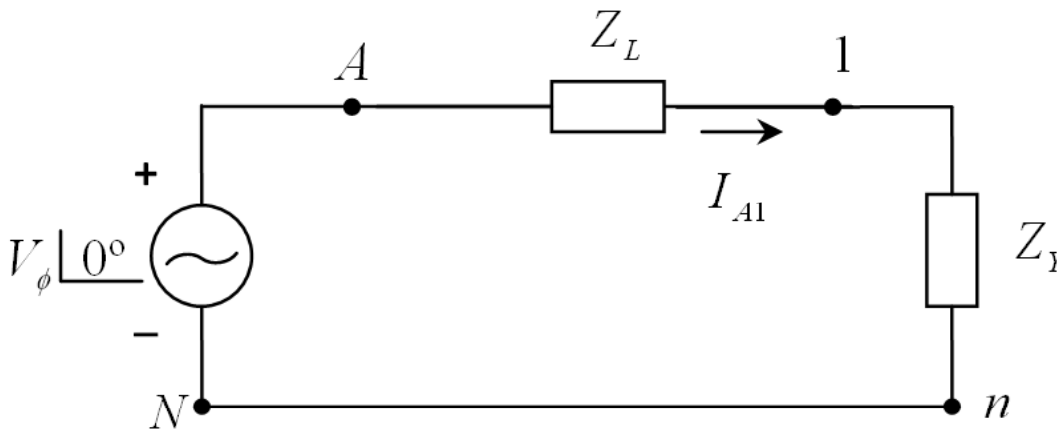
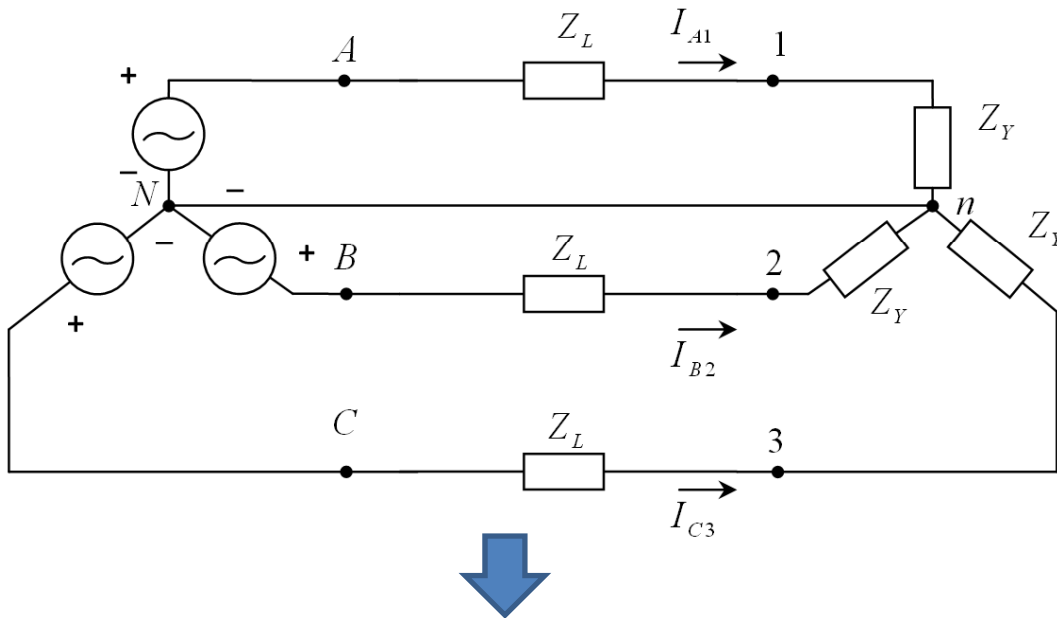


No importa si existe el cable de neutro o no, en el circuito trifásico balanceado $V_{nN}=0$

→ se puede analizar con una sola malla



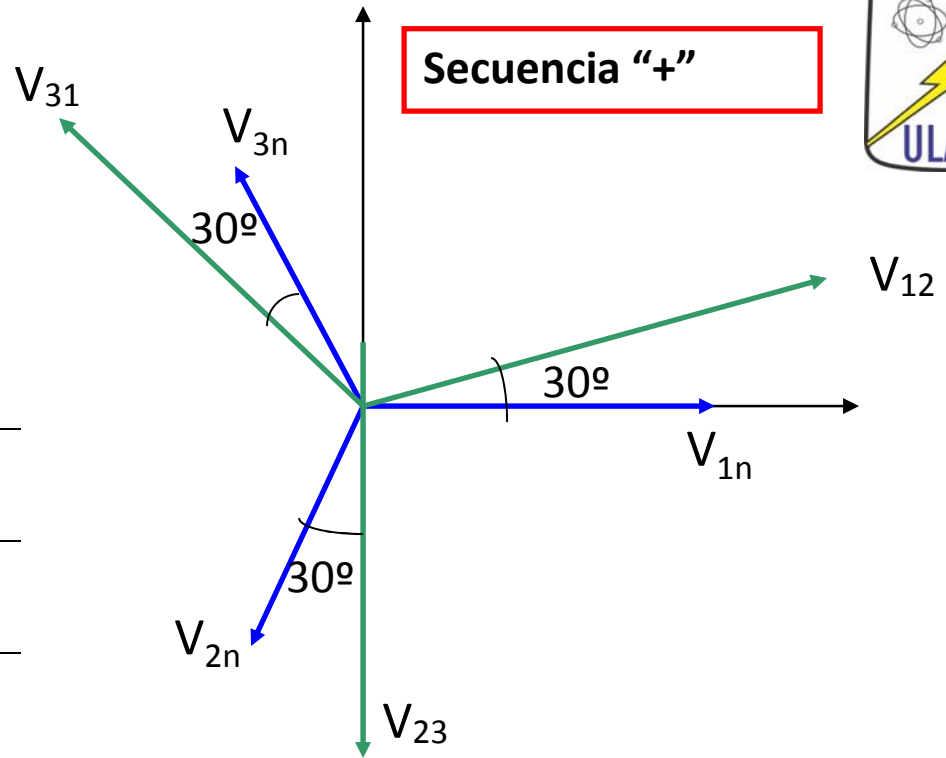
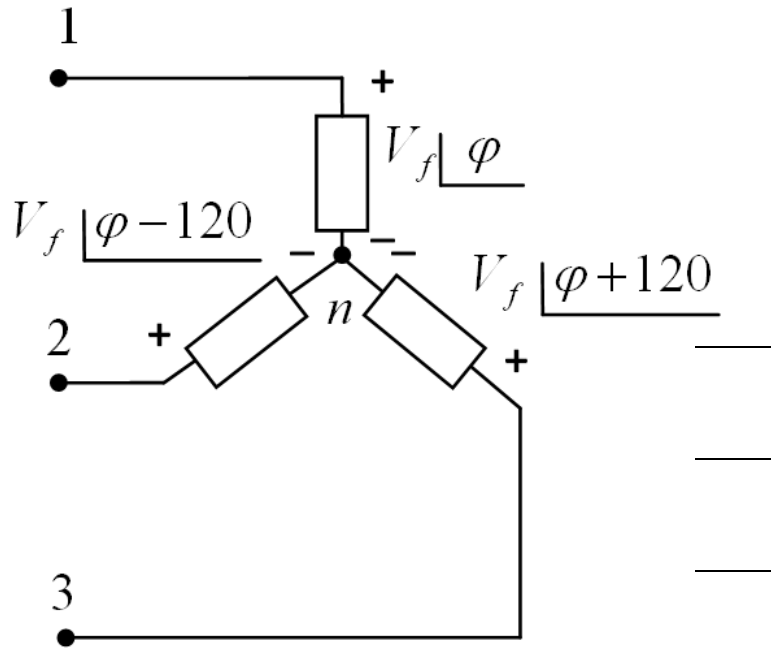
Circuito Trifásico Balanceado



$$I_{A1} = \frac{V_{\phi} \angle 0^{\circ}}{Z_L + Z_Y} = |I_L| \angle \theta$$

$$I_{B2} = \frac{V_{\phi} \angle -120^{\circ}}{Z_L + Z_Y} = |I_L| \angle \theta - 120^{\circ}$$

$$I_{C3} = \frac{V_{\phi} \angle +120^{\circ}}{Z_L + Z_Y} = |I_L| \angle \theta + 120^{\circ}$$

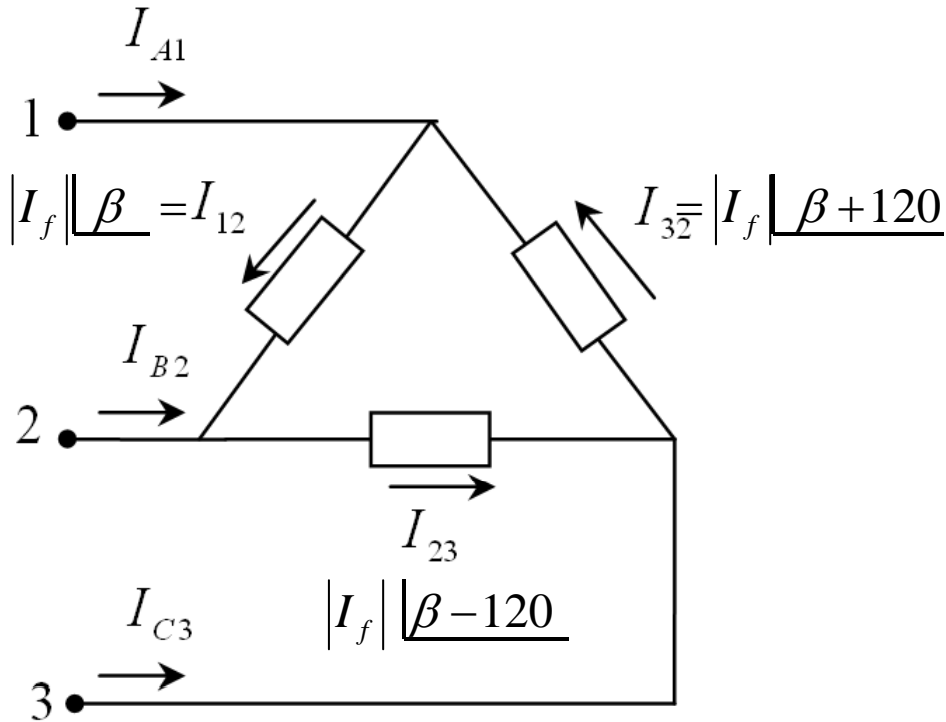
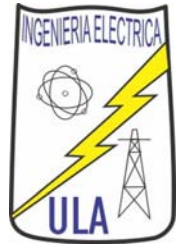


$$V_{12} = \sqrt{3} |V_f| \angle \varphi + 30$$

$$V_{23} = \sqrt{3} |V_f| \angle \varphi - 120 + 30$$

$$V_{31} = \sqrt{3} |V_f| \angle \varphi + 120 + 30$$

$V_{12} = V_{1n} - V_{2n} \Rightarrow$ Un fador menos una versión del mismo atrasada en 120°
 $\Rightarrow +30$



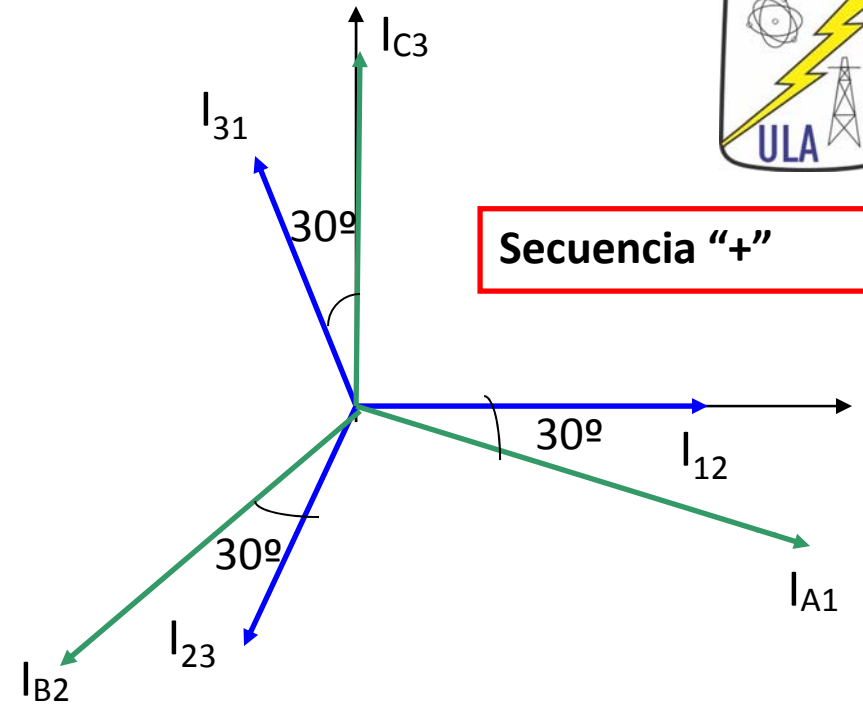
$$|I_f| \angle \beta = I_{12} \quad I_{31} = |I_f| \angle \beta + 120$$

$$|I_f| \angle \beta - 120$$

$$I_{A1} = \sqrt{3} |I_f| \angle \beta - 30$$

$$I_{B2} = \sqrt{3} |I_f| \angle \beta - 120 - 30$$

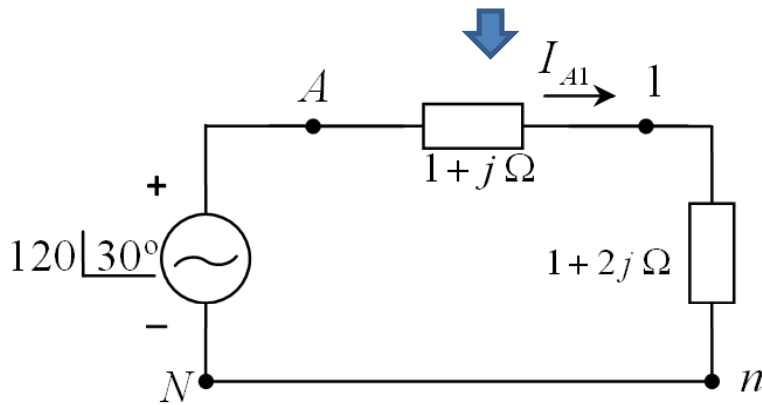
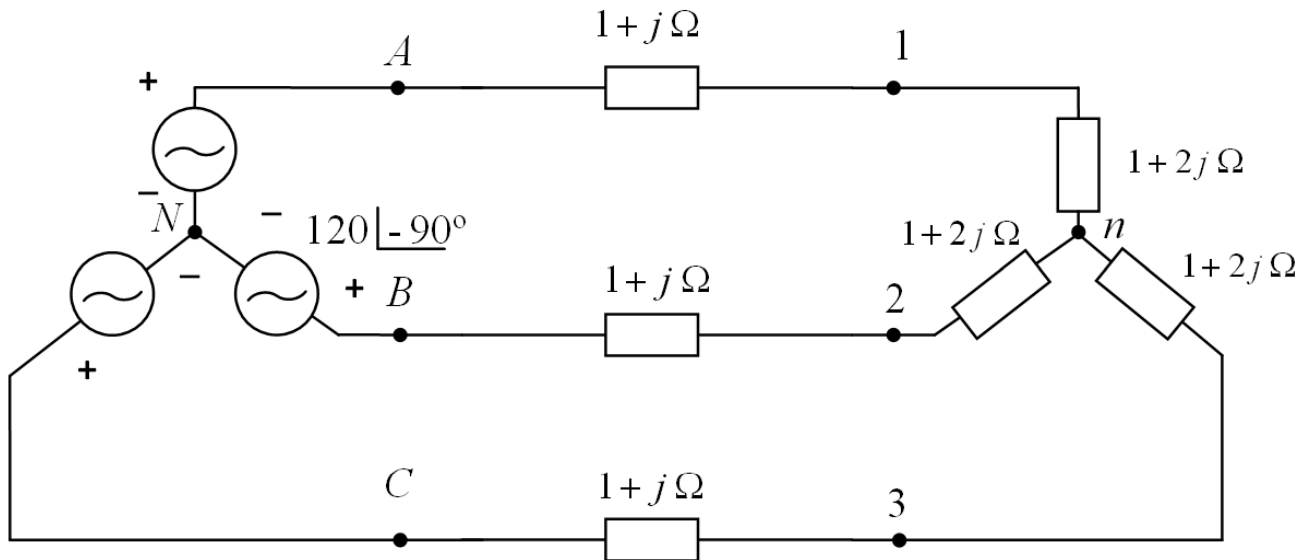
$$I_{C3} = \sqrt{3} |I_f| \angle \beta + 120 - 30$$



$I_{A1} = I_{12} - I_{31}$ → Un fasor menos una versión del mismo **adelantada** en 120°
→ -30



Ejemplo



$$I_{A1} = \frac{120 \angle 30^\circ}{2 + 3j} = 33,28 \angle -26^\circ$$

$$I_{B2} = 33,28 \angle -146^\circ$$

$$I_{C3} = 33,28 \angle 94^\circ$$

$$V_{1n} = I_{A1} (1 + 2j) = 74,41 \angle 37,43^\circ$$

$$V_{12} = \sqrt{3} (74,41) \angle 37,43^\circ + 30^\circ = 128,89 \angle 67,43^\circ$$