Circuitos Elétricos III
Introdução

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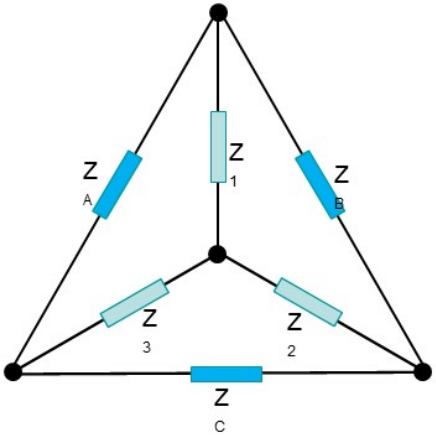
Conversão estrela-triângulo



Estrela → Triângulo	Triângulo → Estrela
$Z_A = \frac{Z_1Z_2 + Z_2Z_3 + Z_3Z_1}{Z_2}$	$Z_1 = \frac{Z_AZ_B}{Z_A + Z_B + Z_C}$
$Z_B = \frac{Z_1Z_2 + Z_2Z_3 + Z_3Z_1}{Z_3}$	$Z_2 = \frac{Z_BZ_C}{Z_A + Z_B + Z_C}$
$Z_C = \frac{Z_1Z_2 + Z_2Z_3 + Z_3Z_1}{Z_1}$	$Z_3 = \frac{Z_CZ_A}{Z_A + Z_B + Z_C}$

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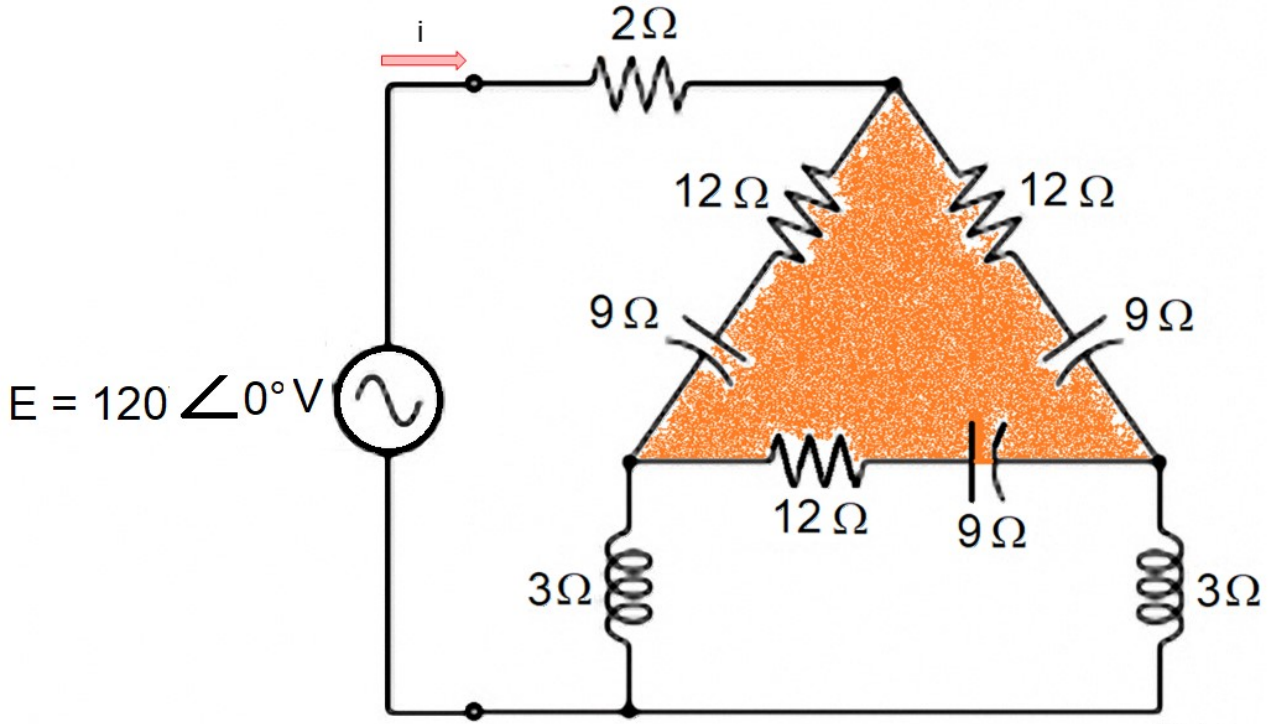

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Aplicando Delta-Y

$$Z_1 = \frac{Z_A Z_B}{Z_A + Z_B + Z_C}$$

$$Z_2 = \frac{Z_B Z_C}{Z_A + Z_B + Z_C}$$

$$Z_3 = \frac{Z_C Z_A}{Z_A + Z_B + Z_C}$$

$$Z_\Sigma = (12\ -j9) + (12\ -j9) + (12\ -j9)$$

$$Z_\Sigma = 36\ -j\,27 = \ 45\ \angle -36.8699°$$

$$Z_1 = Z_2 = Z_3 = \frac{(12\ -j9) \times (12\ -j9)}{45\ \angle -36.8699°} =$$

$$= \frac{(15\angle -36.8699°) \times (15\angle -36.8699°)}{45\ \angle -36.8699°} =$$

$$= \frac{225\angle -73.74°}{45\ \angle -36.8699°}$$

$$Z_1 = 5\angle -36.8699°\ \Omega$$

$$\begin{cases} Z_1 = Z_2 = Z_3 = 5\angle -36.8699°\ \Omega \\ Z_1 = Z_2 = Z_3 = 4\ -j3\ \Omega \end{cases}$$

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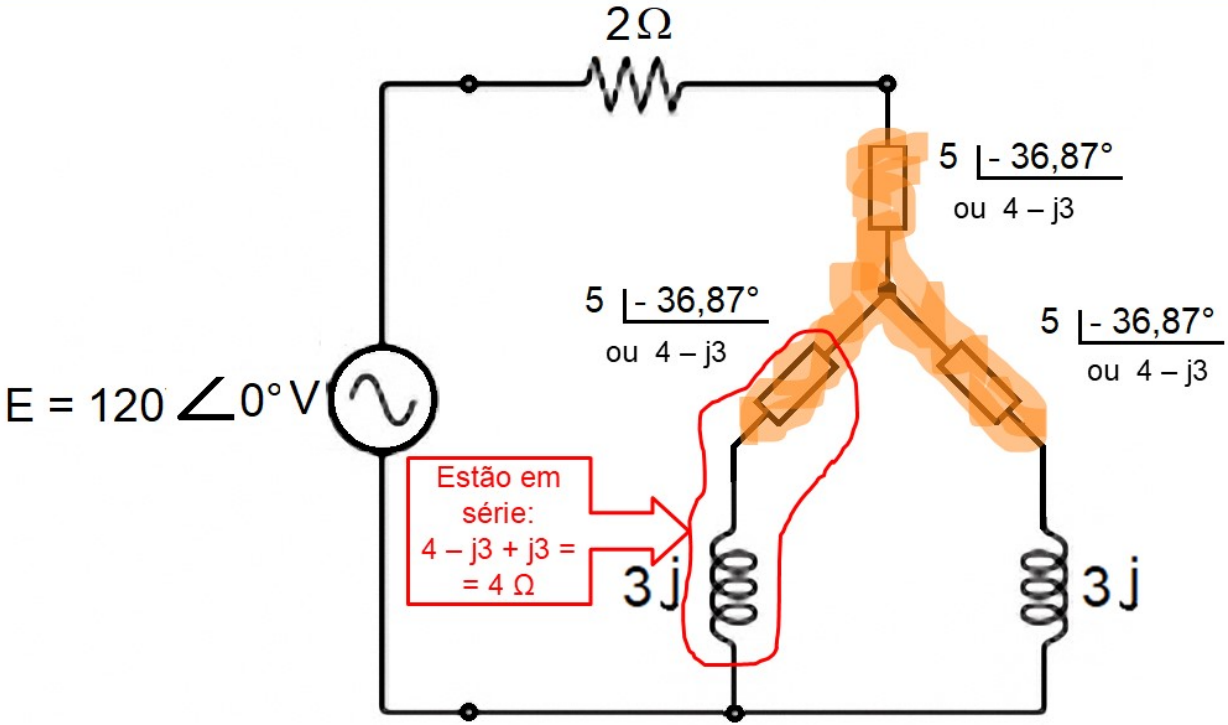
2Ω
5 ∠ - 36,87°
ou 4 – j3
5 ∠ - 36,87°
ou 4 – j3
5 ∠ - 36,87°
ou 4 – j3
E = 120 ∠0° V
Estão em série:
4 – j3 + j3 =
= 4 Ω
3 j
3 j

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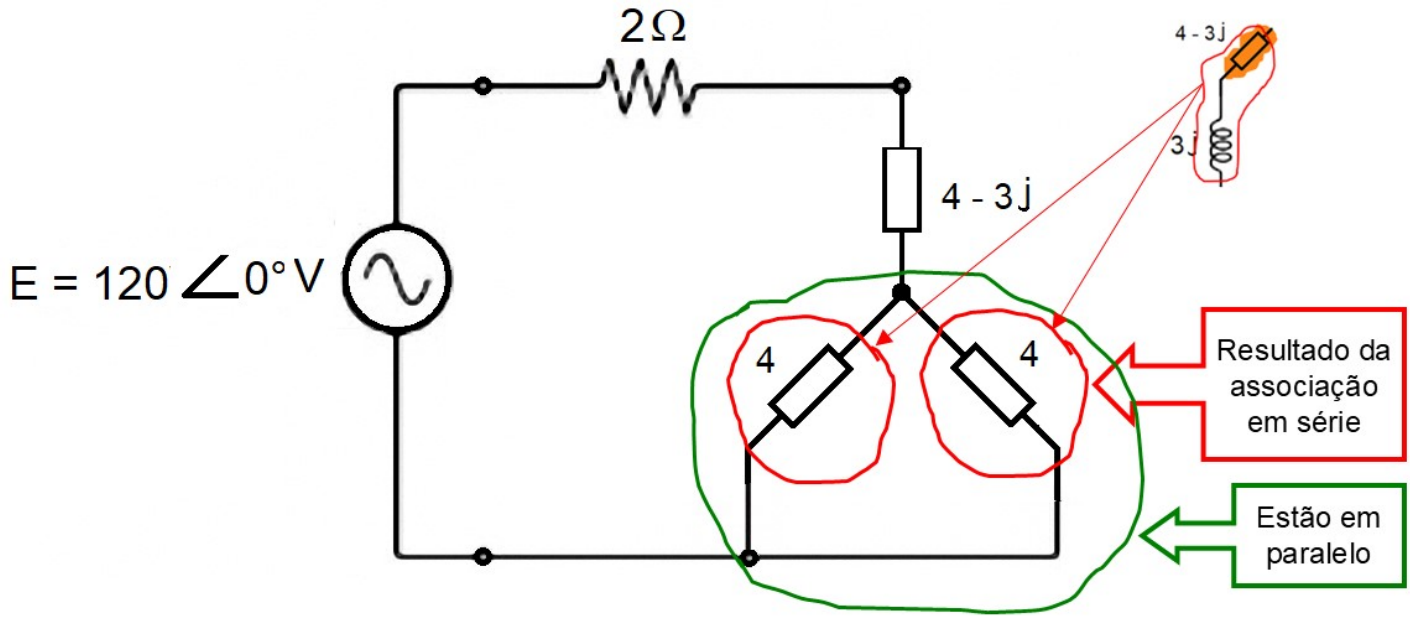
2Ω
4 - 3j
3j
E = 120 ∠0° V
4
4
Resultado da associação em série
Estão em paralelo

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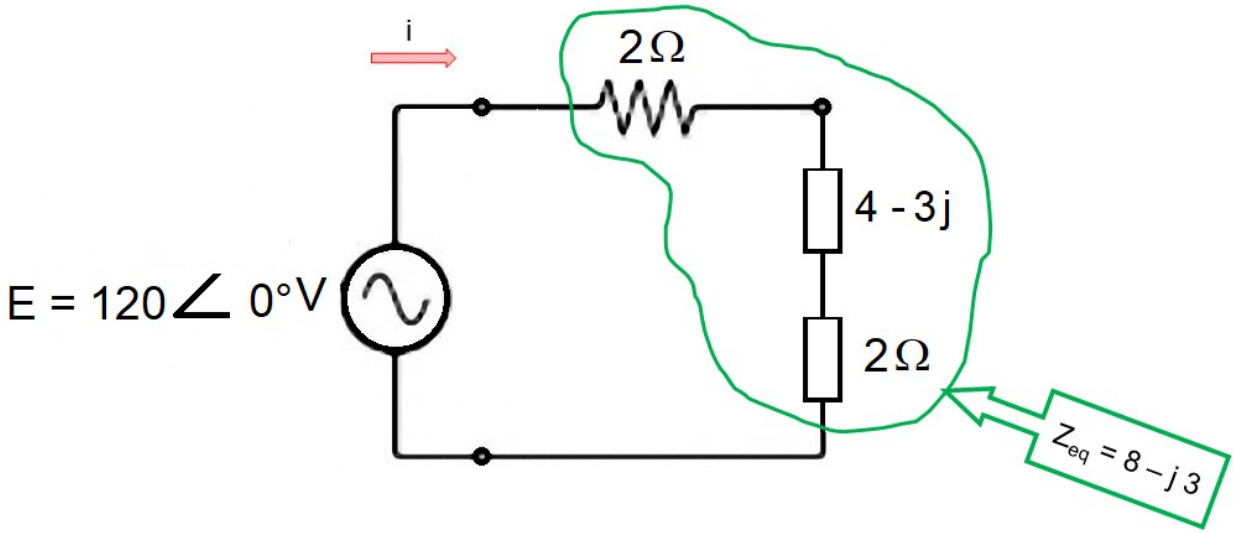
Reduzindo...



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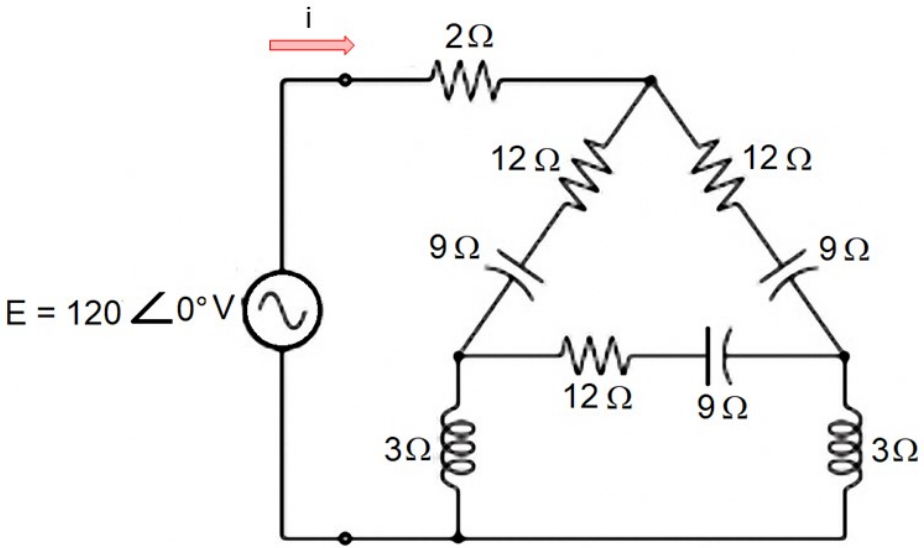
Conclusão



$$V = R \times i$$

$$i = \frac{V}{R}$$

$$i = \frac{120\,\angle 0°}{8 - 3J}$$

$$i = \frac{120\,\angle 0°}{8{,}54\,\angle -20{,}55°}$$

$$i = 14{,}05\,\angle 20{,}55°\ A$$

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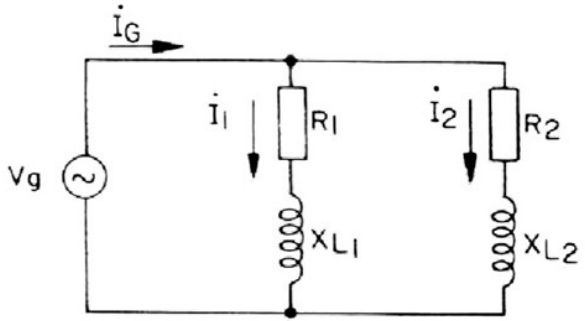
2° Exemplo

Para o circuito determinar:

a) impedância complexa
b) corrente do gerador, $\dot{I}_1$ e $\dot{I}_2$
c) diagrama fasorial



$R_1 = 50\Omega \qquad X_{L1} = 20\Omega$

$R_2 = 50\Omega \qquad X_{L2} = 80\Omega$

$v_g = 110 . \sqrt{2} . \operatorname{sen}\omega t \quad (v)$

$\dot{V}_g = 110 \angle 0°$

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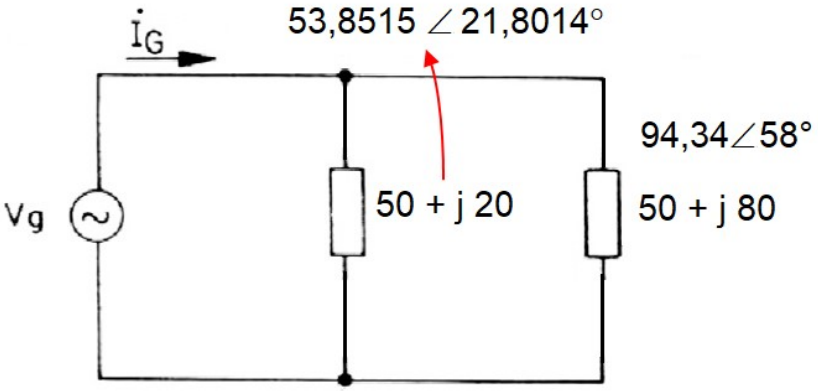


$$Z_{eq} = \frac{1}{\frac{1}{53.8515\angle 21.8014°} + \frac{1}{94.34\angle 58°}}$$

$$Z_{eq} = \frac{1}{0.0186\angle -21.8014° + 0.0106\angle -58°}$$

$$Z_{eq} = \frac{1}{0.0173 - 0.0069j + 0.0056 - j0.009}$$

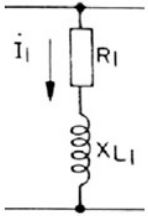
$$Z_{eq} = \frac{1}{0.0229 - 0.0159j}$$

$$Z_{eq} = \frac{1}{0.0279\angle -34.7731°}$$

$$Z_{eq} = 35.8697\angle 34.7731° \, \Omega$$

$$I_G = \frac{110\angle 0°}{35.8697\angle 34.7731°}$$

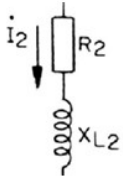
$$I_G = 3.0667\angle -34.7731° \, A$$



$$I_1 = \frac{110\angle 0°}{50 + j20}$$

$$I_1 = \frac{110\angle 0°}{53.8516\angle 21.8°}$$

$$I_1 = 2.0427\angle -21.8°\ A$$

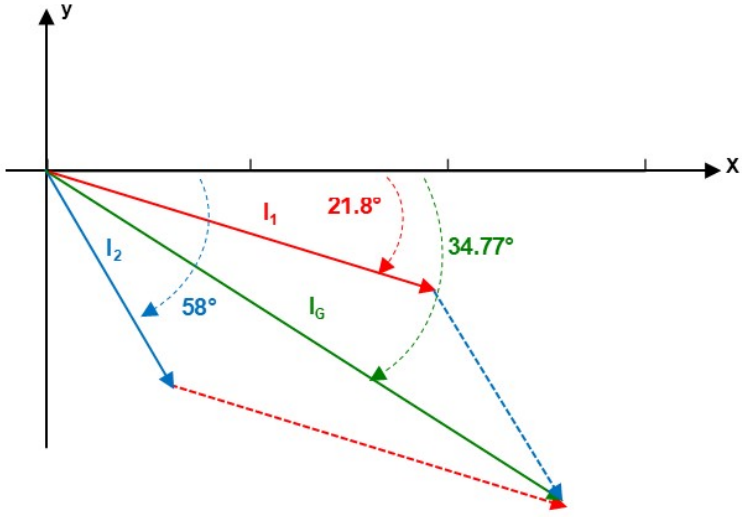


$$I_2 = \frac{110\angle 0°}{50 + j80}$$

$$I_2 = \frac{110\angle 0°}{94{,}34\angle 58°}$$

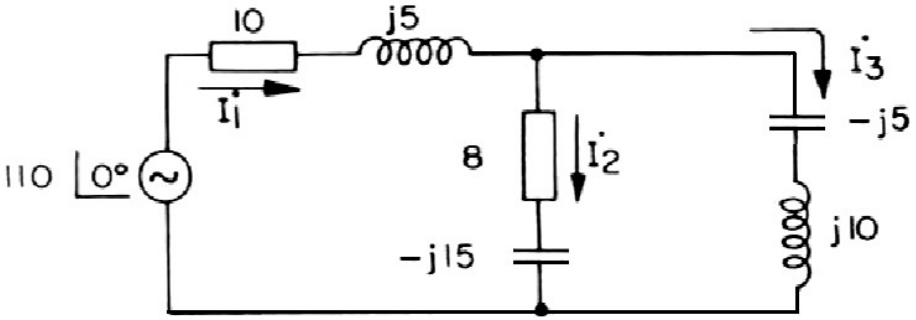
$$I_2 = 1.166\angle -58°\ A$$

Diagrama de Fasores



Aplique este exercício para prática

Determinar no circuito a impedância e todas as correntes.



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