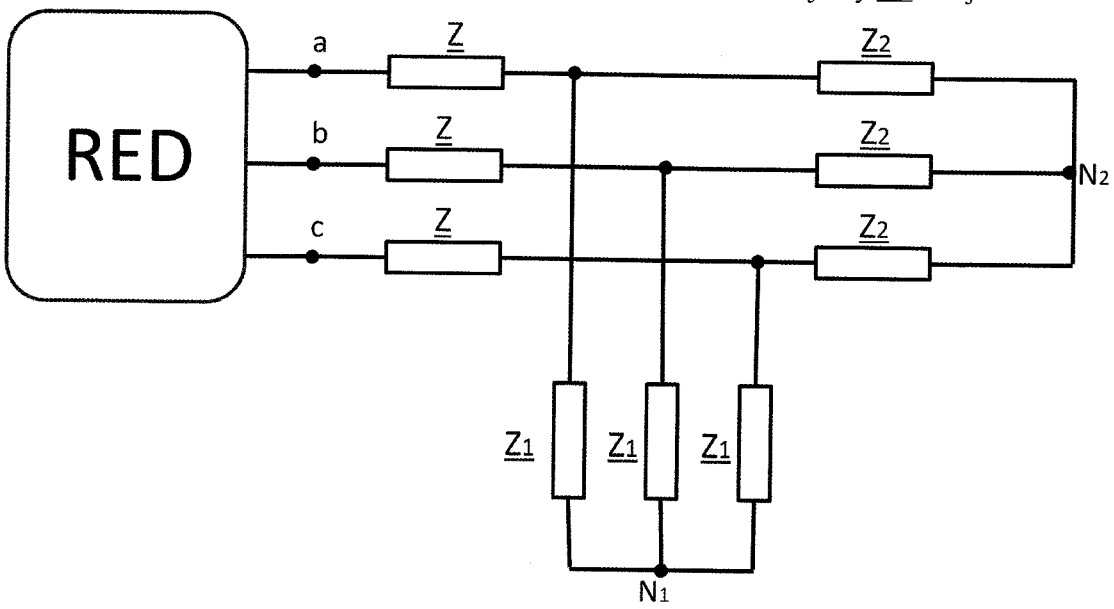
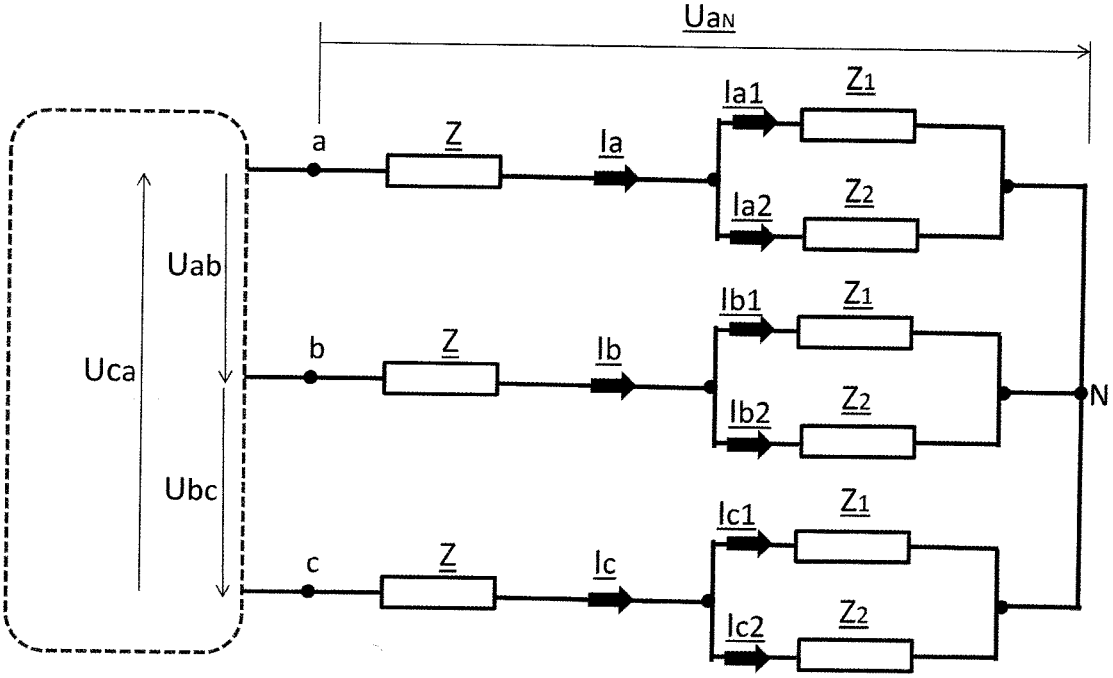
Ejercicio 1111

El circuito trifásico de la figura se alimenta con el sistema de tensiones siguientes: $\underline{Uab}$ = 100 V., $\underline{Ubc}$ = -50+j50 V., $\underline{Uca}$ = -50-j50. Siendo $\underline{Z} = \underline{Z_1}$ = 1+j Ω y $\underline{Z_2}$ = 1+j2



Determinar el valor de la corriente que circula en cada una de las fases de las estrellas de impedancia $\underline{Z_1}$ y $\underline{Z_2}$.



$$\underline{Z}_{eq} = \underline{Z} + \frac{\underline{Z}_1 \cdot \underline{Z}_2}{\underline{Z}_1 + \underline{Z}_2} = (1+j) + \frac{(1+j)(1+2j)}{(1+j)+(1+2j)} = \frac{20+j22}{13} = 2.287 \angle 47.73^\circ$$

$$\underline{U}_{aN} = \frac{\frac{\underline{U}_{ab}}{\underline{Z}_{eq}} + \frac{\underline{U}_{ac}}{\underline{Z}_{eq}}}{\frac{1}{\underline{Z}_{eq}} + \frac{1}{\underline{Z}_{eq}} + \frac{1}{\underline{Z}_{eq}}} = \frac{\underline{U}_{ab} - \underline{U}_{ca}}{3} = \frac{100 - (-50 - j50)}{3} = 50\left(1 + j\frac{1}{3}\right) \Rightarrow$$

$$\underline{U}_{aN} = 52.70 \angle 18.43^\circ$$

En lo que se refiere a las cargas el sistema es equilibrado por lo que $N_1 = N_2 = N$. son los generadores los que crean desequilibrio.

$$U_{bN} = U_{ba} + U_{aN} = U_{aN} - U_{ab} = 50\left(1 + j\frac{1}{3}\right) - 100 = 50\left(-1 + j\frac{1}{3}\right)$$
$$= -50 + j\frac{50}{3} = 52.70 \angle 161.57°$$

$$U_{cN} = U_{ca} + U_{aN} = -50 - j50 + 50\left(1 + j\frac{1}{3}\right) = -j\frac{100}{3} = 33.33 \angle -90°$$

$$J_a = \frac{U_{aN}}{Z_{eq}} = \frac{52.70 \angle 18.43°}{2.287 \angle 47.73} = 23.05 \angle -29.3° \text{ A}$$

$$J_b = \frac{U_{bN}}{Z_{eq}} = \frac{52.70 \angle 161.57°}{2.287 \angle 47.73} = 23.05 \angle 113.84° \text{ A}$$

$$J_c = \frac{U_{cN}}{Z_{eq}} = \frac{33.33 \angle -90°}{2.287 \angle 47.73} = 14.57 \angle -137.73° \text{ A}$$

$$J_{a1} = J_a \cdot \frac{Z_2}{Z_1 + Z_2} = J_a \cdot \frac{1 + j2}{(1+j) + (1+j2)} = 23.05 \angle -29.3 \frac{2.236 \angle 63.43}{3.61 \angle 56.31} = 14.28 \angle -22.18°$$

$$J_{a2} = J_a \cdot \frac{Z_1}{Z_1 + Z_2} = J_a \frac{1 + j}{(1+j) + (1+2j)} = 23.05 \angle -29.3 \frac{1.414 \angle 45}{3.61 \angle 56.31} = 9.03 \angle -40.61°$$

$$J_{b1} = J_b \cdot \frac{Z_2}{Z_1 + Z_2} = 23.05 \angle 113.84 \frac{2.236 \angle 63.43}{3.61 \angle 56.31} = 14.28 \angle 120.96° \text{ A}$$

$$J_{b2} = J_b \frac{Z_1}{Z_1 + Z_2} = 23.05 \angle 113.84 \frac{1.414 \angle 45°}{3.61 \angle 56.31} = 9.03 \angle 102.84° \text{ A}$$

$$J_{c2} = J_c \frac{Z_2}{Z_1 + Z_2} = 14.57 \angle -137.73 \frac{1.414 \angle 45°}{3.61 \angle 56.31°} = 5.71 \angle -148.72° \text{ A}$$

$$J_{c1} = J_c \frac{Z_2}{Z_1 + Z_2} = 14.57 \angle -137.73 \frac{2.236 \angle 63.43}{3.61 \angle 56.31} = 9.02 \angle -130.61° \text{ A}$$