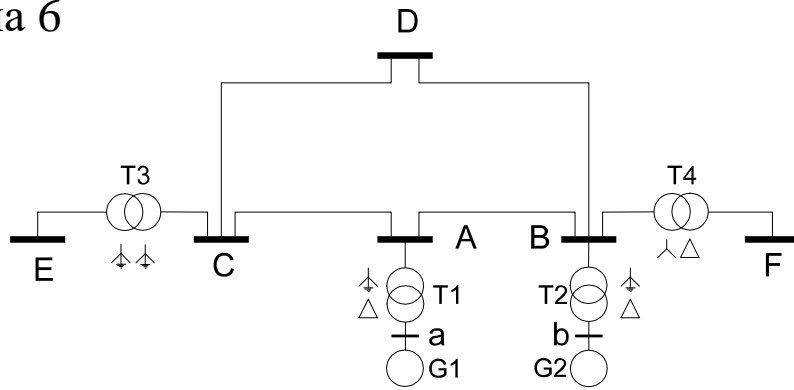


Задача 6



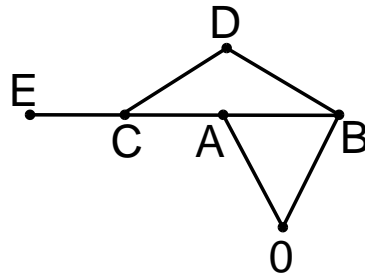
Элемент	Податоци за елементите	
	Реактанции (р.у.)	
	Директен систем	Нулти систем
Генератор G1	10	
Генератор G2	25	
Трансформатор T1	10	
Трансформатор T2	25	
Трансформатор T3	37	
Трансформатор T4	25	
Вод А-В	30	90
Вод А-С	24	70.8
Вод В-Д	15	54
Вод С-Д	30	90

a) Т.К.В во A;

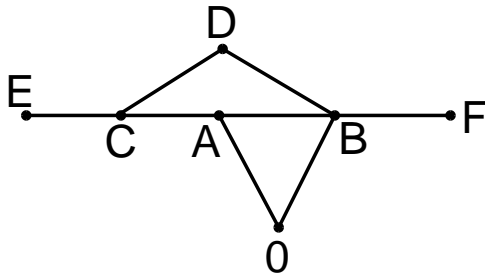
b) е.к.В во C; $\underline{I}_{A-C}^{a,b,c} = ?$

$$\underline{U}_{(0)}^a = \frac{1,05}{\sqrt{3}}$$

нулти редослед



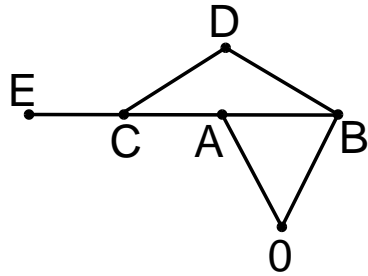
директен редослед



$$\underline{Z}^{(1)} = j \begin{bmatrix} 15,6 & 11 & 14 & 12 & 14 & 11 \\ 11 & 22,5 & 15 & 20 & 15 & 22,5 \\ 14 & 15 & 30 & 20 & 30 & 15 \\ 12 & 20 & 20 & 30 & 20 & 20 \\ 14 & 15 & 30 & 20 & 67 & 15 \\ 11 & 22,5 & 15 & 20 & 15 & 47,5 \end{bmatrix} \begin{matrix} A \\ B \\ C \\ D \\ E \\ F \end{matrix}$$

Задача 6

нушти редослед



$$\underline{Z}^{(0)} = j \begin{bmatrix} 8,984 & 2,54 & 6,86 & 4,16 & 6,86 \\ 2,54 & 18,65 & 7,85 & 14,6 & 7,85 \\ 6,86 & 7,85 & 54,65 & 25,4 & 54,65 \\ 4,16 & 14,6 & 25,4 & 52,4 & 25,4 \\ 6,86 & 7,85 & 54,65 & 25,4 & 91,65 \end{bmatrix} \begin{matrix} A \\ B \\ C \\ D \\ E \end{matrix}$$

$$\underline{I}_{C(e.k.B.)}^{0,1,2} = \frac{\sqrt{3} \cdot \underline{U}_{C(0)}^a}{\underline{Z}_{CC}^{(0)} + \underline{Z}_{CC}^{(1)} + \underline{Z}_{CC}^{(2)} + 3\underline{Z}_{k.B.}} \cdot \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix} = -j \frac{\sqrt{3} \frac{1,05}{\sqrt{3}}}{54,65 + 2 \cdot 30} \cdot \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix} = -j 9,1583 \cdot 10^{-3} \cdot \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}$$

$$\underline{I}_{C(e.k.B.)}^{a,b,c} = -\underline{T} \cdot j 9,1583 \cdot 10^{-3} \cdot \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix} = -j 0,015863 \cdot \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}$$

$$\underline{U}_{C(e.k.B.)}^{0,1,2} = \frac{\sqrt{3} \cdot \underline{U}_{C(0)}^a}{\underline{Z}_{CC}^{(0)} + \underline{Z}_{CC}^{(1)} + \underline{Z}_{CC}^{(2)} + 3\underline{Z}_{k.B.}} \cdot \begin{bmatrix} -\underline{Z}_{CC}^{(0)} \\ \underline{Z}_{CC}^{(0)} + \underline{Z}_{CC}^{(2)} + 3\underline{Z}_{k.B.} \\ -\underline{Z}_{CC}^{(2)} \end{bmatrix}$$

$$\underline{U}_{C(e.k.B.)}^{0,1,2} = \frac{1,05}{114,65} \cdot \begin{bmatrix} -54,65 \\ 54,65 + 30 \\ -30 \end{bmatrix} = \begin{bmatrix} -0,50050 \\ 0,77525 \\ -0,27475 \end{bmatrix} \quad \underline{U}_{C(e.k.B.)}^{a,b,c} = \underline{T} \cdot \begin{bmatrix} -0,50050 \\ 0,77525 \\ -0,27475 \end{bmatrix} = \begin{bmatrix} 0 \\ -0,43345 - j0,525 \\ -0,43345 + j0,525 \end{bmatrix}$$

Задача 6

$$\underline{I}_{A-C(е.к.в.)}^{0,1,2} = \left(\underline{Z}_{A-C}^{0,1,2} \right)^{-1} \cdot \left(\underline{Z}_{CC}^{0,1,2} - \underline{Z}_{AC}^{0,1,2} \right) \cdot \underline{I}_{C(е.к.в.)}^{0,1,2}$$

$$\underline{I}_{A-C}^{0,1,2} = \begin{bmatrix} \frac{1}{\underline{Z}_{A-C}^{(0)}} & 0 & 0 \\ 0 & \frac{1}{\underline{Z}_{A-C}^{(1)}} & 0 \\ 0 & 0 & \frac{1}{\underline{Z}_{A-C}^{(2)}} \end{bmatrix} \cdot \left(\begin{bmatrix} \underline{Z}_{CC}^{(0)} & 0 & 0 \\ 0 & \underline{Z}_{CC}^{(1)} & 0 \\ 0 & 0 & \underline{Z}_{CC}^{(2)} \end{bmatrix} - \begin{bmatrix} \underline{Z}_{AC}^{(0)} & 0 & 0 \\ 0 & \underline{Z}_{AC}^{(1)} & 0 \\ 0 & 0 & \underline{Z}_{AC}^{(2)} \end{bmatrix} \right) \cdot \underline{I}_C^{0,1,2}$$

$$\underline{I}_{A-C}^{0,1,2} = \begin{bmatrix} \frac{\underline{Z}_{CC}^{(0)} - \underline{Z}_{AC}^{(0)}}{\underline{Z}_{A-C}^{(0)}} & 0 & 0 \\ 0 & \frac{\underline{Z}_{CC}^{(1)} - \underline{Z}_{AC}^{(1)}}{\underline{Z}_{A-C}^{(1)}} & 0 \\ 0 & 0 & \frac{\underline{Z}_{CC}^{(2)} - \underline{Z}_{AC}^{(2)}}{\underline{Z}_{A-C}^{(2)}} \end{bmatrix} \cdot \left(-j9,1583 \cdot 10^{-3} \right) \cdot \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}$$

$$\underline{I}_{A-C}^{0,1,2} = -j9,1583 \cdot 10^{-3} \cdot \begin{bmatrix} \frac{\underline{Z}_{CC}^{(0)} - \underline{Z}_{AC}^{(0)}}{\underline{Z}_{A-C}^{(0)}} \\ \frac{\underline{Z}_{CC}^{(1)} - \underline{Z}_{AC}^{(1)}}{\underline{Z}_{A-C}^{(1)}} \\ \frac{\underline{Z}_{CC}^{(2)} - \underline{Z}_{AC}^{(2)}}{\underline{Z}_{A-C}^{(2)}} \end{bmatrix} = -j \cdot \begin{bmatrix} 6,1819 \\ 6,1055 \\ 6,1055 \end{bmatrix} \cdot 10^{-3}$$

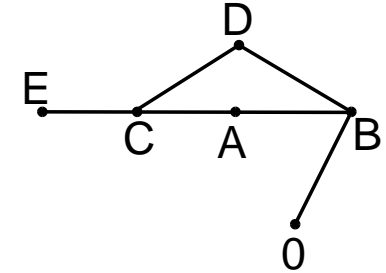
Задача 6

$$\underline{I}_{A-C}^{a,b,c} = -j \cdot \underline{T} \cdot \begin{bmatrix} 6,1819 \\ 6,1055 \\ 6,1055 \end{bmatrix} \cdot 10^{-3} = -j \cdot \begin{bmatrix} 0,01062 \\ 4,4 \cdot 10^{-5} \\ 4,4 \cdot 10^{-5} \end{bmatrix}$$

нушти редослед

c) е.к.в во C; $\underline{I}_{A-C}^{a,b,c} = ?$ T1(DY)

$$\underline{U}_{(0)}^a = \frac{1,05}{\sqrt{3}}$$



$$\underline{I}_{A-C}^{0,1,2} = \frac{\sqrt{3} \cdot \underline{U}_{C(0)}^a}{\underline{Z}_{CC}^{(0)} + \underline{Z}_{CC}^{(1)} + \underline{Z}_{CC}^{(2)} + 3\underline{Z}_{k.v.}} \cdot \begin{bmatrix} \frac{\underline{Z}_{CC}^{(0)} - \underline{Z}_{AC}^{(0)}}{\underline{Z}_{A-C}^{(0)}} \\ \frac{\underline{Z}_{CC}^{(1)} - \underline{Z}_{AC}^{(1)}}{\underline{Z}_{A-C}^{(1)}} \\ \frac{\underline{Z}_{CC}^{(2)} - \underline{Z}_{AC}^{(2)}}{\underline{Z}_{A-C}^{(2)}} \end{bmatrix}$$

Задача 6

$$\underline{Z}^{(0)} = j \begin{bmatrix} 8,984 & 2,54 & 6,86 & 4,16 & 6,86 \\ 2,54 & 18,65 & 7,85 & 14,6 & 7,85 \\ 6,86 & 7,85 & 54,65 & 25,4 & 54,65 \\ 4,16 & 14,6 & 25,4 & 52,4 & 25,4 \\ 6,86 & 7,85 & 54,65 & 25,4 & 91,65 \end{bmatrix} \begin{matrix} A \\ B \\ C \\ D \\ E \end{matrix}$$

Спојница А-0 (-j10)

$$\underline{Z}_{\text{ПОМ.КОЛ.}} = j \begin{bmatrix} 8,984 \\ 2,54 \\ 6,86 \\ 4,16 \\ 6,86 \end{bmatrix} \begin{matrix} A \\ B \\ C \\ D \\ E \end{matrix}$$

$$\underline{Z}_{CC}^{(0)} = \underline{Z}_{CC}^{(0)} - \frac{\underline{Z}_{\text{ПОМ.КОЛ.}}(C) \cdot \underline{Z}_{\text{ПОМ.КОЛ.}}(C)}{\underline{Z}_{\text{ПОМ.КОЛ.}}(A) - \underline{Z}_{\text{ПОМ.КОЛ.}}(0) + \underline{Z}_{A-0}} = j54,65 - j \frac{6,86^2}{8,984 - 0 + (-10)} = j100,9685$$

$$\underline{Z}_{AC}^{(0)} = \underline{Z}_{AC}^{(0)} - \frac{\underline{Z}_{\text{ПОМ.КОЛ.}}(A) \cdot \underline{Z}_{\text{ПОМ.КОЛ.}}(C)}{\underline{Z}_{\text{ПОМ.КОЛ.}}(A) - \underline{Z}_{\text{ПОМ.КОЛ.}}(0) + \underline{Z}_{A-0}} = j6,86 - j \frac{8,984 \cdot 6,86}{-1,016} = j67,51968$$

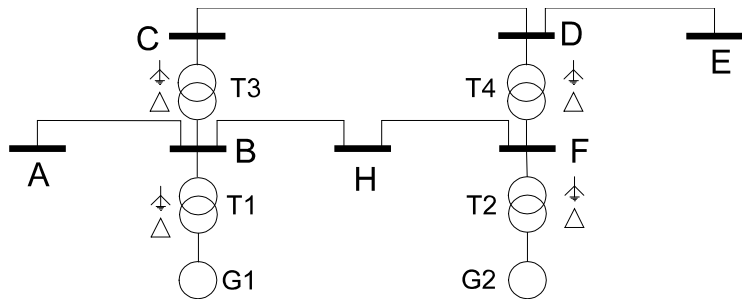
Задача 6

$$\underline{I}_{C(e.k.B.)}^{0,1,2} = \frac{\sqrt{3} \cdot \underline{U}_{C(0)}^a}{\underline{Z}_{CC}^{(0)} + \underline{Z}_{CC}^{(1)} + \underline{Z}_{CC}^{(2)} + 3\underline{Z}_{K.B.}} \cdot \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix} = -j \frac{\sqrt{3} \frac{1,05}{\sqrt{3}}}{100,9685 + 2 \cdot 30} \cdot \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix} = -j 6,523015 \cdot 10^{-3} \cdot \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}$$

$$\underline{I}_{A-C}^{0,1,2} = -j 6,523015 \cdot 10^{-3} \cdot \begin{bmatrix} 100,9685 - 67,51968 \\ \frac{70,8}{30 - 14} \\ 24 \\ \frac{30 - 14}{24} \\ 24 \end{bmatrix} = -j \cdot \begin{bmatrix} 3,0817 \\ 4,3487 \\ 4,3487 \end{bmatrix} \cdot 10^{-3}$$

$$\underline{I}_{A-C}^{a,b,c} = -j \cdot \underline{T} \cdot \begin{bmatrix} 3,0817 \\ 4,3487 \\ 4,3487 \end{bmatrix} \cdot 10^{-3} = j \cdot \begin{bmatrix} -0,0068 \\ 7,3 \cdot 10^{-4} \\ 7,3 \cdot 10^{-4} \end{bmatrix}$$

Задача 10



Податоци за елементите

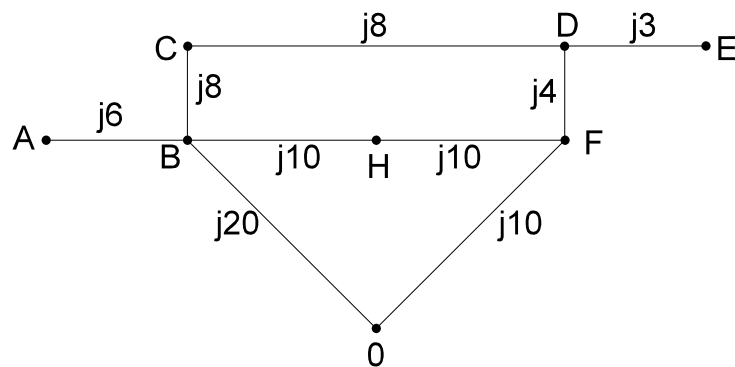
Елемент	Реактанции (р.у.)	
	Директен редослед	Нулти редослед
Генератор G1	10	
Генератор G2	5	
Трансоформатор T1	10	10
Трансоформатор T2	5	5
Трансоформатор T3	8	8
Трансоформатор T4	4	4
Вод А-В	6	18
Вод В-Н	10	28
Вод Н-F	10	28
Вод C-D	8	24
Вод D-E	3	9

a) Т.К.В во A; $\underline{I}_{B-H}^{a,b,c} = ?$

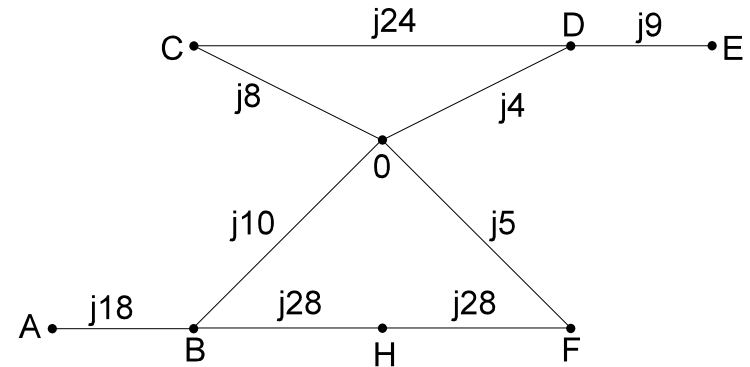
b) е.к.в во E; $\underline{I}_{T4}^{a,b,c} = ?$

$$\underline{U}_{(0)}^a = \frac{1,0}{\sqrt{3}}$$

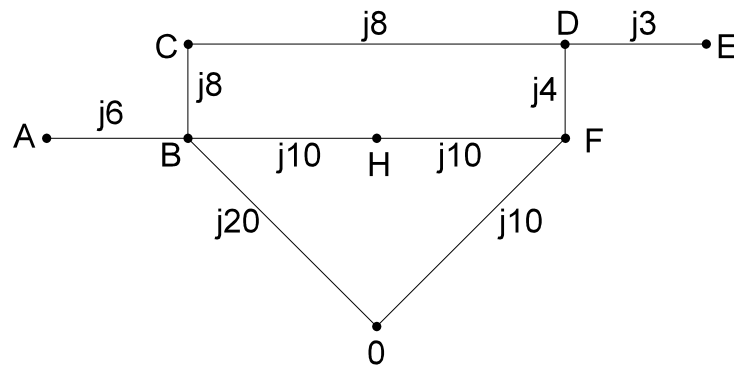
Директен редослед



Нулти редослед



Задача 10



$$X_{\text{дел.3}}^{(1)} = \begin{matrix} B \\ F \end{matrix} \begin{bmatrix} 20 & 0 \\ 0 & 10 \end{bmatrix} - \frac{1}{20 - (-10) + 20} \begin{matrix} B \\ F \end{matrix} \begin{bmatrix} 20 \\ -10 \end{bmatrix} \begin{bmatrix} 20 & -10 \end{bmatrix} = \begin{matrix} B \\ F \end{matrix} \begin{bmatrix} 12 & 4 \\ 4 & 8 \end{bmatrix}$$

$$X_{\text{дел.5}}^{(1)} = \begin{matrix} B \\ F \\ C \\ D \end{matrix} \begin{bmatrix} 12 & 4 & 12 & 4 \\ 4 & 8 & 4 & 8 \\ 12 & 4 & 20 & 4 \\ 4 & 8 & 4 & 12 \end{bmatrix} - \frac{1}{16 - (-8) + 8} \begin{matrix} B \\ F \\ C \\ D \end{matrix} \begin{bmatrix} 8 \\ -4 \\ 16 \\ -8 \end{bmatrix} \begin{bmatrix} 8 & -4 & 16 & -8 \end{bmatrix} = \begin{matrix} B \\ F \\ C \\ D \end{matrix} \begin{bmatrix} 10 & 5 & 8 & 6 \\ 5 & 7,5 & 6 & 7 \\ 8 & 6 & 12 & 8 \\ 6 & 7 & 8 & 10 \end{bmatrix}$$

$$X_{\text{дел.7}}^{(1)} = \begin{matrix} B \\ F \\ C \\ D \\ E \\ A \end{matrix} \begin{bmatrix} 10 & 5 & 8 & 6 & 6 & 10 \\ 5 & 7,5 & 6 & 7 & 7 & 5 \\ 8 & 6 & 12 & 8 & 8 & 8 \\ 6 & 7 & 8 & 10 & 10 & 6 \\ 6 & 7 & 8 & 10 & 13 & 6 \\ 10 & 5 & 8 & 6 & 6 & 16 \end{bmatrix}$$

Задача 10

$$\underline{Z}^{(1)} = j \begin{bmatrix} 10 & 5 & 8 & 6 & 6 & 10 \\ 5 & 7,5 & 6 & 7 & 7 & 5 \\ 8 & 6 & 12 & 8 & 8 & 8 \\ 6 & 7 & 8 & 10 & 10 & 6 \\ 6 & 7 & 8 & 10 & 13 & 6 \\ 10 & 5 & 8 & 6 & 6 & 16 \end{bmatrix} \begin{matrix} \text{B} \\ \text{F} \\ \text{C} \\ \text{D} \\ \text{E} \\ \text{A} \end{matrix}$$

$$\underline{I}_{\text{A(T.K.B.)}}^{0,1,2} = \frac{\sqrt{3} \cdot \underline{U}_{\text{A(0)}}^a}{\underline{Z}_{\text{AA}}^{(1)} + \underline{Z}_{\text{K.B.}}} \cdot \begin{bmatrix} 0 \\ 1 \\ 0 \end{bmatrix} = \frac{\sqrt{3} \cdot \frac{1,0}{\sqrt{3}}}{j16} \cdot \begin{bmatrix} 0 \\ 1 \\ 0 \end{bmatrix} = -j0,0625 \cdot \begin{bmatrix} 0 \\ 1 \\ 0 \end{bmatrix}$$

$$\underline{I}_{\text{A(T.K.B.)}}^{a,b,c} = -\frac{j0,0625}{\sqrt{3}} \cdot \begin{bmatrix} 1 \\ \underline{a}^2 \\ \underline{a} \end{bmatrix}$$

Задача 10

$$\underline{I}_{i-l(\text{Т.К.В.})}^{0,1,2} = \left(\underline{Z}_{i-l}^{0,1,2} \right)^{-1} \cdot \left(\underline{Z}_{lk}^{0,1,2} - \underline{Z}_{ik}^{0,1,2} \right) \cdot \underline{I}_{k(\text{Т.К.В.})}^{0,1,2}$$

$$\underline{I}_{\text{B-F}(\text{Т.К.В.})}^{0,1,2} = \left(\underline{Z}_{\text{B-F}}^{0,1,2} \right)^{-1} \cdot \left(\underline{Z}_{\text{FA}}^{0,1,2} - \underline{Z}_{\text{BA}}^{0,1,2} \right) \cdot \underline{I}_{\text{A}(\text{Т.К.В.})}^{0,1,2}$$

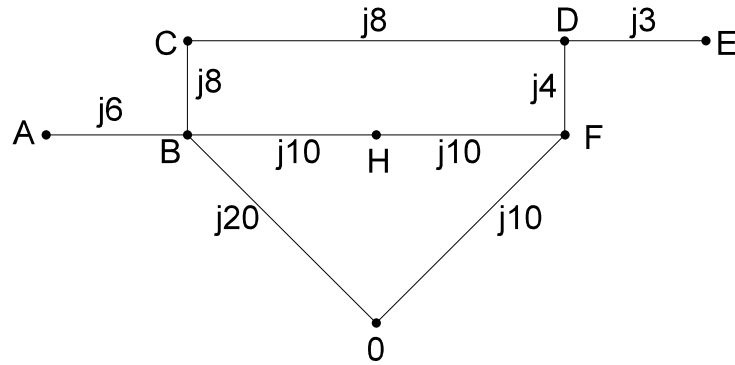
$$\underline{I}_{\text{B-F}(\text{Т.К.В.})}^{0,1,2} = \frac{\underline{Z}_{\text{AF}}^{(1)} - \underline{Z}_{\text{AB}}^{(1)}}{\underline{Z}_{\text{B-F}}^{(1)}} \cdot \frac{\sqrt{3} \cdot \underline{U}_{\text{A}(0)}^{\text{a}}}{\underline{Z}_{\text{AA}}^{(1)} + \underline{Z}_{\text{К.В.}}^{(1)}} \cdot \begin{bmatrix} 0 \\ 1 \\ 0 \end{bmatrix} = j \frac{5-10}{20} \cdot \frac{\sqrt{3} \cdot \frac{1,0}{\sqrt{3}}}{j16} \cdot \begin{bmatrix} 0 \\ 1 \\ 0 \end{bmatrix} = j0,015625 \cdot \begin{bmatrix} 0 \\ 1 \\ 0 \end{bmatrix}$$

$$\underline{I}_{\text{B-F}(\text{Т.К.В.})}^{\text{a,b,c}} = \underline{T} \cdot \underline{I}_{\text{B-F}(\text{Т.К.В.})}^{0,1,2}$$

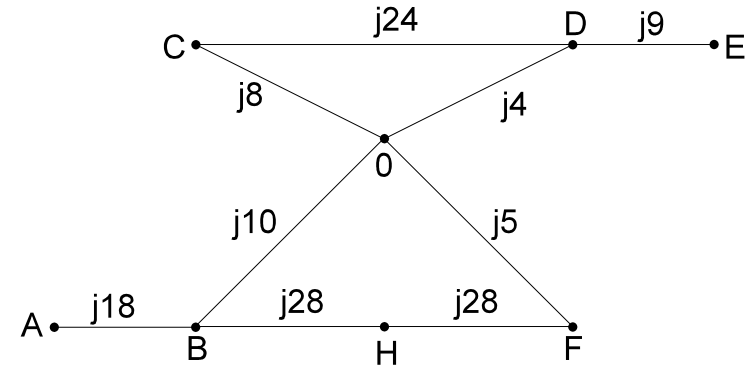
$$\underline{I}_{\text{B-F}(\text{Т.К.В.})}^{\text{a,b,c}} = \frac{\underline{Z}_{\text{AF}}^{(1)} - \underline{Z}_{\text{AB}}^{(1)}}{\underline{Z}_{\text{B-F}}^{(1)}} \cdot \frac{\underline{U}_{\text{A}(0)}^{\text{a}}}{\underline{Z}_{\text{AA}}^{(1)} + \underline{Z}_{\text{К.В.}}^{(1)}} \cdot \begin{bmatrix} 1 \\ \underline{a}^2 \\ \underline{a} \end{bmatrix} = \frac{5,0-10,0}{20} \cdot \frac{1,0}{j16} \cdot \frac{1}{\sqrt{3}} \cdot \begin{bmatrix} 1 \\ \underline{a}^2 \\ \underline{a} \end{bmatrix} = j \frac{0,015625}{\sqrt{3}} \cdot \begin{bmatrix} 1 \\ \underline{a}^2 \\ \underline{a} \end{bmatrix}$$

Задача 10

Директен редослед



Нулти редослед



$$\underline{I}_{T4_{(e.k.B.)}}^{a,b,c} = \underline{T} \cdot \left(\underline{I}_{F-D_{(e.k.B.)}}^{0,1,2} + \underline{I}_{0-D_{(e.k.B.)}}^{0,1,2} \right)$$

$$\underline{I}_{T4_{(e.k.B.)}}^{a,b,c} = \underline{T} \cdot \left\{ \left(\underline{Z}_{F-D}^{0,1,2} \right)^{-1} \cdot \left(\underline{U}_{F_{(e.k.v.)}}^{0,1,2} - \underline{U}_{D_{(e.k.B.)}}^{0,1,2} \right) + \left(\underline{Z}_{0-D}^{0,1,2} \right)^{-1} \cdot \left(\underline{U}_{0_{(e.k.B.)}}^{0,1,2} - \underline{U}_{D_{(e.k.B.)}}^{0,1,2} \right) \right\}$$

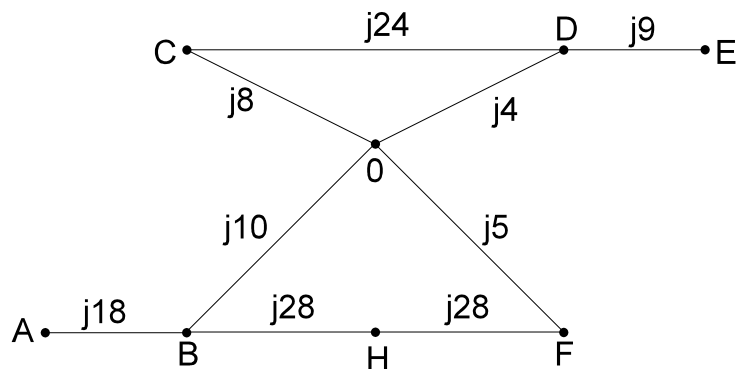
$$\underline{U}_0^{0,1,2} = 0 \quad \underline{U}_{D(0)}^{0,1,2} = \underline{U}_{F(0)}^{0,1,2} \quad \underline{Z}_{FE}^{(0)} = 0 \quad \underline{Z}_{F-D}^{(0)} = \underline{Z}_{0-D}^{(1)} = \underline{Z}_{0-D}^{(2)} = \infty$$

Задача 10

$$\begin{aligned}
 \underline{I}_{T4}^{0,1,2} &= \begin{bmatrix} 0 & 0 & 0 \\ 0 & \frac{1}{\underline{Z}_{F-D}^{(1)}} & 0 \\ 0 & 0 & \frac{1}{\underline{Z}_{F-D}^{(2)}} \end{bmatrix} \cdot \left(\begin{bmatrix} \underline{Z}_{DE}^{(0)} & 0 & 0 \\ 0 & \underline{Z}_{DE}^{(1)} & 0 \\ 0 & 0 & \underline{Z}_{DE}^{(2)} \end{bmatrix} - \begin{bmatrix} 0 & 0 & 0 \\ 0 & \underline{Z}_{FE}^{(1)} & 0 \\ 0 & 0 & \underline{Z}_{FE}^{(2)} \end{bmatrix} \right) \cdot \underline{I}_{E}^{0,1,2} \\
 - \begin{bmatrix} \frac{1}{\underline{Z}_{0-D}^{(0)}} & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix} \cdot \left(\begin{bmatrix} 0 \\ \sqrt{3} \underline{U}_{D(0)}^a \\ 0 \end{bmatrix} - \begin{bmatrix} \underline{Z}_{DE}^{(0)} & 0 & 0 \\ 0 & \underline{Z}_{DE}^{(1)} & 0 \\ 0 & 0 & \underline{Z}_{DE}^{(2)} \end{bmatrix} \cdot \underline{I}_{E}^{0,1,2} \right) &= \begin{bmatrix} 0 \\ \underline{I}_{F-D}^{(1)} \\ \underline{I}_{F-D}^{(2)} \end{bmatrix} + \begin{bmatrix} \underline{I}_{0-D}^{(0)} \\ 0 \\ 0 \end{bmatrix} \\
 \underline{I}_{T4}^{a,b,c} &= \underline{T} \cdot \begin{bmatrix} \frac{\underline{Z}_{DE}^{(0)}}{\underline{Z}_{F-D}^{(0)}} & 0 & 0 \\ 0 & \frac{\underline{Z}_{DE}^{(1)} - \underline{Z}_{FE}^{(1)}}{\underline{Z}_{F-D}^{(1)}} & 0 \\ 0 & 0 & \frac{\underline{Z}_{DE}^{(2)} - \underline{Z}_{FE}^{(2)}}{\underline{Z}_{F-D}^{(2)}} \end{bmatrix} \cdot \underline{I}_{E}^{0,1,2}
 \end{aligned}$$

Задача 10

Нулли редослед



$$\underline{Z}^{(0)} = \begin{bmatrix} 6,2222 & 0,88889 & 0,88889 \\ 0,88889 & 3,55556 & 3,55556 \\ 0,88889 & 3,55556 & 12,55556 \end{bmatrix} \begin{matrix} C \\ D \\ E \end{matrix}$$

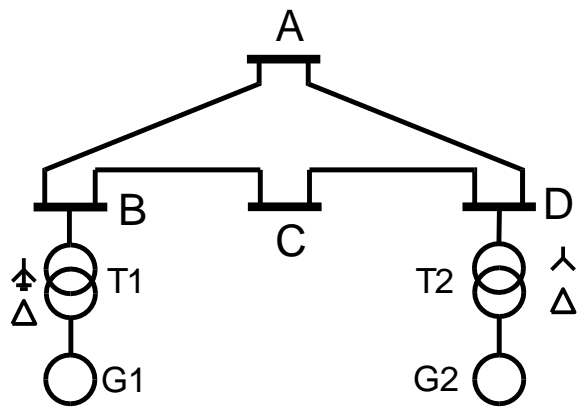
$$\underline{I}_{k(\text{e.к.в.})}^{0,1,2} = \frac{\sqrt{3} \cdot \underline{U}_{k(0)}^a}{\underline{Z}_{kk}^{(0)} + \underline{Z}_{kk}^{(1)} + \underline{Z}_{kk}^{(2)} + 3\underline{Z}_{\text{к.в.}}} \cdot \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}$$

$$\underline{I}_{E(\text{e.к.в.})}^{0,1,2} = \frac{\sqrt{3} \cdot \frac{1,0}{\sqrt{3}}}{j12,55556 + 2 \cdot j13,0} \cdot \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix} = -j0,02594 \cdot \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}$$

$$\underline{I}_{E(\text{e.к.в.})}^{a,b,c} = \underline{T} \cdot (-j0,02594) \cdot \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix} = -j\sqrt{3} \cdot 0,02594 \cdot \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix} = -j0,04492 \cdot \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}$$

$$\underline{I}_{T4}^{a,b,c} = \underline{T} \cdot \begin{bmatrix} \frac{\underline{Z}_{DE}^{(0)}}{\underline{Z}_{F-D}^{(0)}} & 0 & 0 \\ 0 & \frac{\underline{Z}_{DE}^{(1)} - \underline{Z}_{FE}^{(1)}}{\underline{Z}_{F-D}^{(1)}} & 0 \\ 0 & 0 & \frac{\underline{Z}_{DE}^{(2)} - \underline{Z}_{FE}^{(2)}}{\underline{Z}_{F-D}^{(2)}} \end{bmatrix} \cdot \underline{I}_E^{0,1,2} = -j \begin{bmatrix} 0,03577 \\ 0,00208 \\ 0,00208 \end{bmatrix}$$

Задача 11



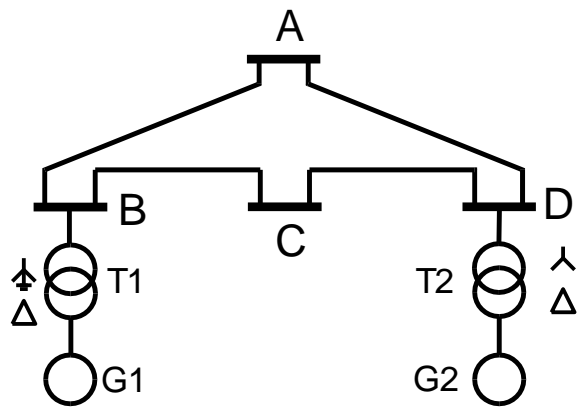
Податоци за елементите

Елемент	Реактанции (р.у.)	
	Директен редослед	Нулти редослед
Генератор G1	10	
Генератор G2	20	
Трансформатор T1	10	10
Трансформатор T2	20	20
Вод А-В	4	12
Вод В-С	20	60
Вод С-Д	20	60
Вод А-Д	4	12

е.к.в. во D; $I_{B-C}^{a,b,c} = ?$

$$\underline{U}_{(0)}^a = \frac{1,05}{\sqrt{3}}$$

Задача 11.а



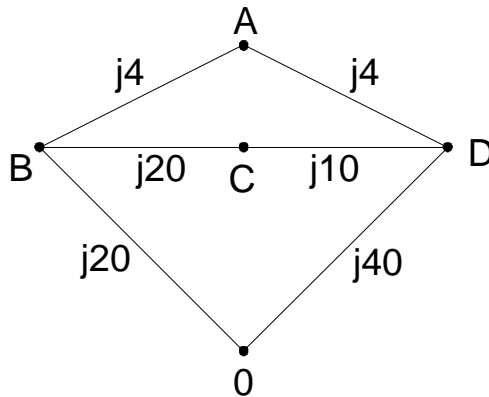
Податоци за елементите

Елемент	Реактанции (р.у.)	
	Директен редослед	Нулти редослед
Генератор G1	10	
Генератор G2	20	
Трансформатор T1	10	10
Трансформатор T2	20	20
Вод A-B	4	12
Вод B-C	20	60
Вод C-D	10	30
Вод A-D	4	12

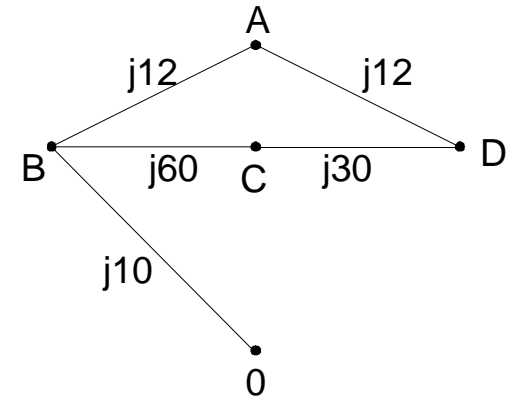
е.к.в. во D; $I_{B-C}^{a,b,c} = ?$

$$\underline{U}_{(0)}^a = \frac{1,05}{\sqrt{3}}$$

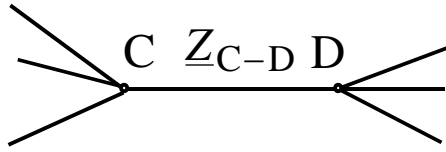
директен редослед



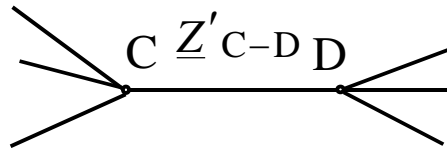
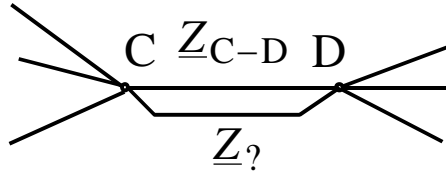
нулти редослед



Задача 11.а



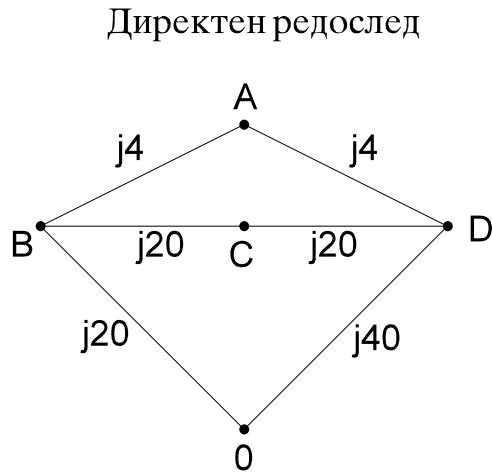
$$\frac{1}{\underline{Z}'_{C-D}} = \frac{1}{\underline{Z}_{C-D}} + \frac{1}{\underline{Z}_?} \Rightarrow \underline{Z}_? = \frac{\underline{Z}_{C-D} \cdot \underline{Z}'_{C-D}}{\underline{Z}_{C-D} - \underline{Z}'_{C-D}}$$



$$\underline{Z}_?^{(1)} = \frac{\underline{Z}_{C-D} \cdot \underline{Z}'_{C-D}}{\underline{Z}_{C-D} - \underline{Z}'_{C-D}} = j \frac{20 \cdot 10}{20 - 10} = j20$$

$$\underline{Z}_?^{(0)} = j \frac{60 \cdot 30}{60 - 30} = j60$$

Задача 11.а



$$\underline{Z}^{(1)} = j \begin{bmatrix} 14 & 12 & 13 & 13 \\ 12 & 16 & 14 & 14 \\ 13 & 14 & 23,5 & 13,5 \\ 13 & 14 & 13,5 & 15,5 \end{bmatrix} \begin{matrix} B \\ D \\ C \\ A \end{matrix}$$

спојница C–D ($j20$)

$$\underline{Z}_{\text{ПОМ.КОЛ.}} = j \begin{bmatrix} 1 \\ -2 \\ 9,5 \\ -0,5 \end{bmatrix} \begin{matrix} B \\ D \\ C \\ A \end{matrix}$$

$$\underline{I}_{-B-C(\text{е.к.в.})}^{0,1,2} = \left(\underline{Z}_{B-C}^{0,1,2} \right)^{-1} \cdot \left(\underline{Z}_{CD}^{0,1,2} - \underline{Z}_{BD}^{0,1,2} \right) \cdot \underline{I}_{-D(\text{е.к.в.})}^{0,1,2}$$

$$\underline{I}_{-D(\text{е.к.в.})}^{0,1,2} = \frac{\sqrt{3} \cdot \underline{U}_{D(0)}^a}{\underline{Z}_{DD}^{(0)} + \underline{Z}_{DD}^{(1)} + \underline{Z}_{DD}^{(2)} + 3 \cdot \underline{Z}_{\text{к.в.}}} \cdot \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}$$

$$\underline{Z}_{\text{ПОМ.}} = \underline{Z}_{\text{ПОМ.КОЛ.}}(C) - \underline{Z}_{\text{ПОМ.КОЛ.}}(D) + \underline{Z}_{C-D} = j9,5 - (-j2) + j20 = j31,5$$

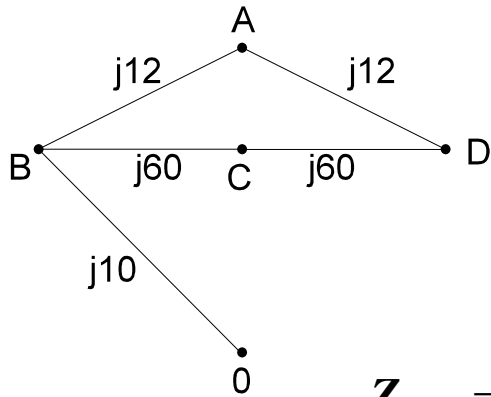
$$\underline{Z}_{DD}^{(1)} = \underline{Z}_{DD}^{(1)} - \frac{\underline{Z}_{\text{ПОМ.КОЛ.}}(D) \cdot \underline{Z}_{\text{ПОМ.КОЛ.}}(D)}{\underline{Z}_{\text{ПОМ.}}} = j16 - j \frac{(-2)^2}{31,5} = j15,87302$$

$$\underline{Z}_{BD}^{(1)} = \underline{Z}_{BD}^{(1)} - \frac{\underline{Z}_{\text{ПОМ.КОЛ.}}(B) \cdot \underline{Z}_{\text{ПОМ.КОЛ.}}(D)}{\underline{Z}_{\text{ПОМ.}}} = j12 - j \frac{1 \cdot (-2)}{31,5} = j12,06349$$

$$\underline{Z}_{CD}^{(1)} = \underline{Z}_{CD}^{(1)} - \frac{\underline{Z}_{\text{ПОМ.КОЛ.}}(C) \cdot \underline{Z}_{\text{ПОМ.КОЛ.}}(D)}{\underline{Z}_{\text{ПОМ.}}} = j14 - j \frac{9,5 \cdot (-2)}{31,5} = j14,60317$$

Задача 11.а

Нулти редослед



spojnica C-D (j60)

$$\underline{Z}^{(0)} = j \begin{bmatrix} 10 & 10 & 10 & 10 \\ 10 & 45 & 20 & 15 \\ 10 & 20 & 30 & 20 \\ 10 & 15 & 20 & 21 \end{bmatrix} \begin{matrix} B \\ D \\ C \\ A \end{matrix}$$

$$\underline{Z}_{\text{pomkol}} = j \begin{bmatrix} 0 \\ -25 \\ 10 \\ 5 \end{bmatrix} \begin{matrix} B \\ D \\ C \\ A \end{matrix}$$

$$\underline{Z}_{\text{пом.}} = \underline{Z}_{\text{пом.кол.}}(C) - \underline{Z}_{\text{пом.кол.}}(D) + \underline{Z}_{C-D} = j10 - (-j25) + j60 = j95$$

$$\underline{Z}_{DD}^{(0)} = \underline{Z}_{DD}^{(0)} - \frac{\underline{Z}_{\text{пом.кол.}}(D) \cdot \underline{Z}_{\text{пом.кол.}}(D)}{\underline{Z}_{\text{пом.кол.}}} = j45 - j \frac{(-25)^2}{95} = j38,42105$$

$$\underline{Z}_{BD}^{(0)} = \underline{Z}_{BD}^{(0)} - \frac{\underline{Z}_{\text{пом.кол.}}(B) \cdot \underline{Z}_{\text{пом.кол.}}(D)}{\underline{Z}_{\text{пом.кол.}}} = j10 - j \frac{0 \cdot (-25)}{95} = j10$$

$$\underline{Z}_{CD}^{(0)} = \underline{Z}_{CD}^{(0)} - \frac{\underline{Z}_{\text{пом.кол.}}(C) \cdot \underline{Z}_{\text{пом.кол.}}(D)}{\underline{Z}_{\text{пом.кол.}}} = j20 - j \frac{10 \cdot (-25)}{95} = j22,63158$$

Задача 11.а

$$\underline{I}_{D(e.k.B.)}^{0,1,2} = \frac{\sqrt{3} \cdot \underline{U}_{D(0)}^a}{\underline{Z}_{DD}^{(0)} + \underline{Z}_{DD}^{(1)} + \underline{Z}_{DD}^{(2)} + 3\underline{Z}_{k.B.}} \cdot \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix} = \frac{1,05}{j \cdot (38,42105 + 2 \cdot 15,87302)} \cdot \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}$$

$$\underline{I}_{D(e.k.B.)}^{0,1,2} = -j0,0173 \cdot \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix} \quad \underline{I}_{D(e.k.B.)}^{a,b,c} = \underline{T} \cdot \underline{I}_{D(e.k.B.)}^{0,1,2} = -j0,029965 \cdot \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}$$

$$\underline{I}_{B-C(e.k.B.)}^{0,1,2} = \left(\underline{Z}_{B-C}^{0,1,2} \right)^{-1} \cdot \left(\underline{Z}_{CD}^{0,1,2} - \underline{Z}_{BD}^{0,1,2} \right) \cdot \underline{I}_{D(e.k.B.)}^{0,1,2}$$

$$\underline{I}_{B-C}^{0,1,2} = \begin{bmatrix} \frac{\underline{Z}_{CD}^{(0)} - \underline{Z}_{BD}^{(0)}}{\underline{Z}_{B-C}^{(0)}} & 0 & 0 \\ 0 & \frac{\underline{Z}_{CD}^{(1)} - \underline{Z}_{BD}^{(1)}}{\underline{Z}_{B-C}^{(1)}} & 0 \\ 0 & 0 & \frac{\underline{Z}_{CD}^{(2)} - \underline{Z}_{BD}^{(2)}}{\underline{Z}_{B-C}^{(2)}} \end{bmatrix} \cdot (-j0,0173) \cdot \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix} = - \begin{bmatrix} 3,642119 \\ 2,196833 \\ 2,196833 \end{bmatrix} \cdot 10^{-3}$$

$$\underline{I}_{B-C}^{a,b,c} = \underline{T} \cdot \underline{I}_{B-C}^{0,1,2} = - \begin{bmatrix} 4,639465 \\ 0,8344369 \\ 0,8344369 \end{bmatrix} \cdot 10^{-3}$$