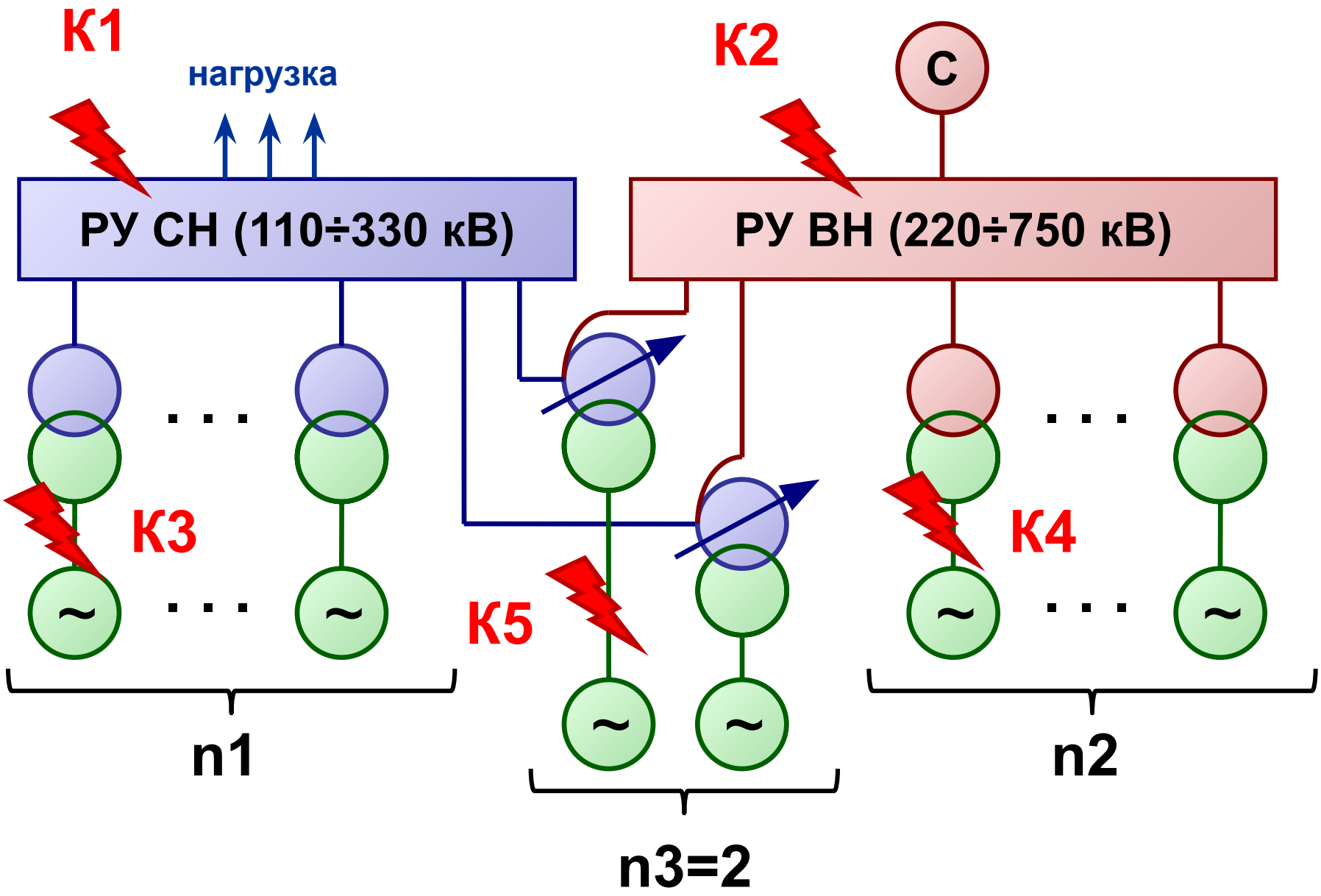
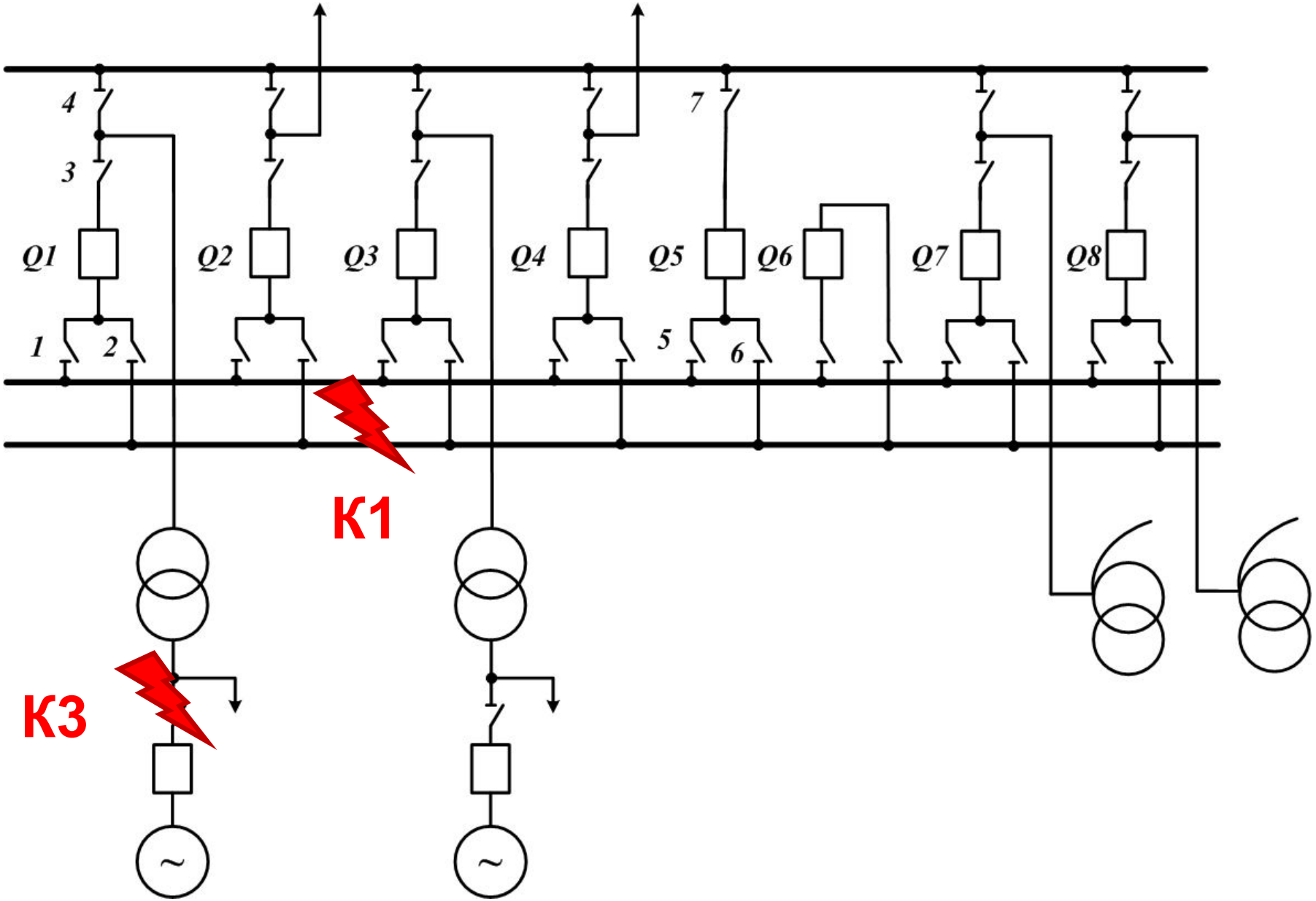

К1
нагрузка
К2
С
РУ СН (110÷330 кВ)
РУ ВН (220÷750 кВ)
К3
К4
К5
n1
n2
n3=2


4
3
7
Q1
Q2
Q3
Q4
Q5
Q6
Q7
Q8
1
2
5
6
К1
К3
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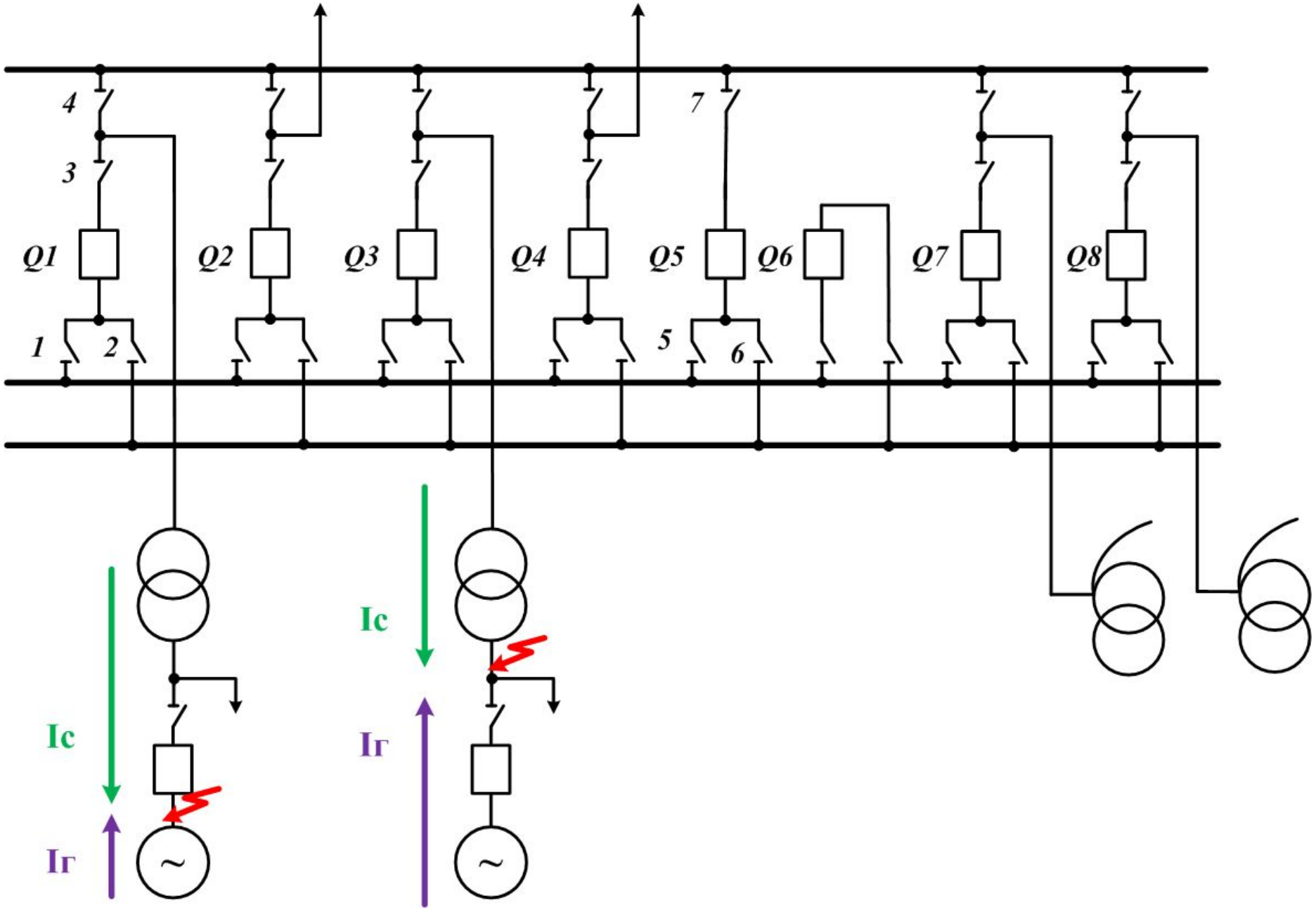
~


4
3
7
Q1
Q2
Q3
Q4
Q5
Q6
Q7
Q8
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2
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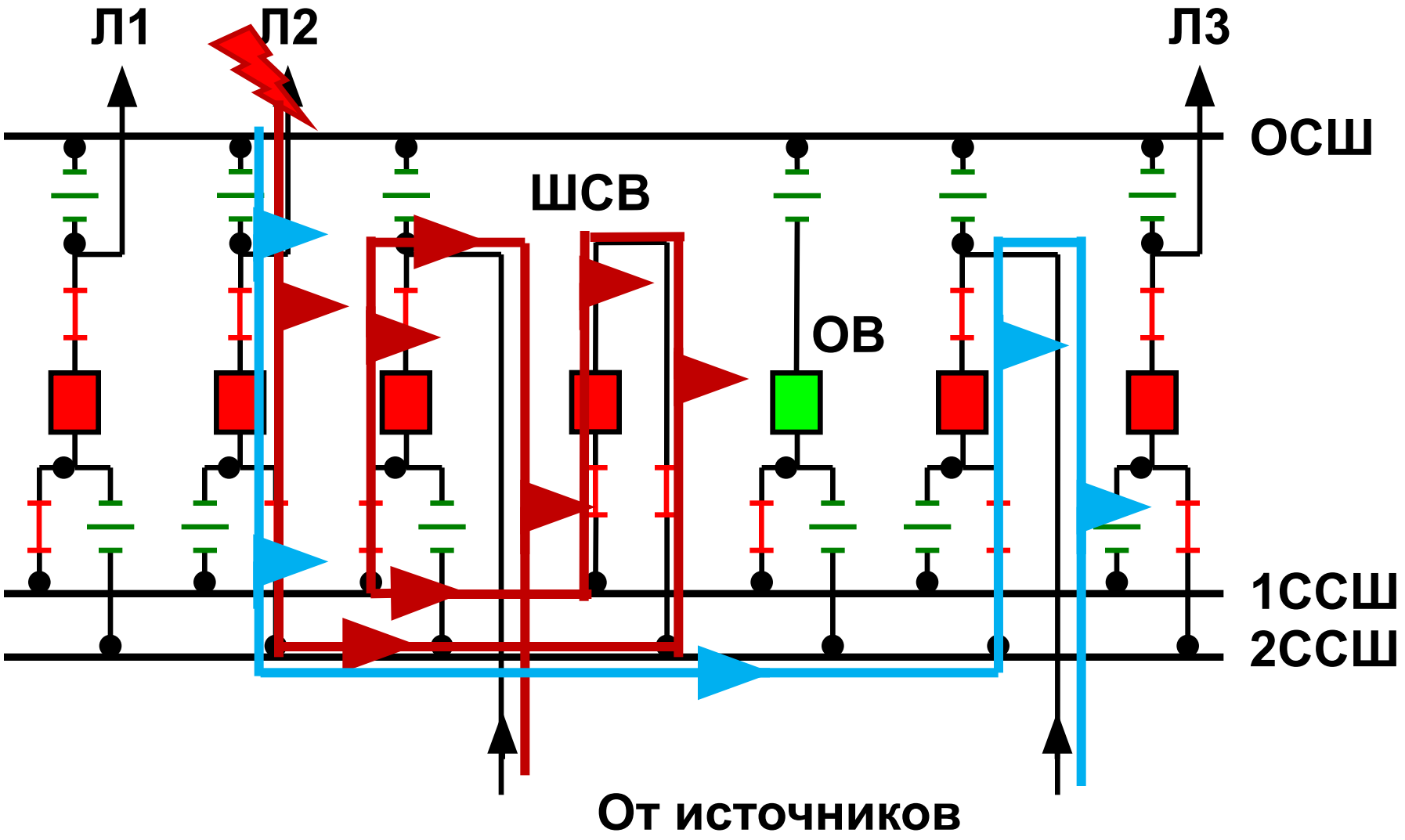
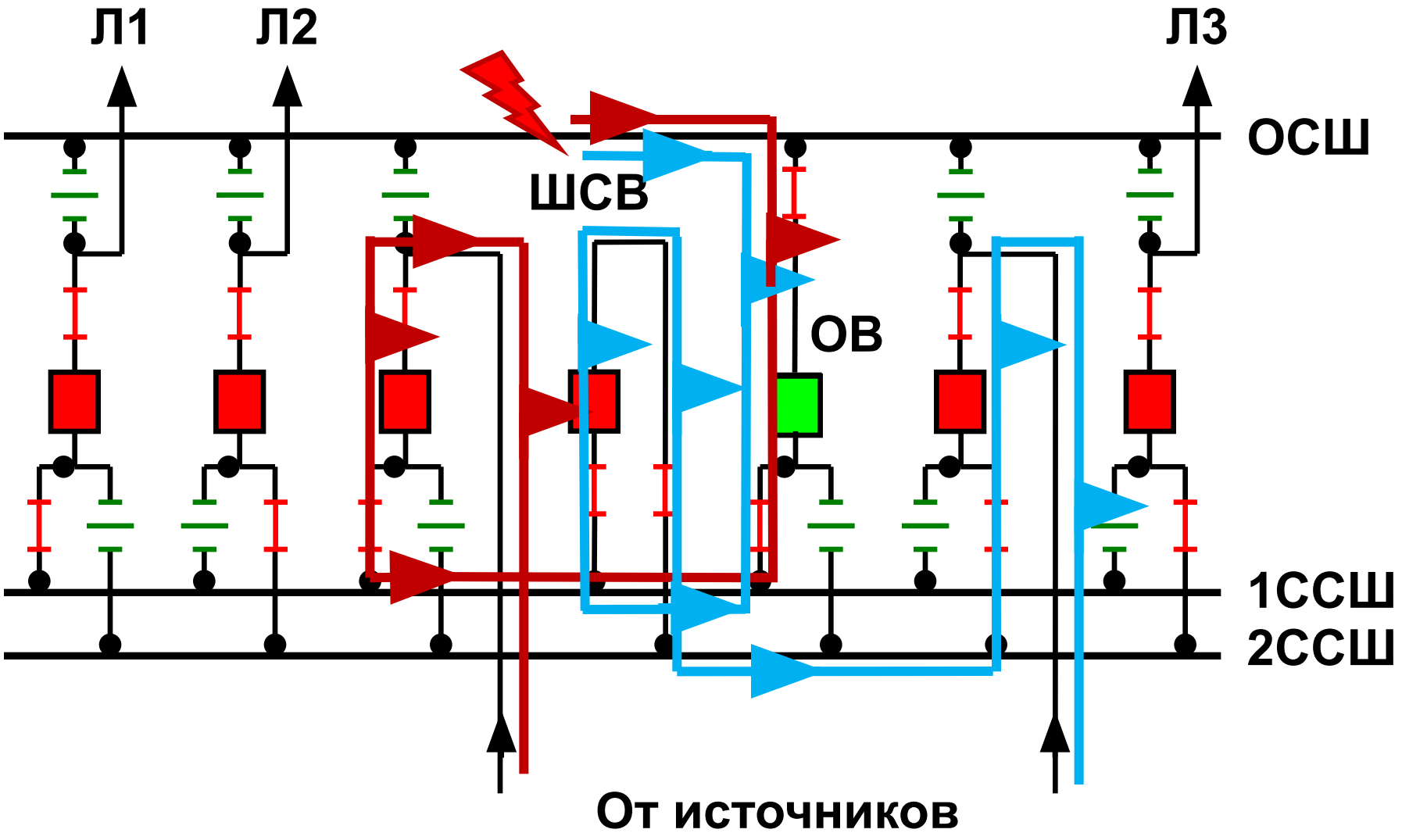
Iг
Iс
Iг

Обоснование выбора выключателя в РУ 35 кВ и выше по суммарному току КЗ



Обоснование выбора выключателя в РУ 35 кВ и выше по суммарному току КЗ



Трансформатор с расщеплённой обмоткой НН

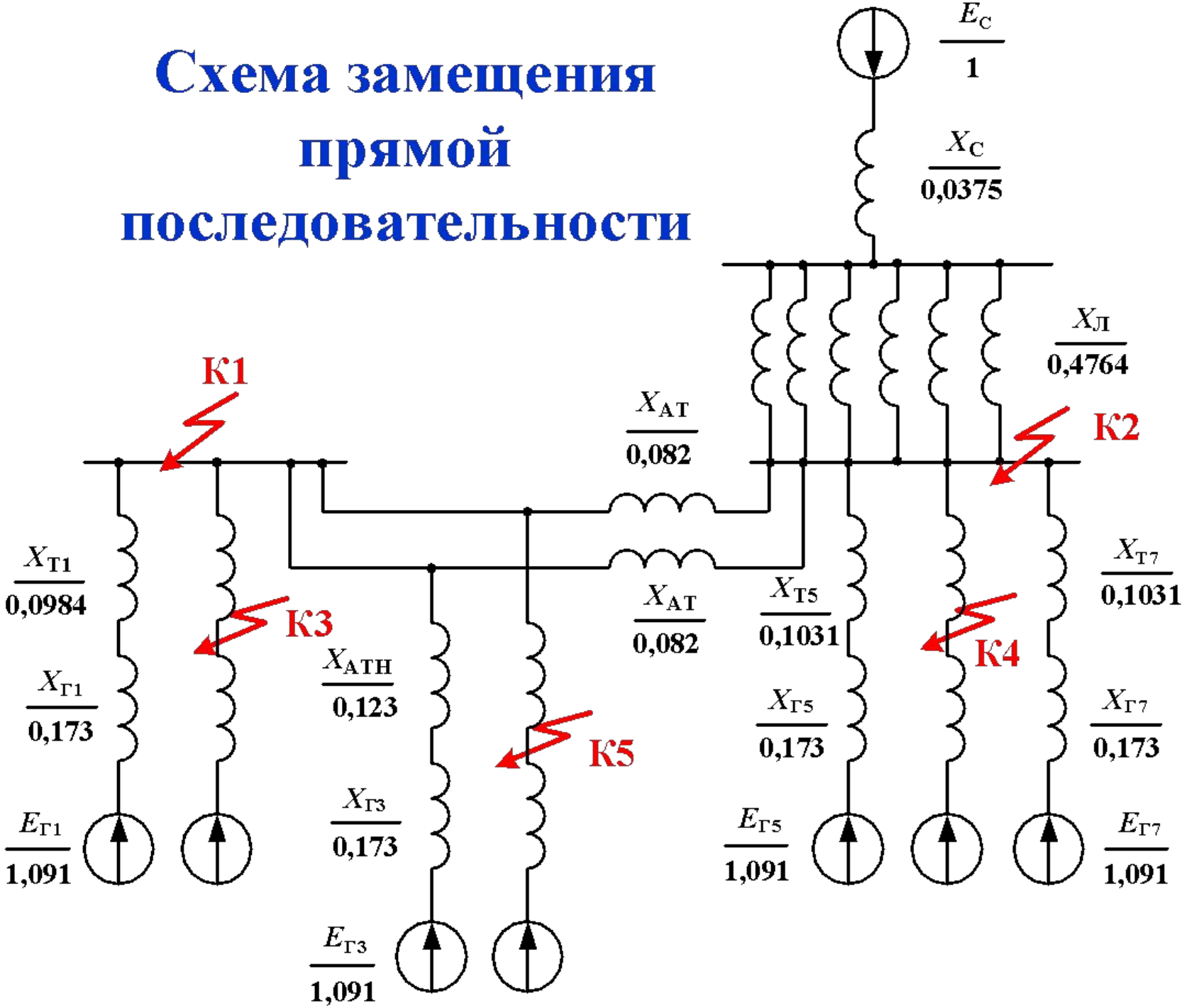
$$k_p = \frac{U_{КН-Н}}{U_{КВ-Н||Н}}$$

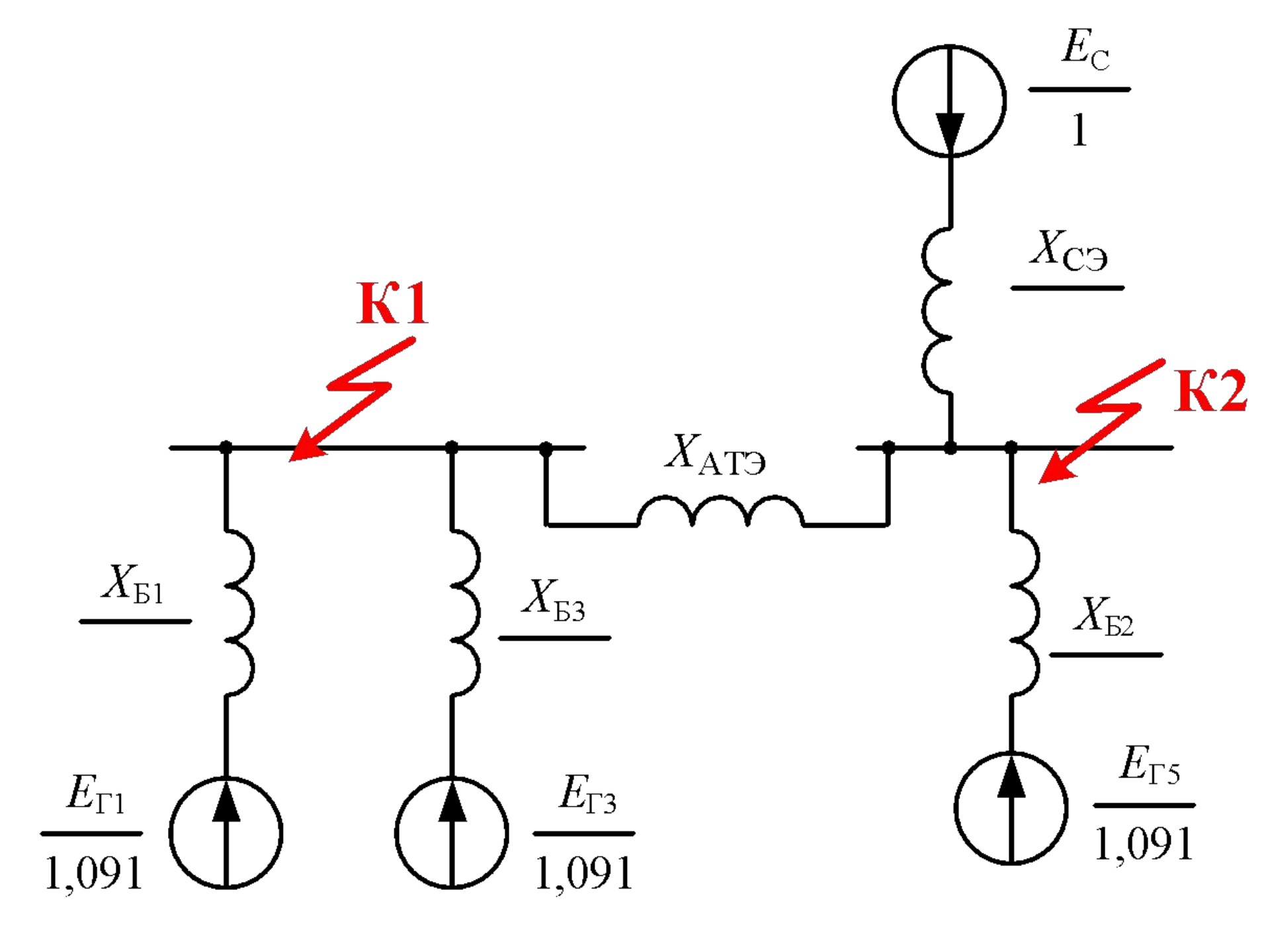
$$x_T = \frac{U_{КВ-Н||Н} \cdot U^2}{100 \cdot S_{НОМ}}$$

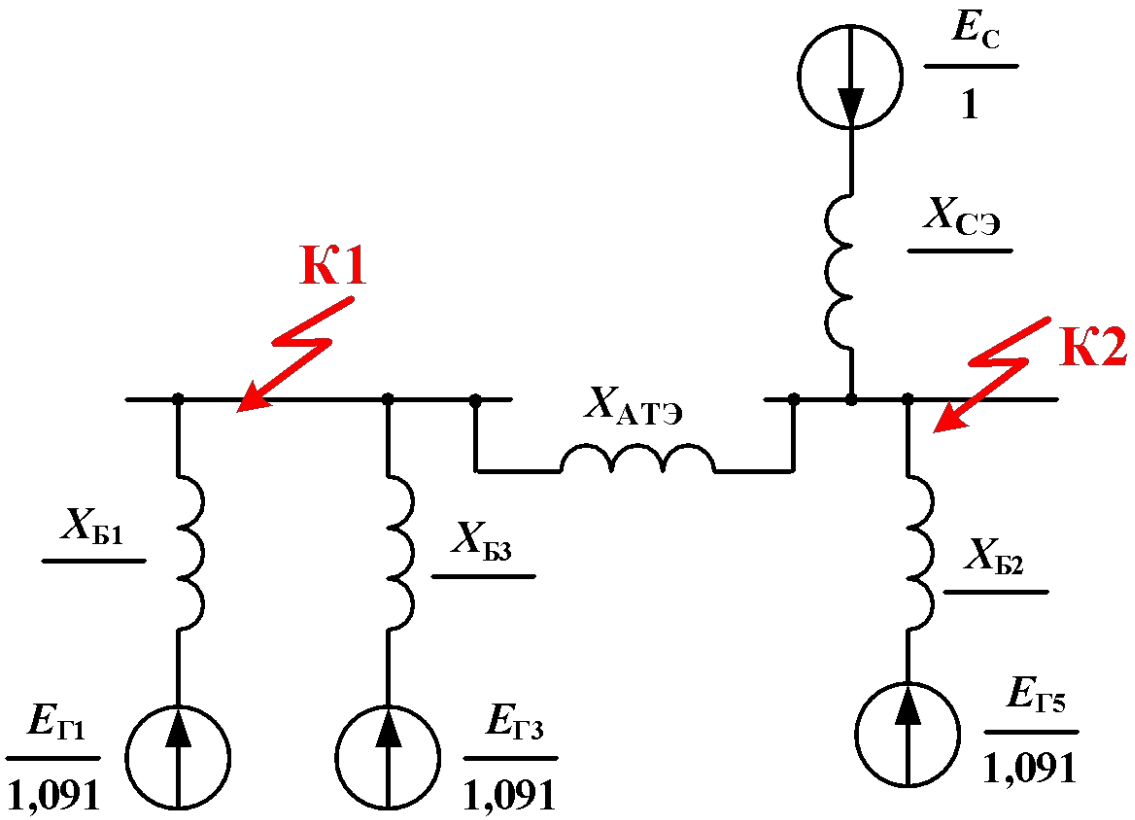
$$x_B = x_T \left(1 - \frac{k_P}{4}\right)$$

$$x_{Н1} = x_{Н2} = \frac{x_T k_P}{2}$$

Схема замещения прямой последовательности




$E_С$
1
$X_{СЭ}$
К1
К2
$X_{АТЭ}$
$X_{Б1}$
$X_{Б3}$
$X_{Б2}$
$E_{Г1}$
1,091
$E_{Г3}$
1,091
$E_{Г5}$
1,091



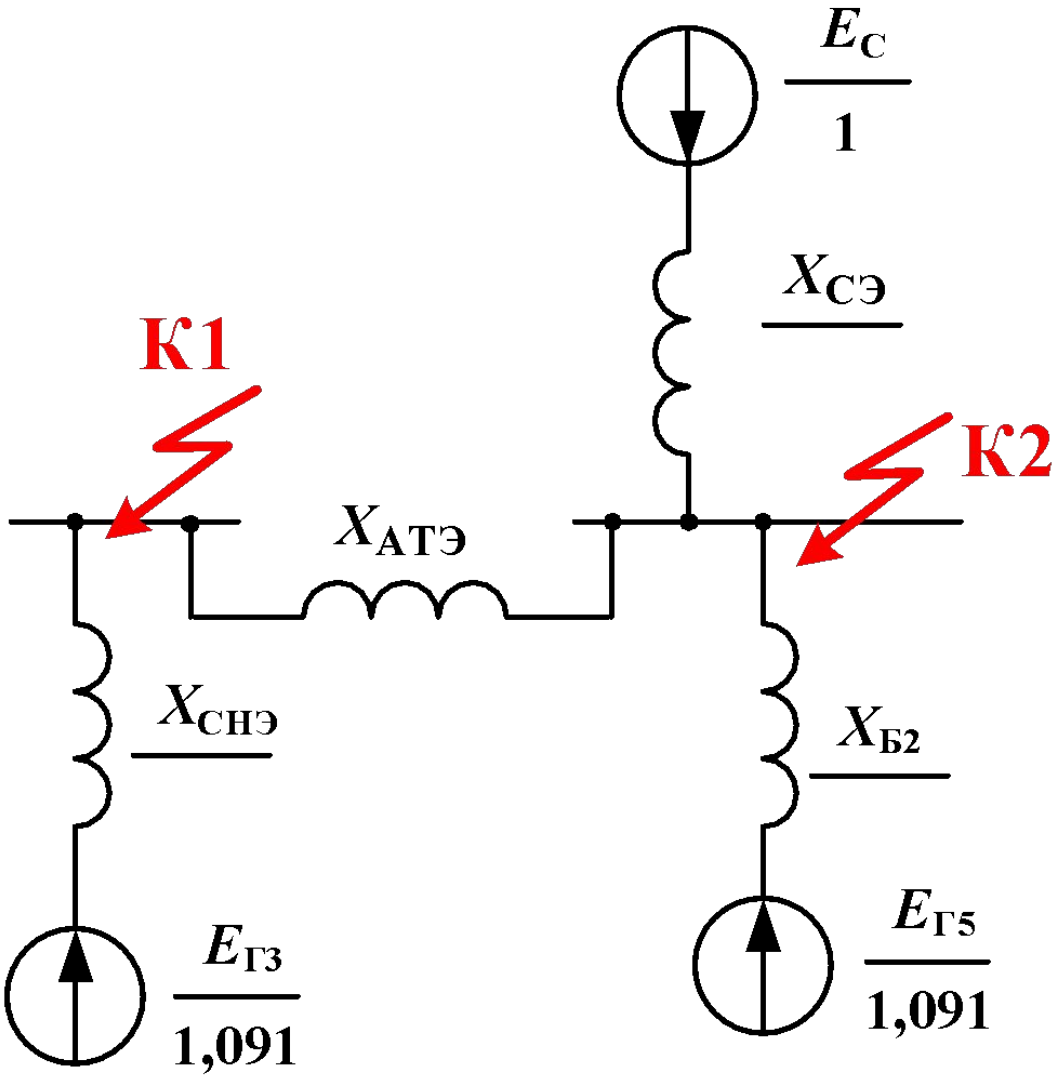
$$X_{С\,Э} = X_С + \frac{X_Л}{N_Л}$$

$$X_{Б1} = \frac{X_{Г1} + X_{Т1}}{n1}$$

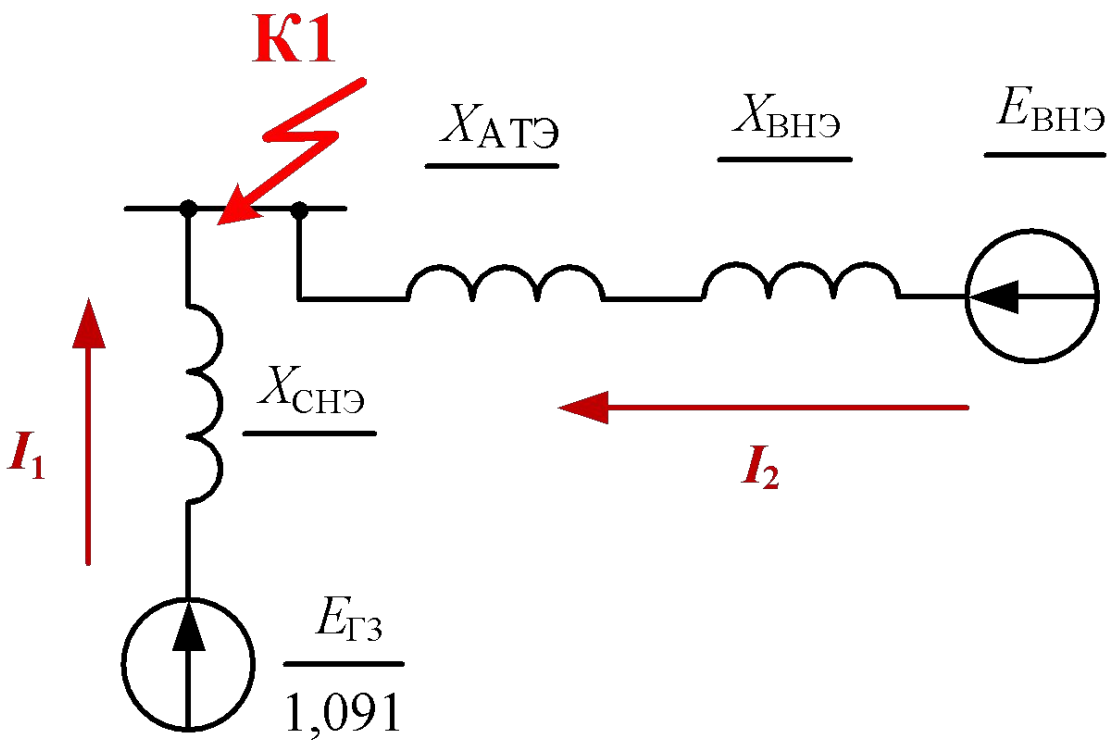
$$X_{Б2} = \frac{X_{Г5} + X_{Т5}}{n2}$$

$$X_{АТЭ} = \frac{X_{АТВ}}{2}$$

$$X_{Б3} = \frac{X_{Г3} + X_{АТН}}{n3}$$

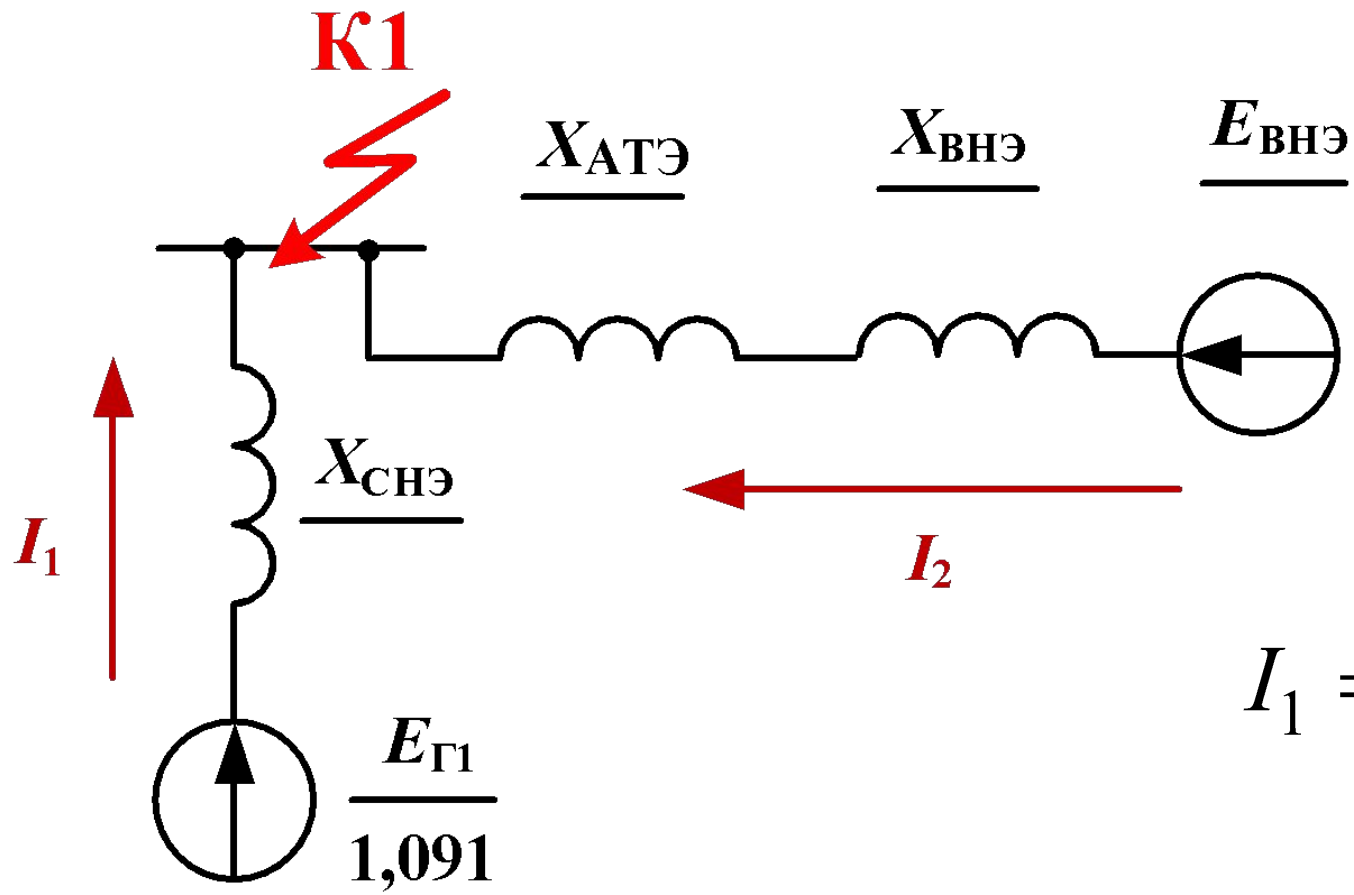


$$X_{СНЭ} = X_{Б1} // X_{Б3} = \frac{X_{Б1} \cdot X_{Б3}}{X_{Б1} + X_{Б3}}$$



$$X_{ВНЭ} = X_{Б2} // X_{СЭ} = \frac{X_{Б2} \cdot X_{СЭ}}{X_{Б2} + X_{СЭ}}$$

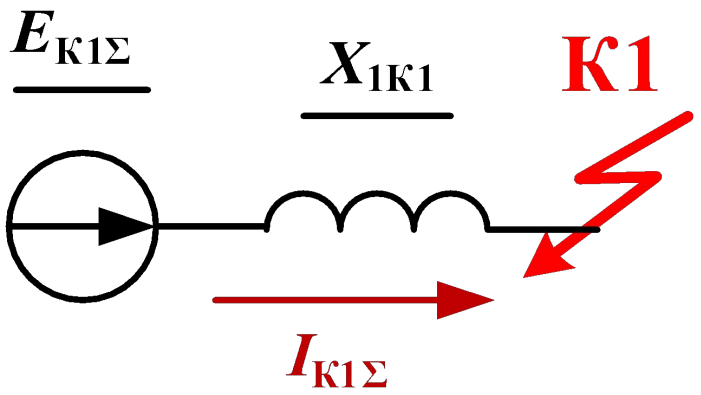
$$E_{ВНЭ} = \frac{E_C \cdot X_{Б2} + E_{Б2} \cdot X_{СЭ}}{X_{Б2} + X_{СЭ}}$$



$$I_1 = \frac{E_{Г1}}{X_{СНЭ}} \cdot I_{БСН}$$

$$I_2 = \frac{E_{ВНЭ}}{X_{ВНЭ} + X_{АТЭ}} \cdot I_{БСН}$$

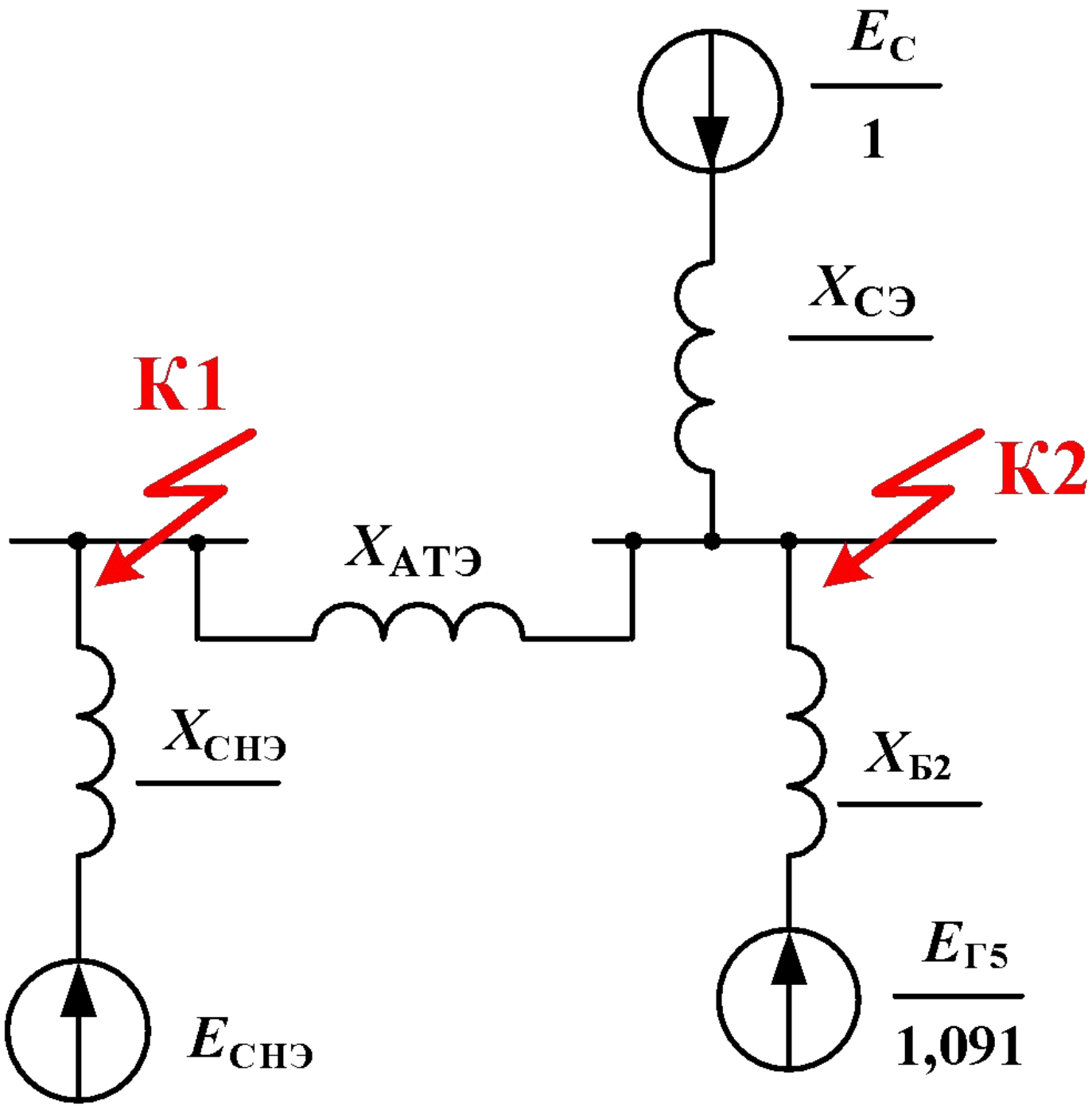
$$I_{К1\Sigma}^{(3)} = I_1 + I_2$$

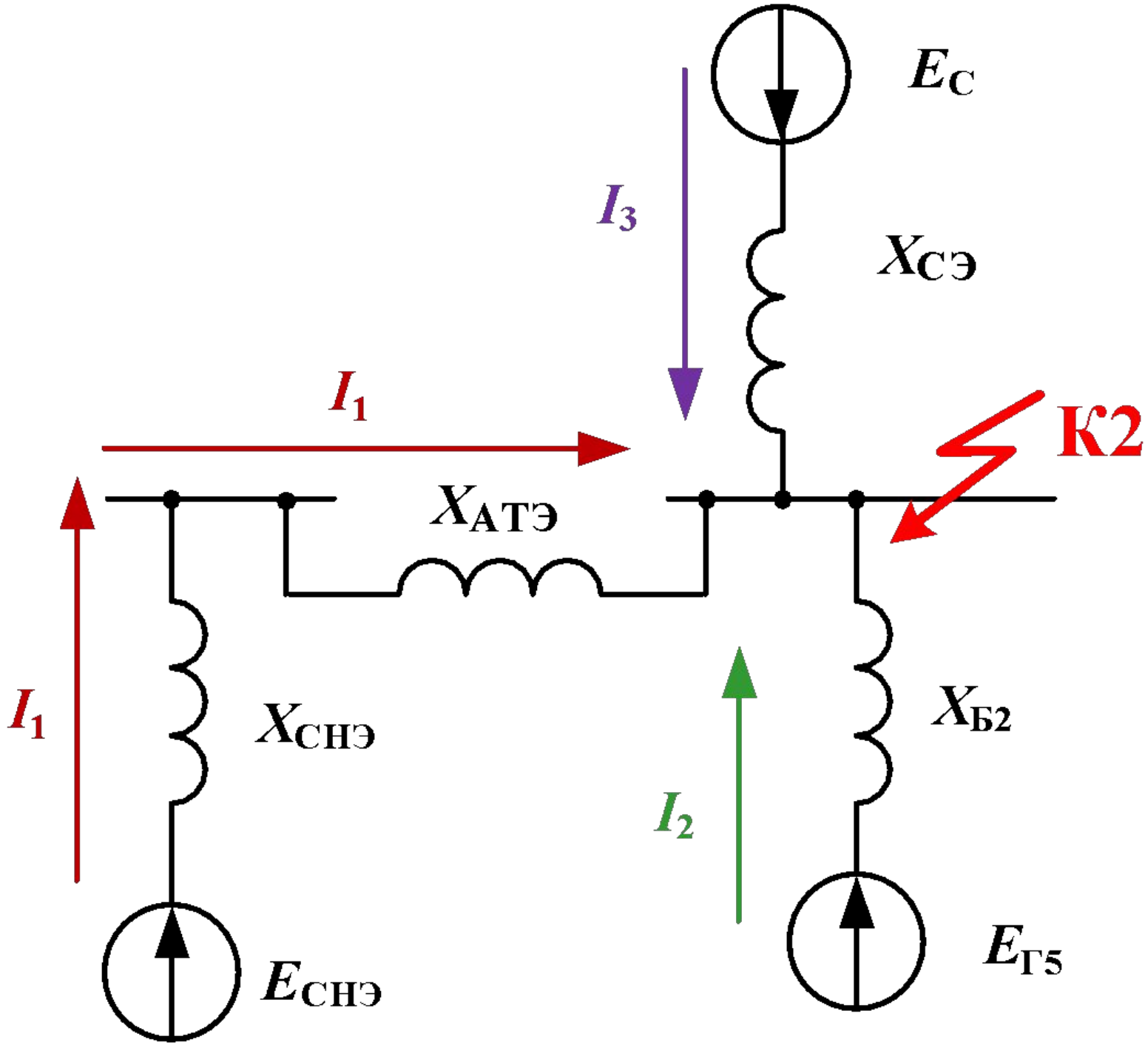


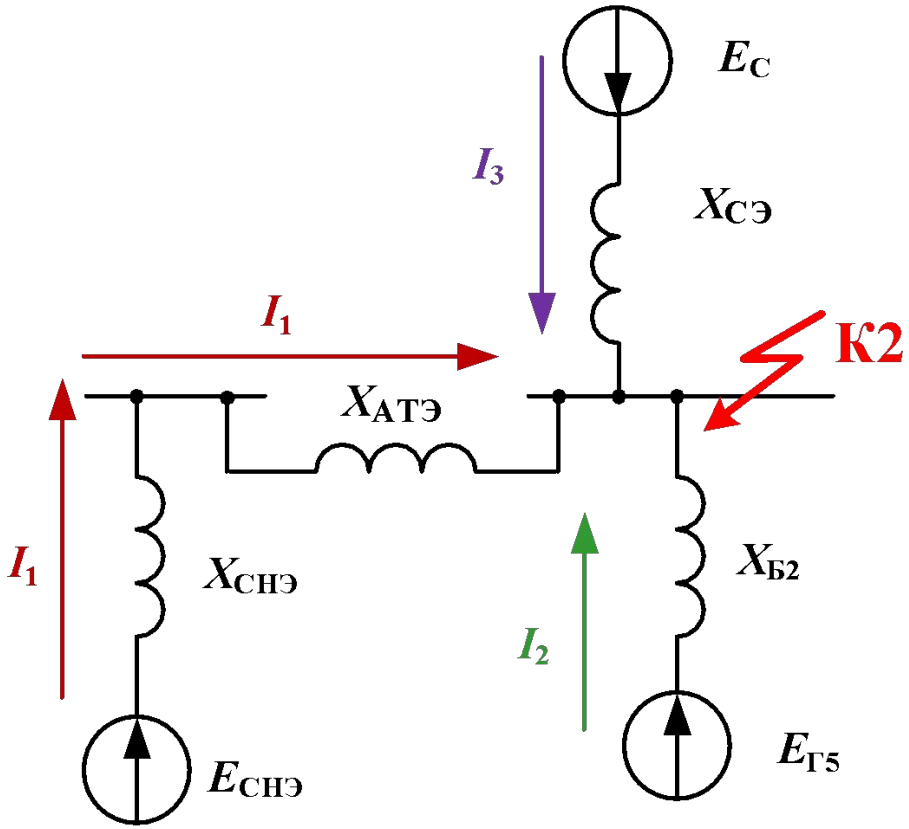
$$X_{1К1} = X_{СНЭ} // \left(X_{АТЭ} + X_{ВНЭ} \right) =$$

$$= \frac{X_{СНЭ} \cdot \left(X_{АТЭ} + X_{ВНЭ} \right)}{X_{СНЭ} + X_{АТЭ} + X_{ВНЭ}}$$

$$E_{К1\Sigma} = \frac{E_{СНЭ} \cdot \left(X_{АТЭ} + X_{ВНЭ} \right) + E_{ВНЭ} \cdot X_{СНЭ}}{X_{АТЭ} + X_{ВНЭ} + X_{СНЭ}}$$


$E_С$
1
$X_{СЭ}$
К1
К2
$X_{АТЭ}$
$X_{СНЭ}$
$X_{Б2}$
$E_{СНЭ}$
$E_{Г5}$
1,091


$E_С$
I_3
$X_{СЭ}$
I_1
К2
$X_{АТЭ}$
I_1
$X_{СНЭ}$
I_2
$X_{Б2}$
$E_{СНЭ}$
$E_{Г5}$



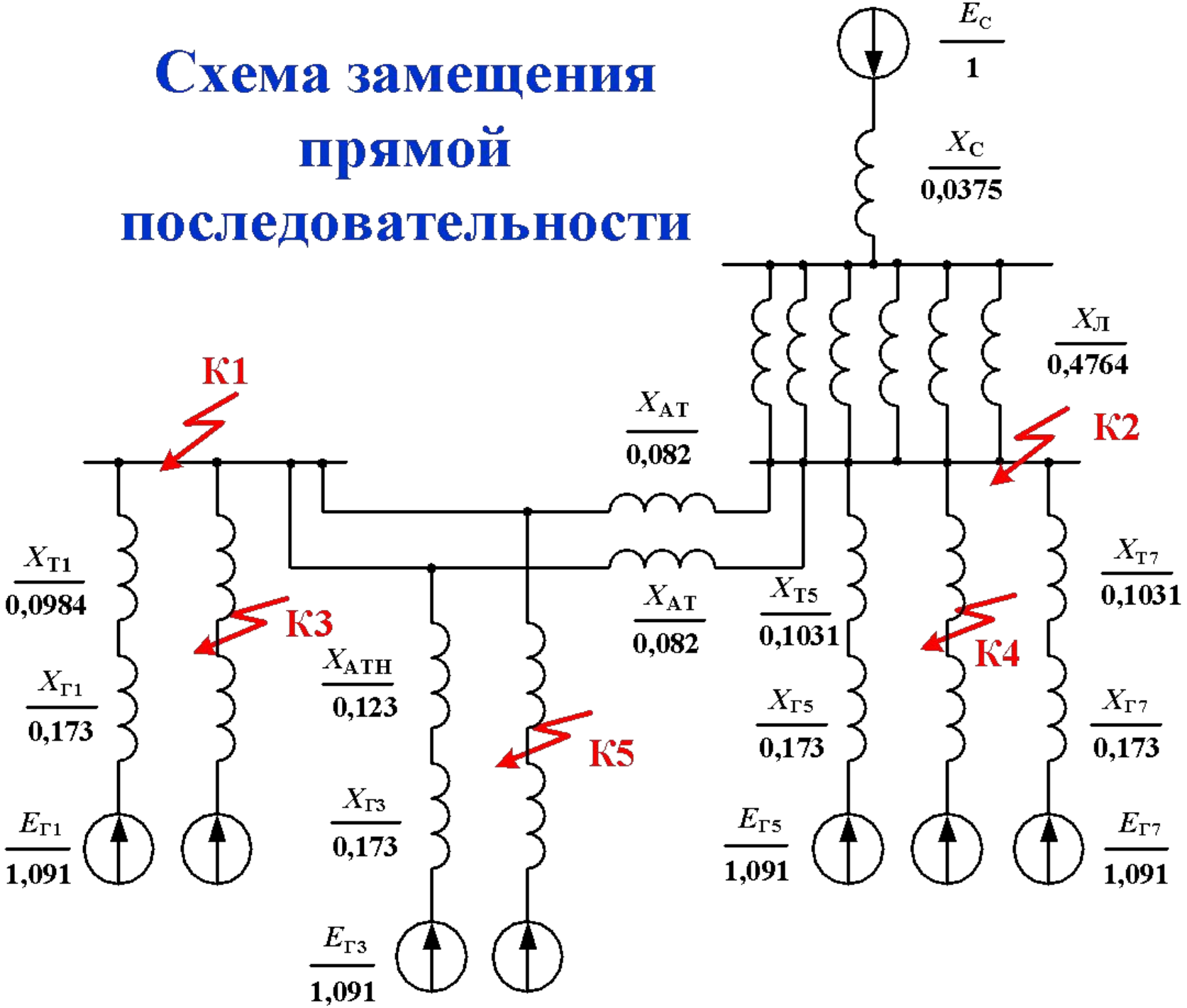
$$I_1 = \frac{E_{СНЭ}}{X_{СНЭ} + X_{АТЭ}} \cdot I_{БВН}$$

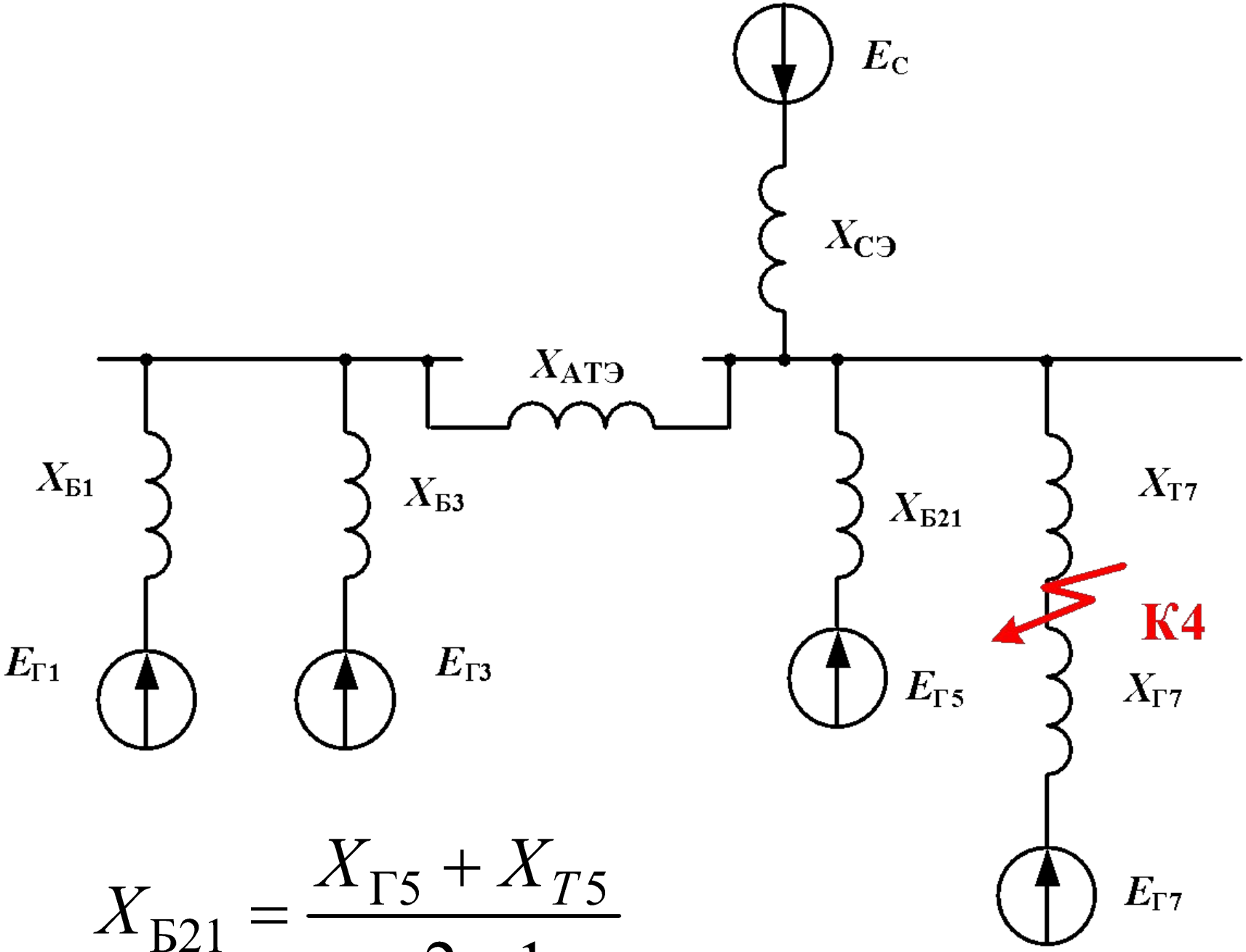
$$I_2 = \frac{E_{Г5}}{X_{Б2}} \cdot I_{БВН}$$

$$I_3 = \frac{E_C}{X_{СЭ}} \cdot I_{БВН}$$

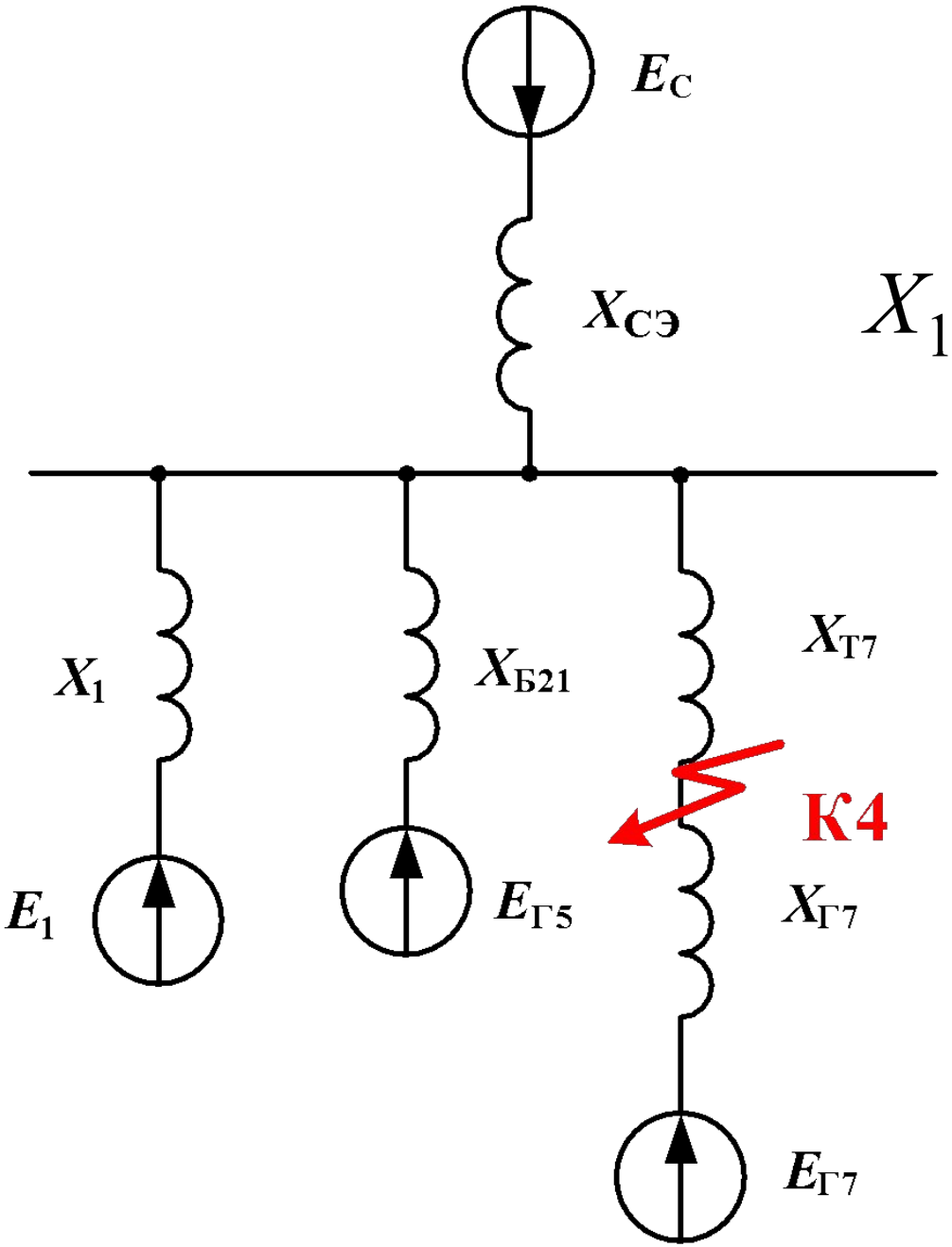
$$I^{(3)}_{К2\Sigma} = I_1 + I_2 + I_3$$

Схема замещения прямой последовательности

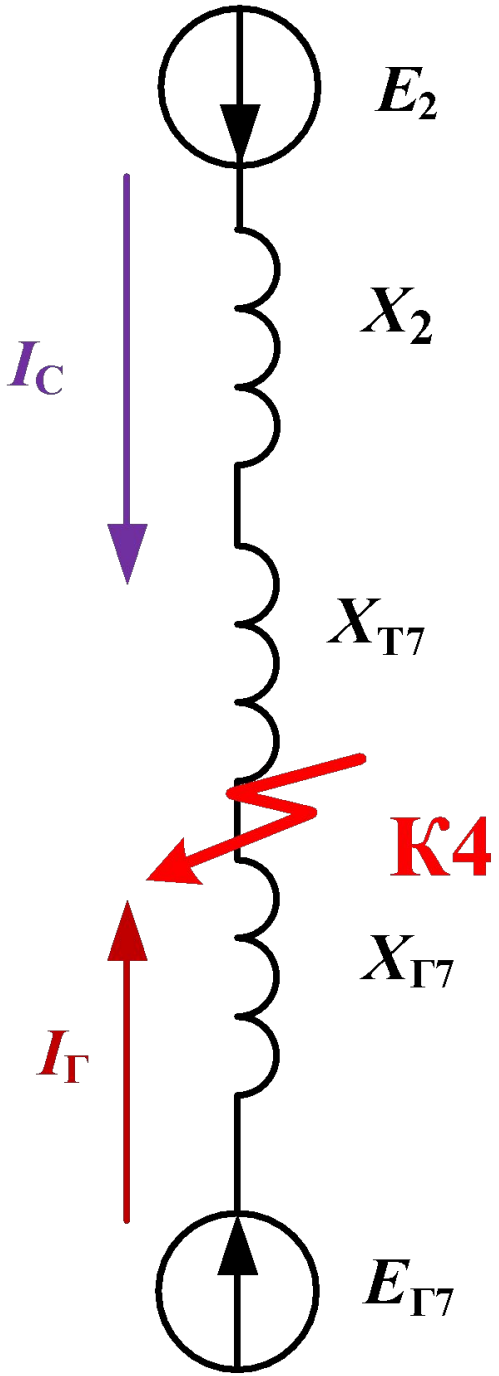




$$X_{Б21} = \frac{X_{Г5} + X_{Т5}}{n2 - 1}$$



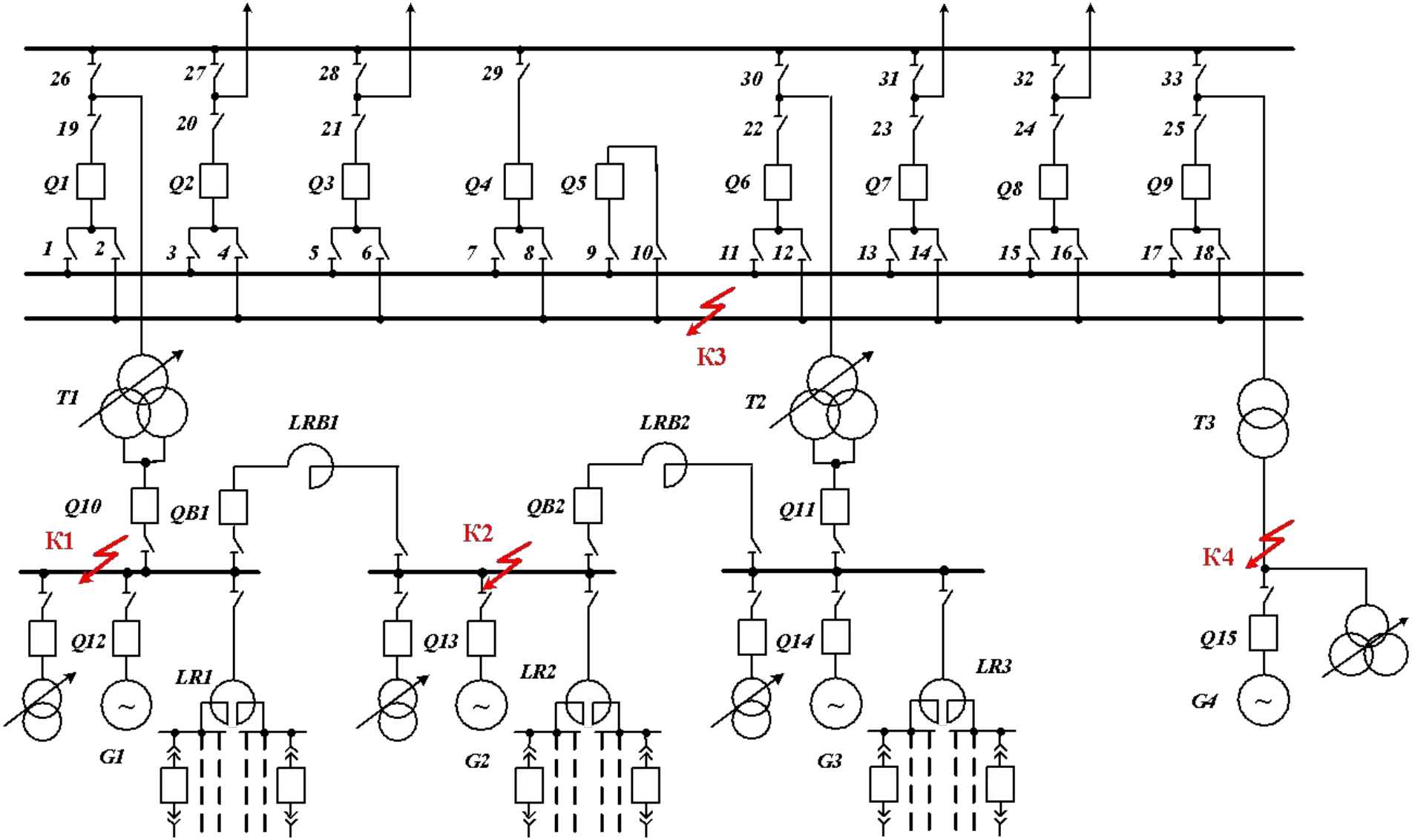
$$X_1 = X_{Б1} // X_{Б3} + X_{АТЭ}$$



$$X_2 = X_1 // X_{Б21} // X_{СЭ}$$

$$I_C = \frac{E_2}{X_2 + X_{Т7}} \cdot I_{БГ}$$

$$I_Г = \frac{E_{Г7}}{X_{Г7}} \cdot I_{БГ}$$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Q1
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Q5
Q6
Q7
Q8
Q9
1
2
3
4
5
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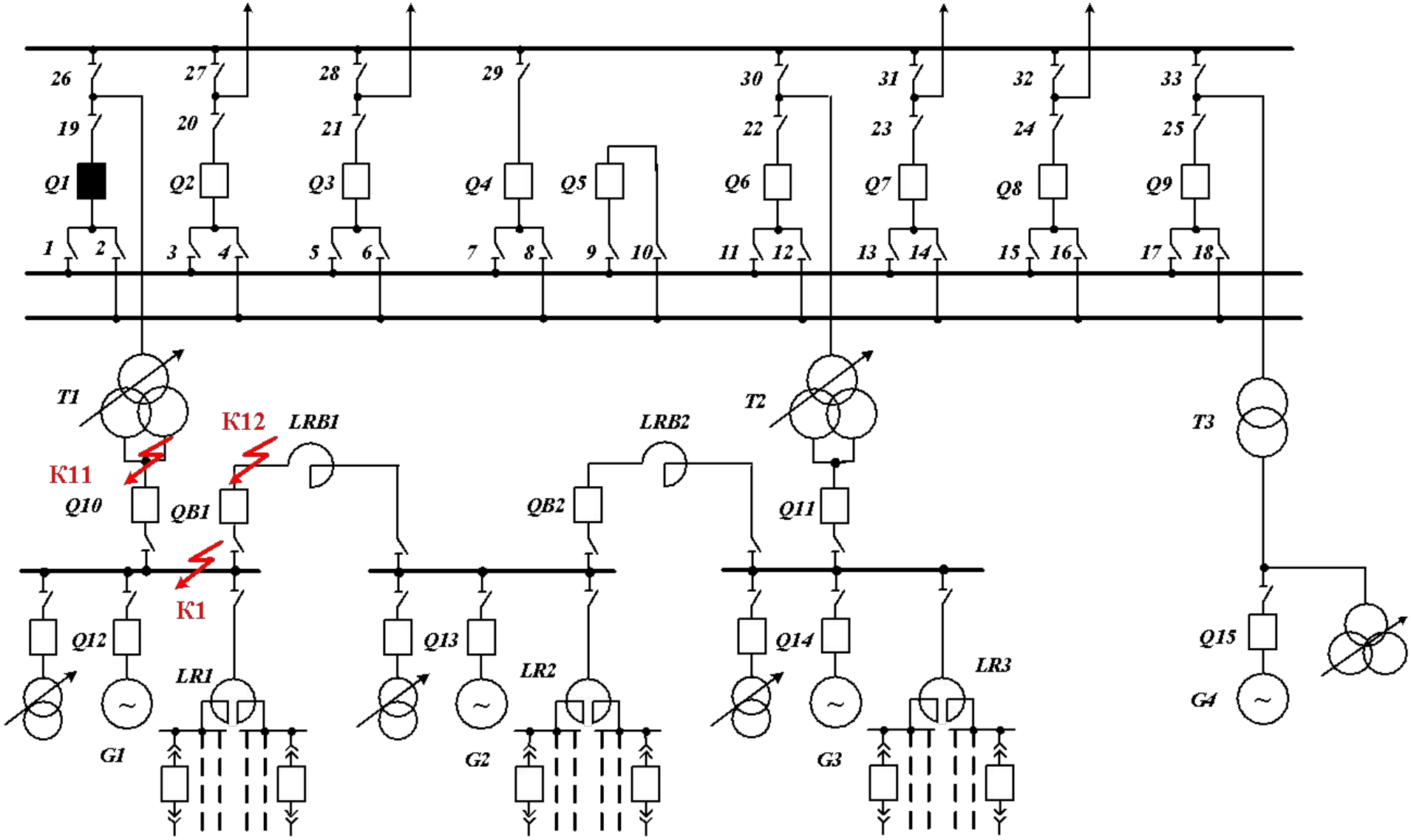
10
11
12
13
14
15
16
17
18
K3
T1
T2
T3
LRB1
LRB2
Q10
QB1
QB2
Q11
K1
K2
K4
Q12
Q13
Q14
Q15
LR1
LR2
LR3
G1
G2
G3
G4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Q6
Q7
Q8
Q9
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T1
T2
T3
K12
LRB1
LRB2
K11
Q10
QB1
QB2
Q11
K1
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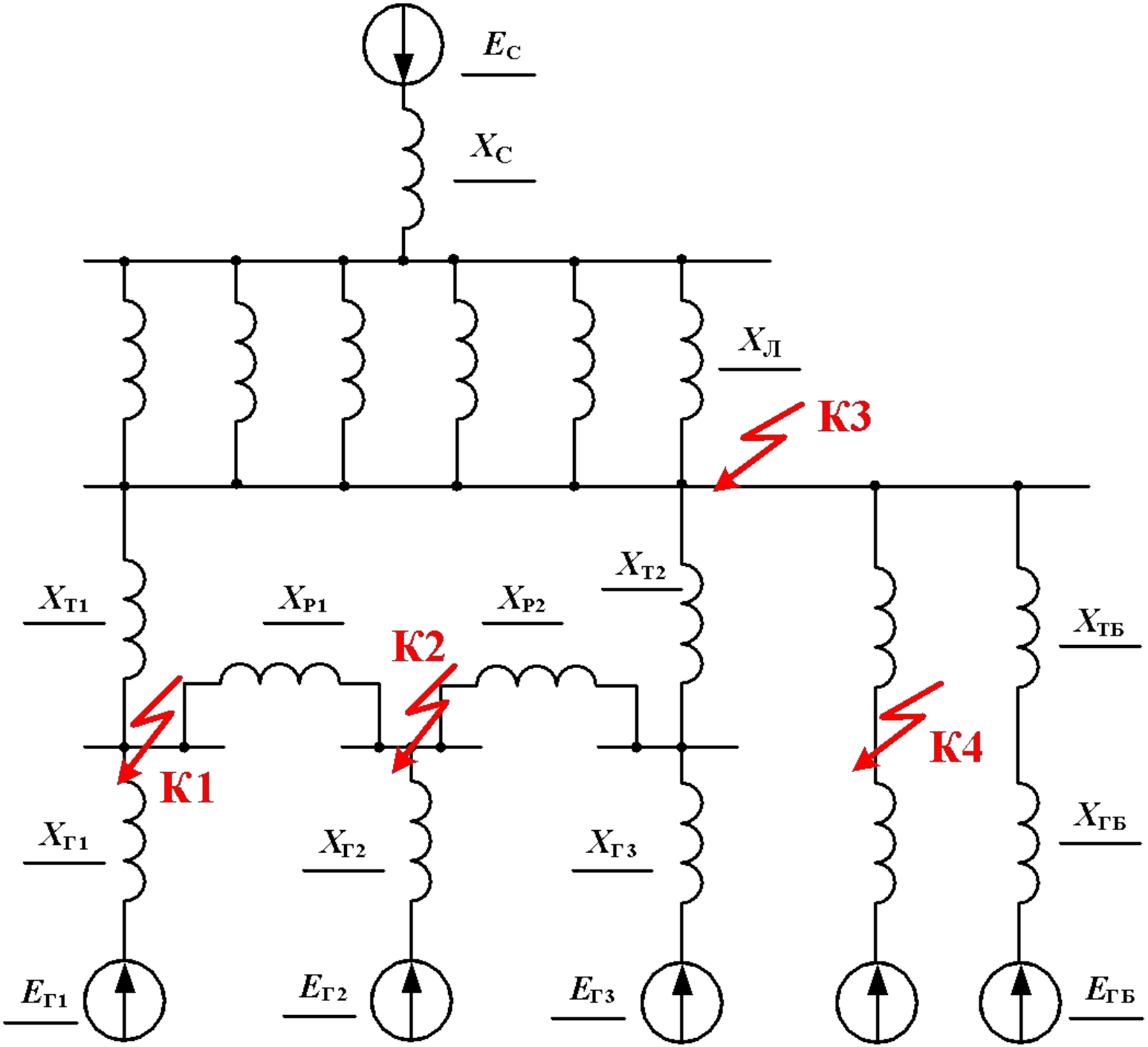
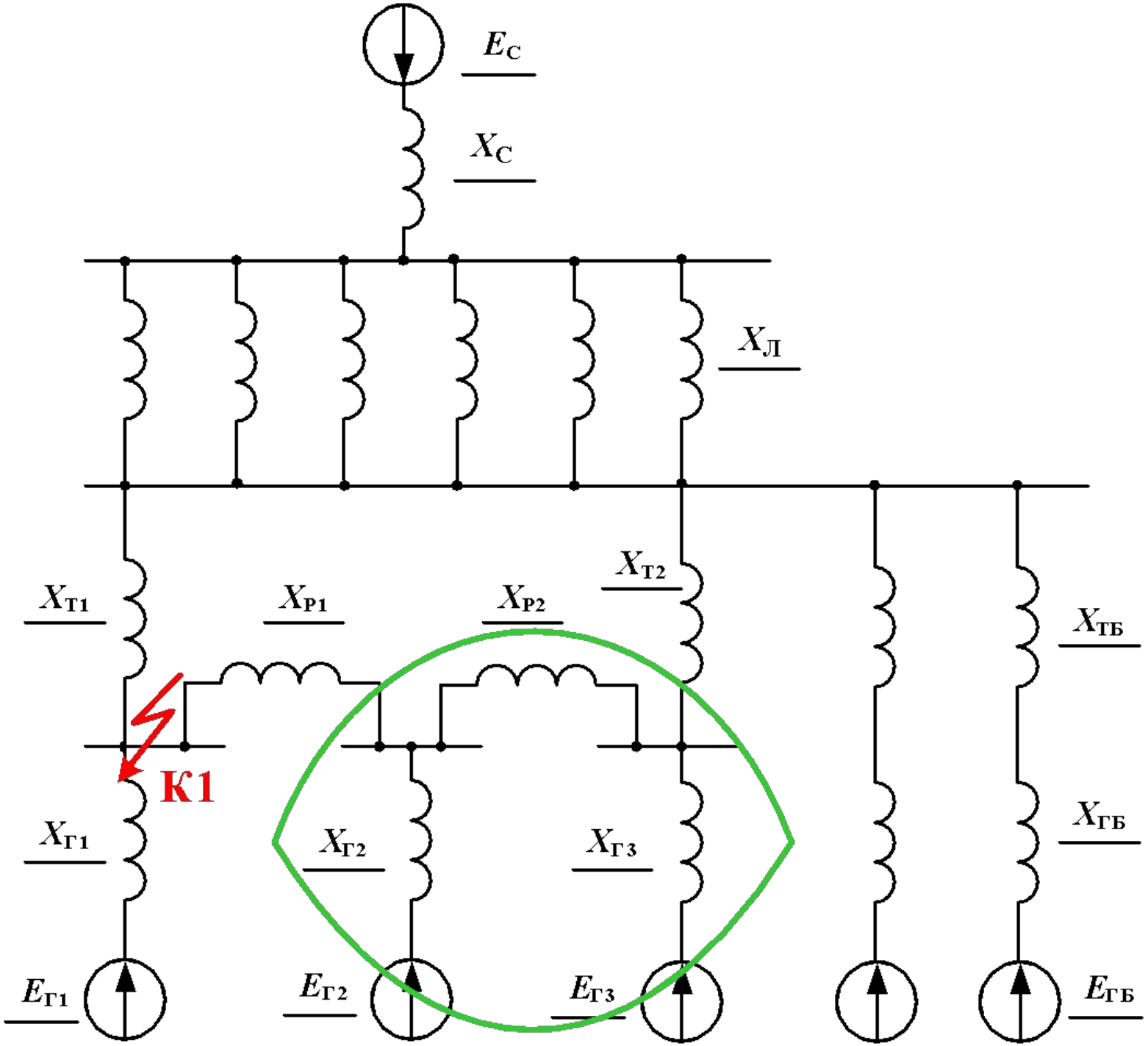
Q13
Q14
Q15
LR1
LR2
LR3
G1
G2
G3
G4


$E_С$
$X_С$
$X_Л$
К3
$X_{Т1}$
$X_{Р1}$
$X_{Р2}$
$X_{Т2}$
$X_{ТБ}$
К2
К1
К4
$X_{Г1}$
$X_{Г2}$
$X_{Г3}$
$X_{ГБ}$
$E_{Г1}$
$E_{Г2}$
$E_{Г3}$
$E_{ГБ}$


$E_С$
$X_С$
$X_Л$
$X_{Т1}$
$X_{Р1}$
$X_{Р2}$
$X_{Т2}$
$X_{ТБ}$
К1
$X_{Г1}$
$X_{Г2}$
$X_{Г3}$
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$E_{Г1}$
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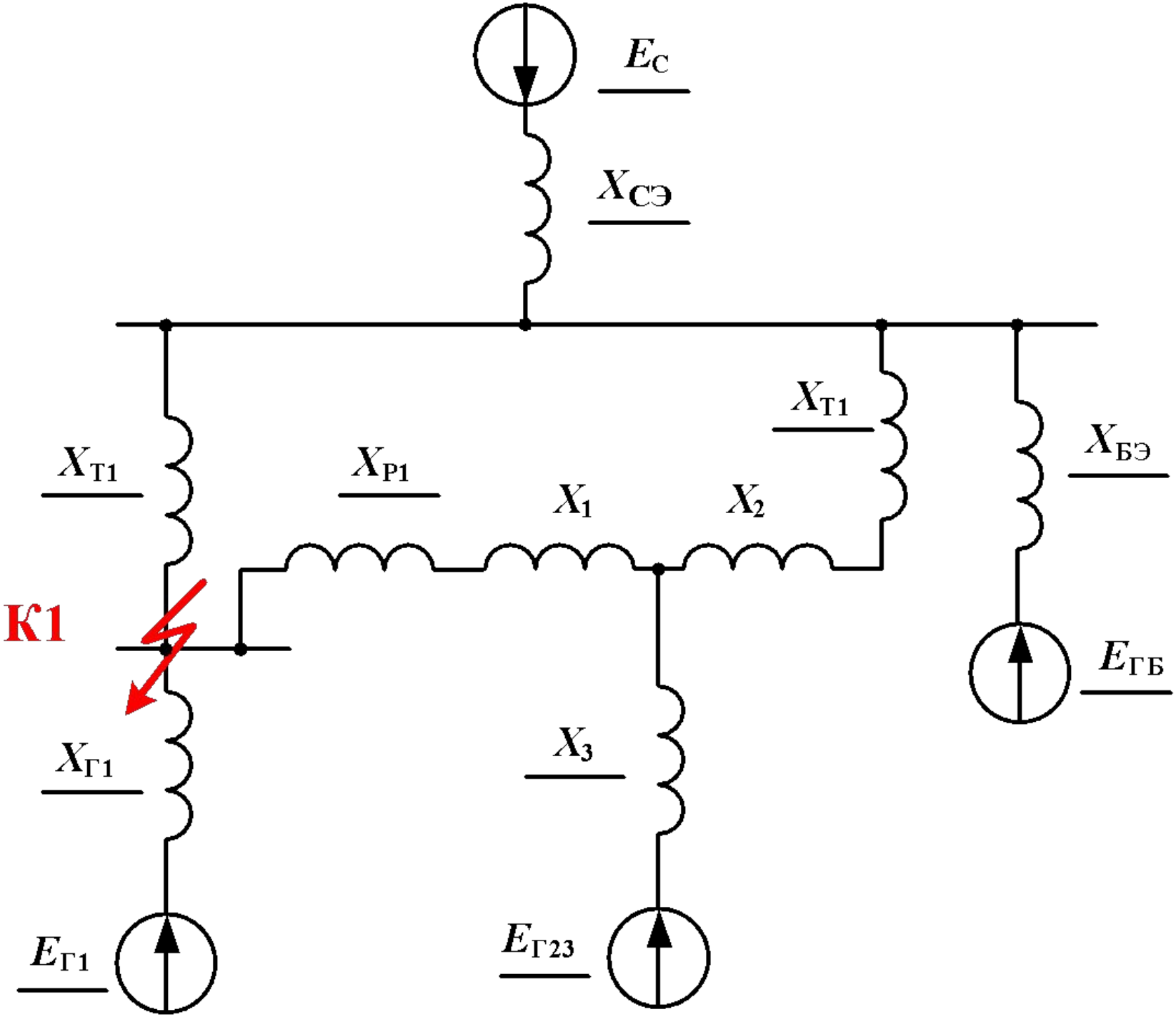
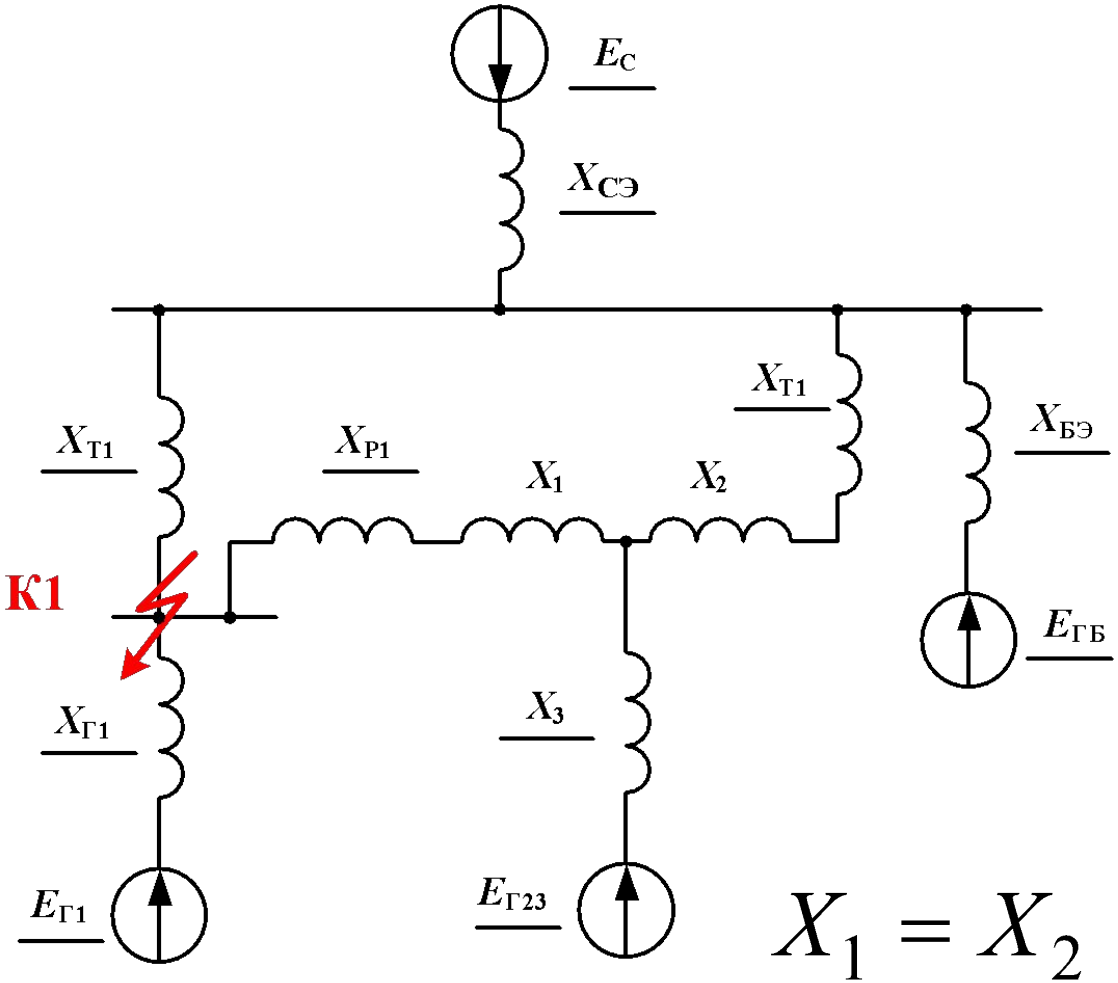
$E_{Г3}$
$E_{ГБ}$


$E_С$
$X_{СЭ}$
$X_{Т1}$
$X_{Р1}$
X_1
X_2
$X_{Т1}$
$X_{БЭ}$
К1
$E_{ГБ}$
$X_{Г1}$
X_3
$E_{Г1}$
$E_{Г23}$

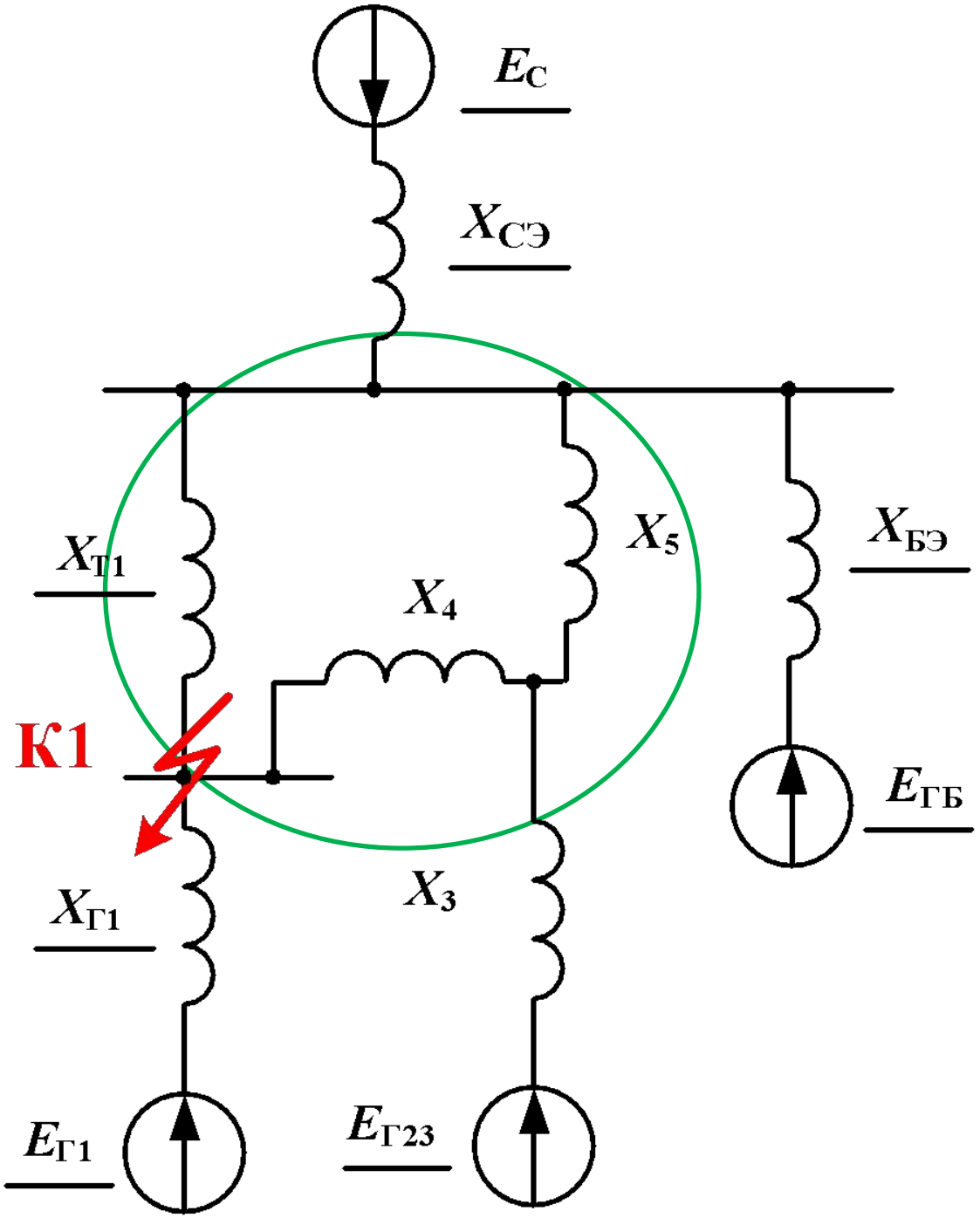


$$X_{С\,Э} = X_С + \frac{X_Л}{N_Л}$$

$$X_{БЭ} = \frac{X_{ГБ} + X_{ТБ}}{n2}$$

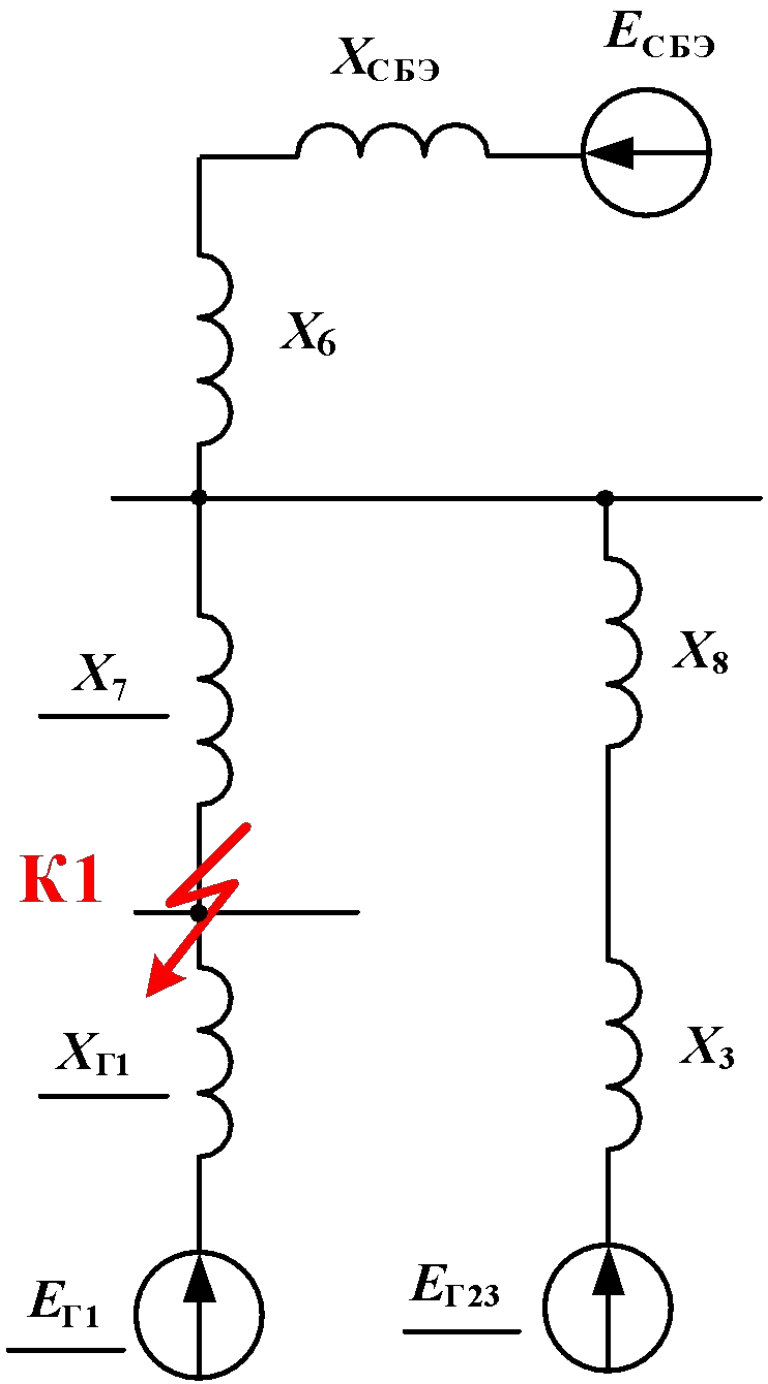
$$X_1 = X_2 = \frac{X_{Г2} \cdot X_{Р2}}{X_{Г2} + X_{Г3} + X_Р}$$

$$X_3 = \frac{X_{Г2} \cdot X_{Г3}}{X_{Г2} + X_{Г3} + X_Р}$$



$$X_4 = X_1 + X_{P1}$$

$$X_5 = X_2 + X_{T2}$$

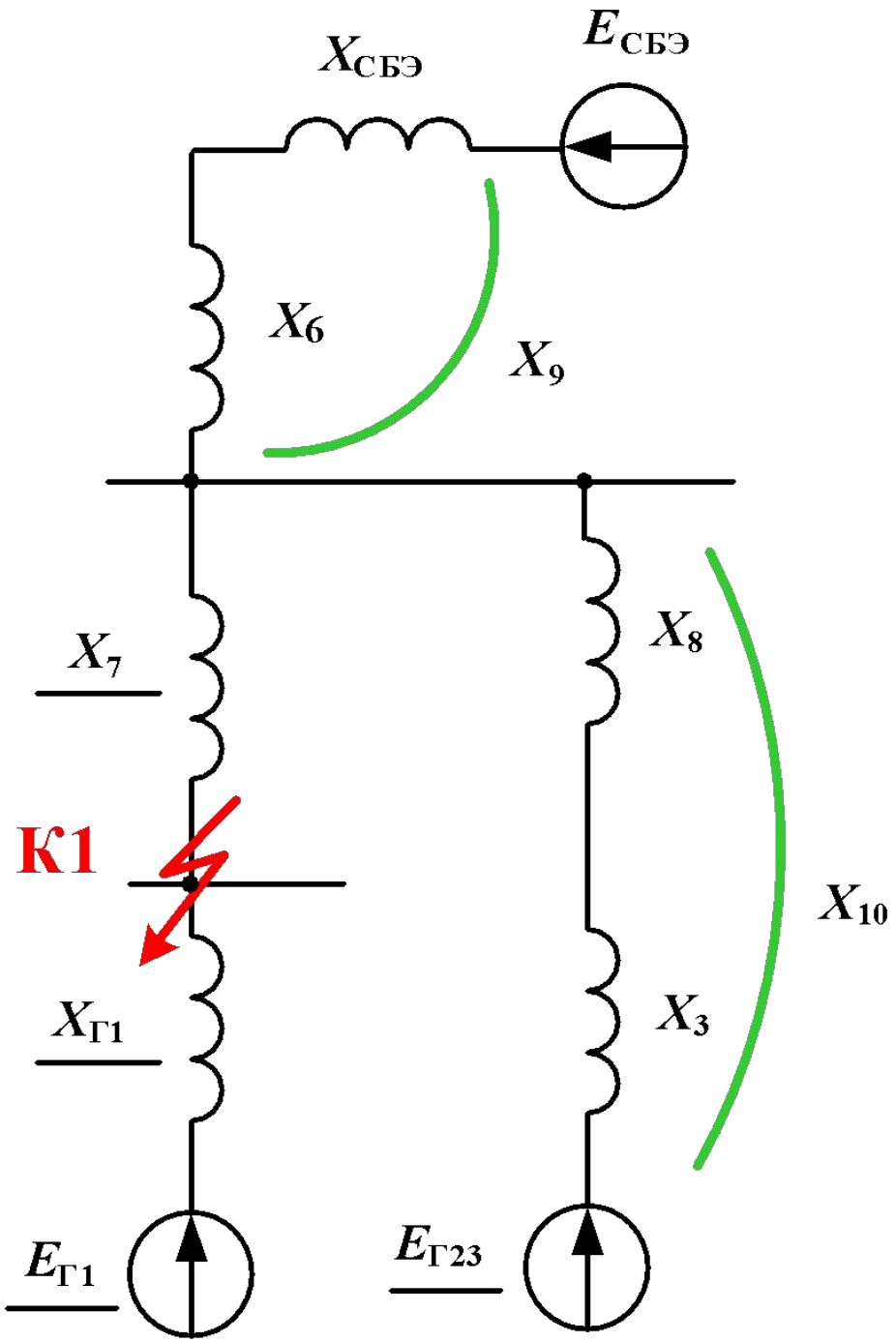


$$X_6 = \frac{X_{T1} \cdot X_5}{X_{T1} + X_5 + X_4}$$

$$X_7 = \frac{X_{T1} \cdot X_4}{X_{T1} + X_5 + X_4}$$

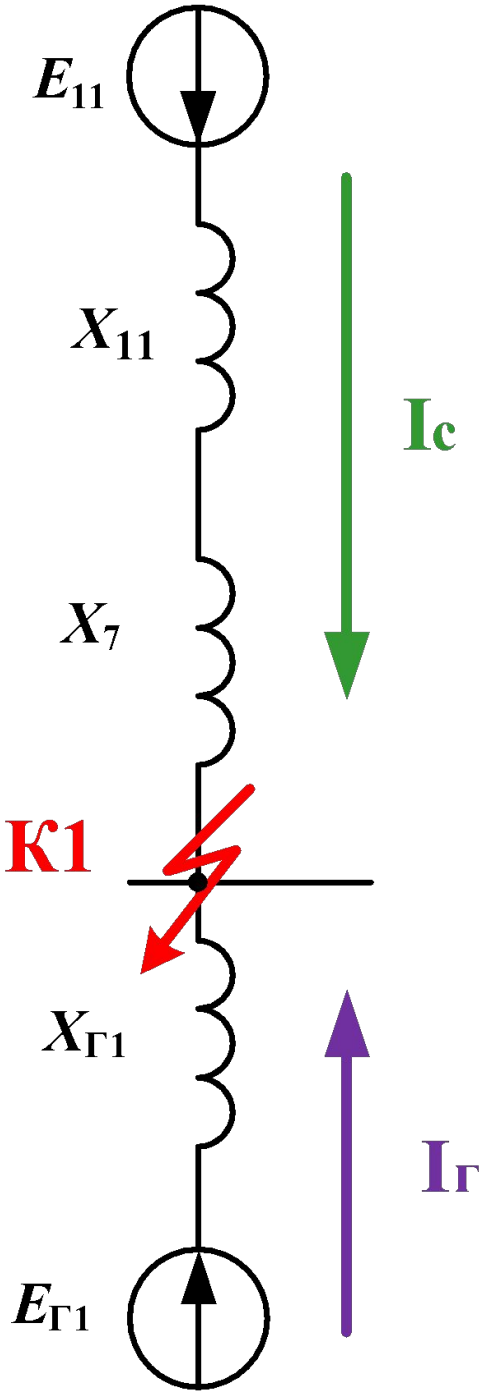
$$X_8 = \frac{X_5 \cdot X_4}{X_{T1} + X_5 + X_4}$$

$$X_{СБЭ} = X_{СЭ} \,//\, X_{БЭ}$$



$$X_9 = X_6 + X_{СБЭ}$$

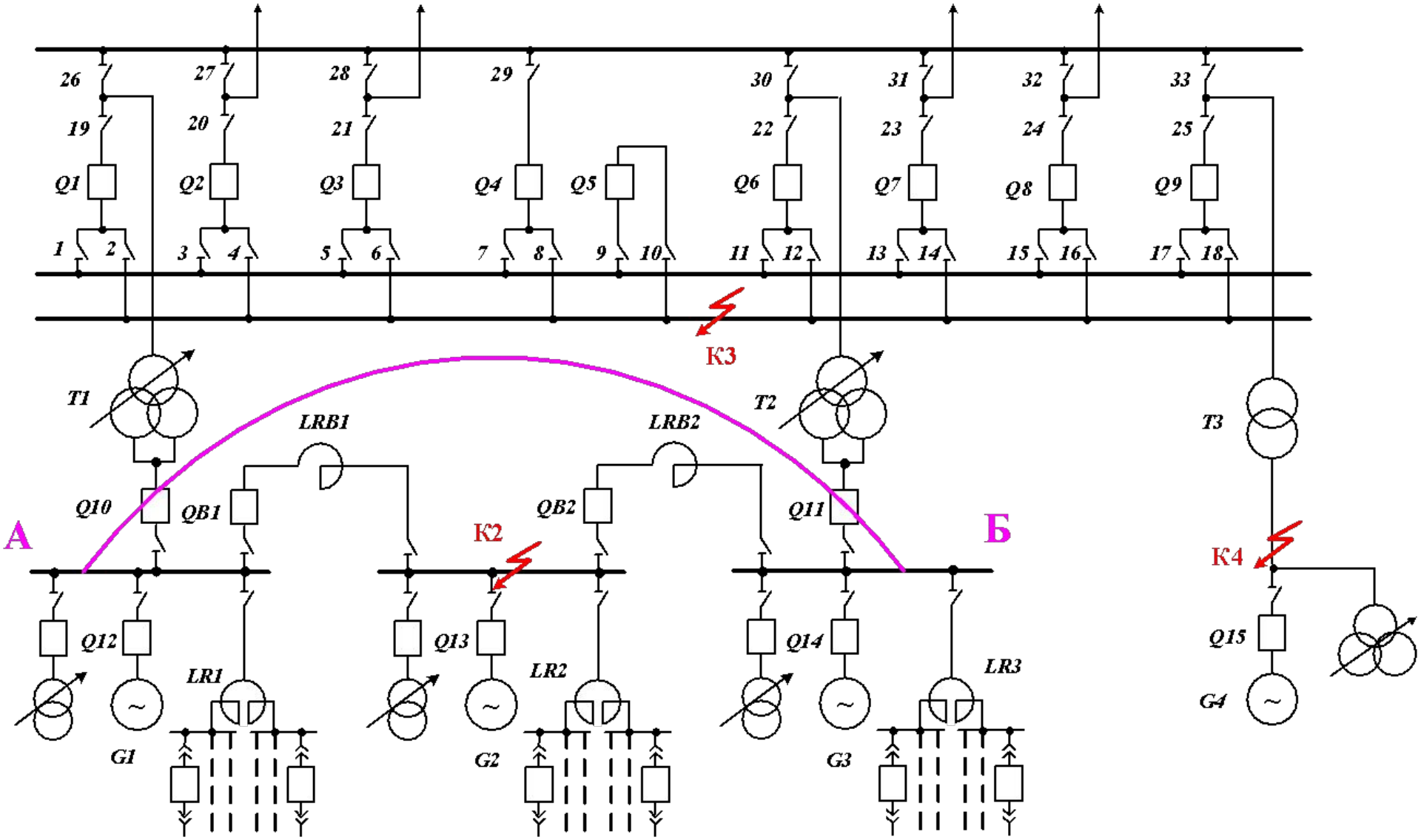
$$X_{10} = X_3 + X_8$$



$$X_{11} = X_9 // X_{10}$$

$$I_C = \frac{E_{11}}{X_{11} + X_7} \cdot I_{БГ}$$

$$I_Г = \frac{E_{Г1}}{X_{Г1}} \cdot I_{БГ}$$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Q1
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Q6
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Q8
Q9
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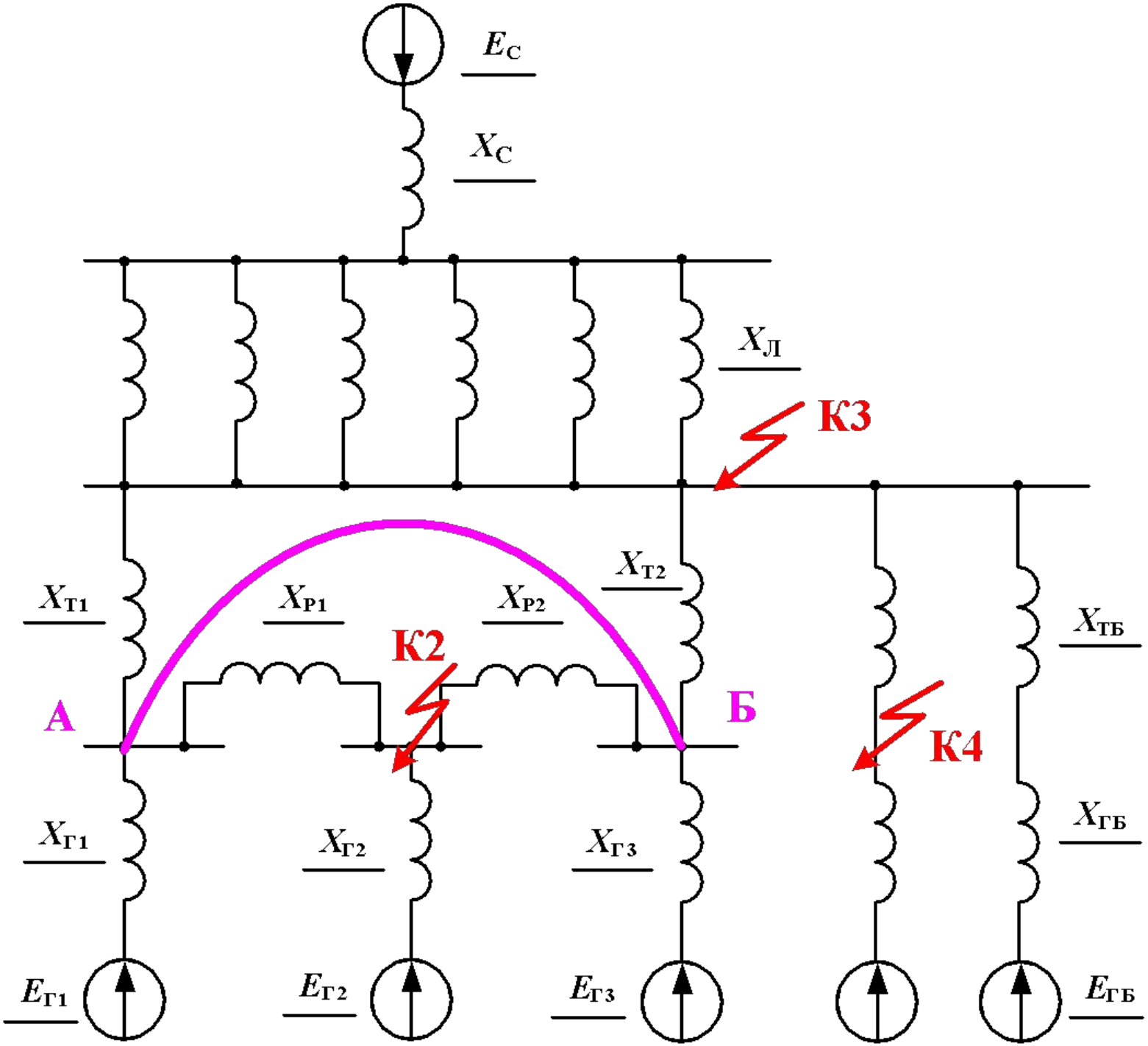
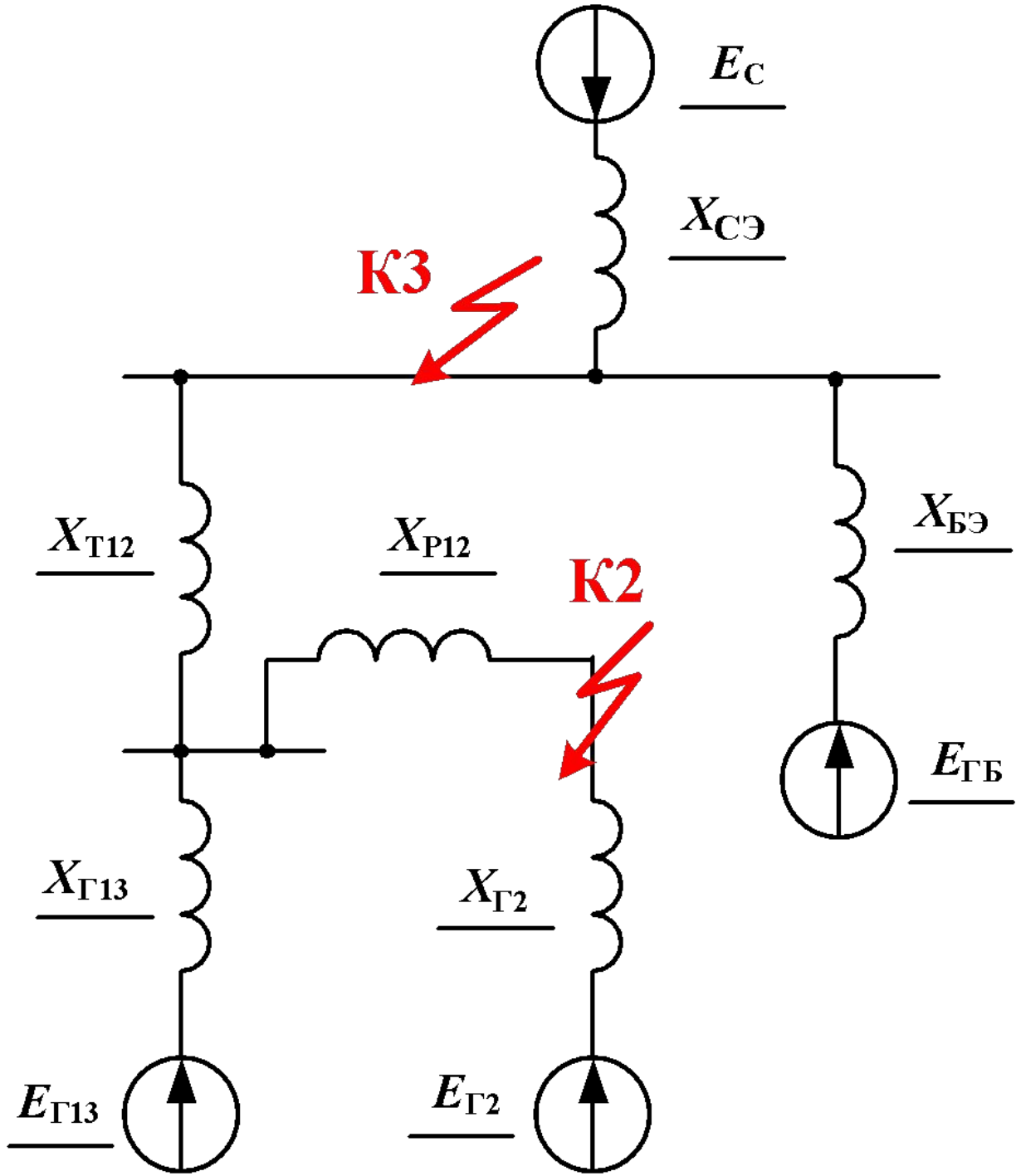
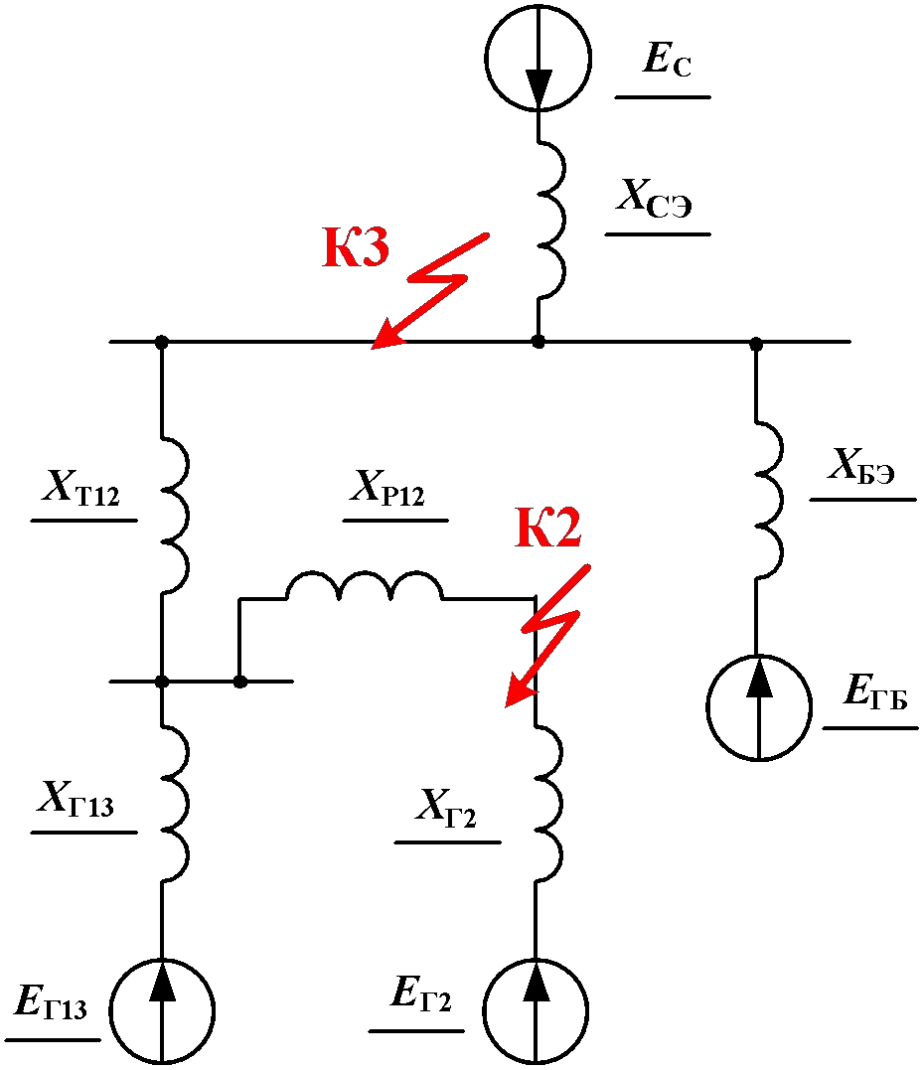
16
17
18
K3
T1
T2
T3
LRB1
LRB2
Q10
QB1
QB2
Q11
A
Б
K2
K4
Q12
Q13
Q14
Q15
LR1
LR2
LR3
G1
G2
G3
G4


$E_С$
$X_С$
$X_Л$
К3
$X_{Т1}$
$X_{Р1}$
$X_{Р2}$
$X_{Т2}$
К2
А
Б
$X_{ТБ}$
К4
$X_{Г1}$
$X_{Г2}$
$X_{Г3}$
$X_{ГБ}$
$E_{Г1}$
$E_{Г2}$
$E_{Г3}$
$E_{ГБ}$

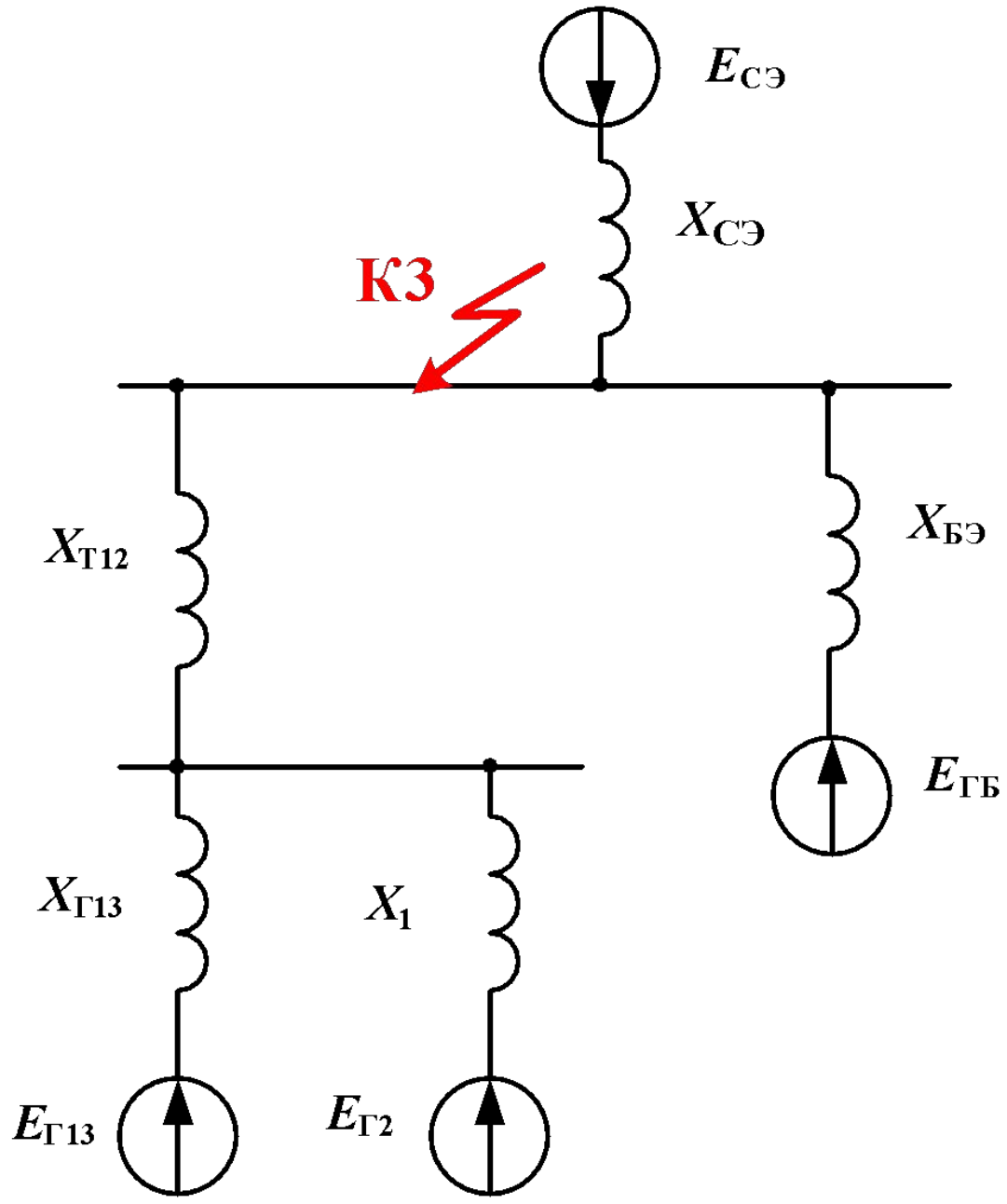

$E_С$
$X_{СЭ}$
К3
$X_{Т12}$
$X_{Р12}$
К2
$X_{БЭ}$
$E_{ГБ}$
$X_{Г13}$
$X_{Г2}$
$E_{Г13}$
$E_{Г2}$



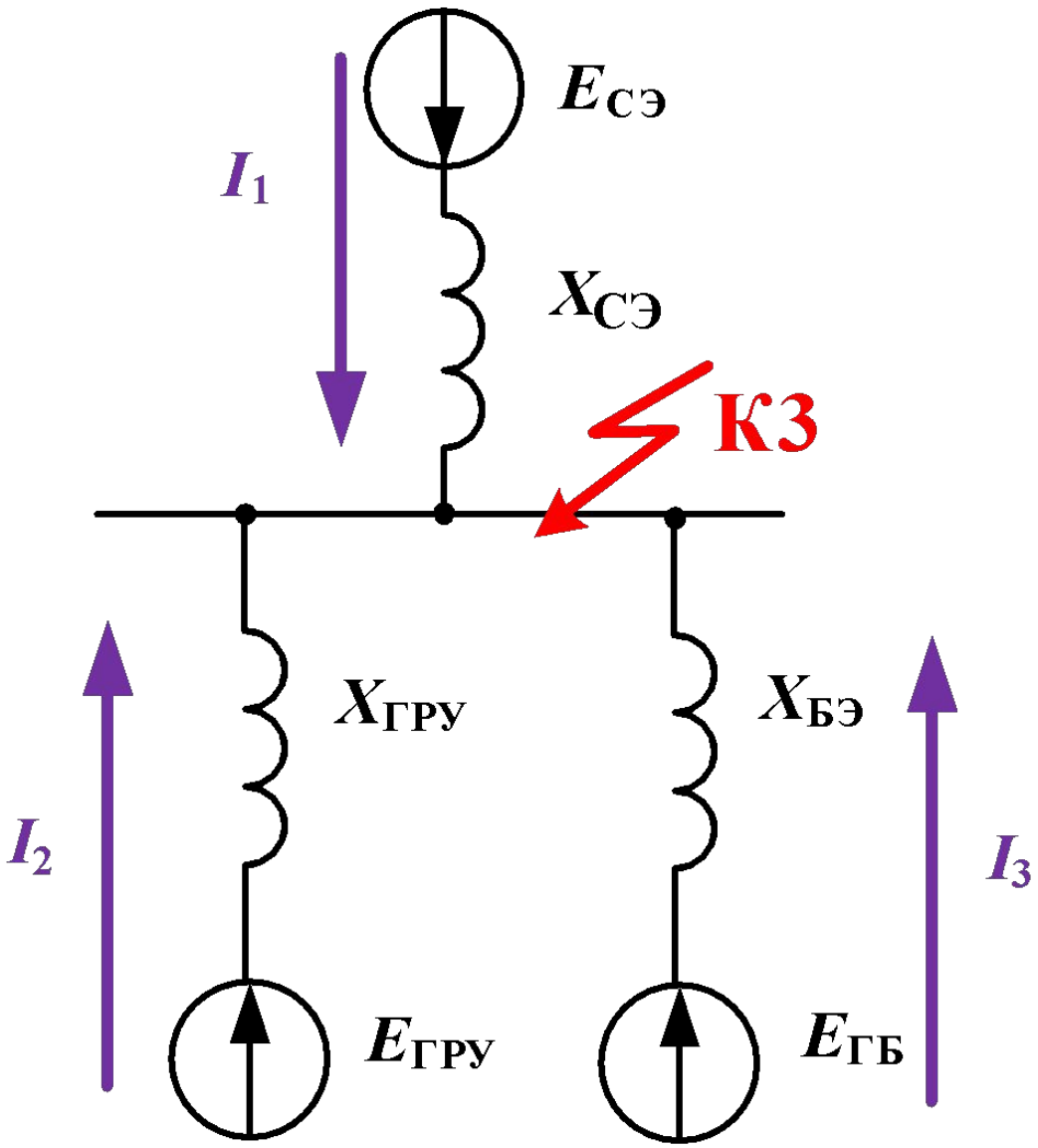
$$X_{С\,Э} = X_С + \frac{X_Л}{N_Л}$$

$$X_{БЭ} = \frac{X_{ГБ} + X_{ТБ}}{n2}$$

$$X_{Т12} = \frac{X_{Т1}}{2} \qquad X_{Р12} = \frac{X_{Р1}}{2} \qquad X_{Г13} = \frac{X_{Г1}}{2}$$



$$X_1 = X_{Р12} + X_{Г2}$$

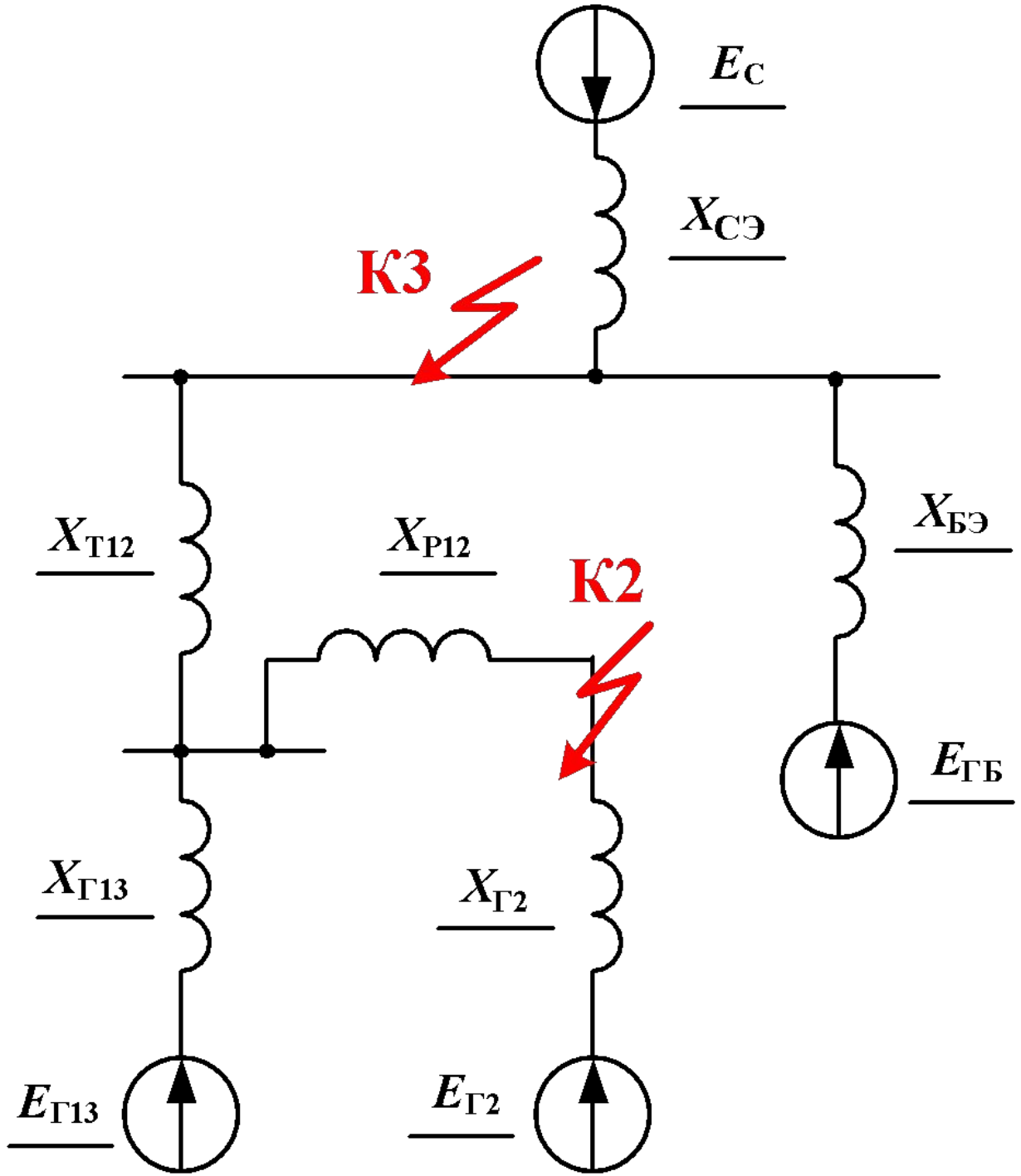


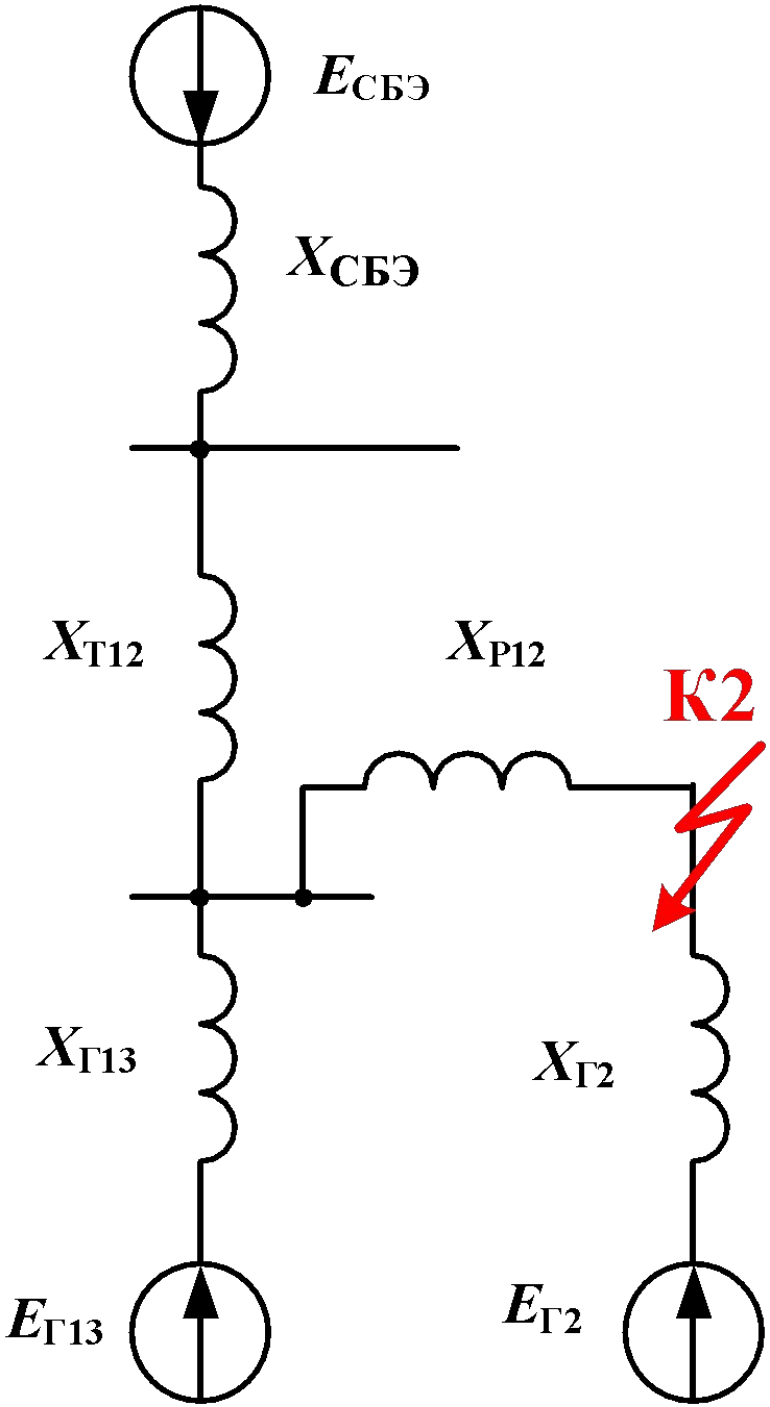
$$I_1 = \frac{E_{СЭ}}{X_{СЭ}} \cdot I_{БВН}$$

$$I_2 = \frac{E_{ГРУ}}{X_{ГРУ}} \cdot I_{БВН}$$

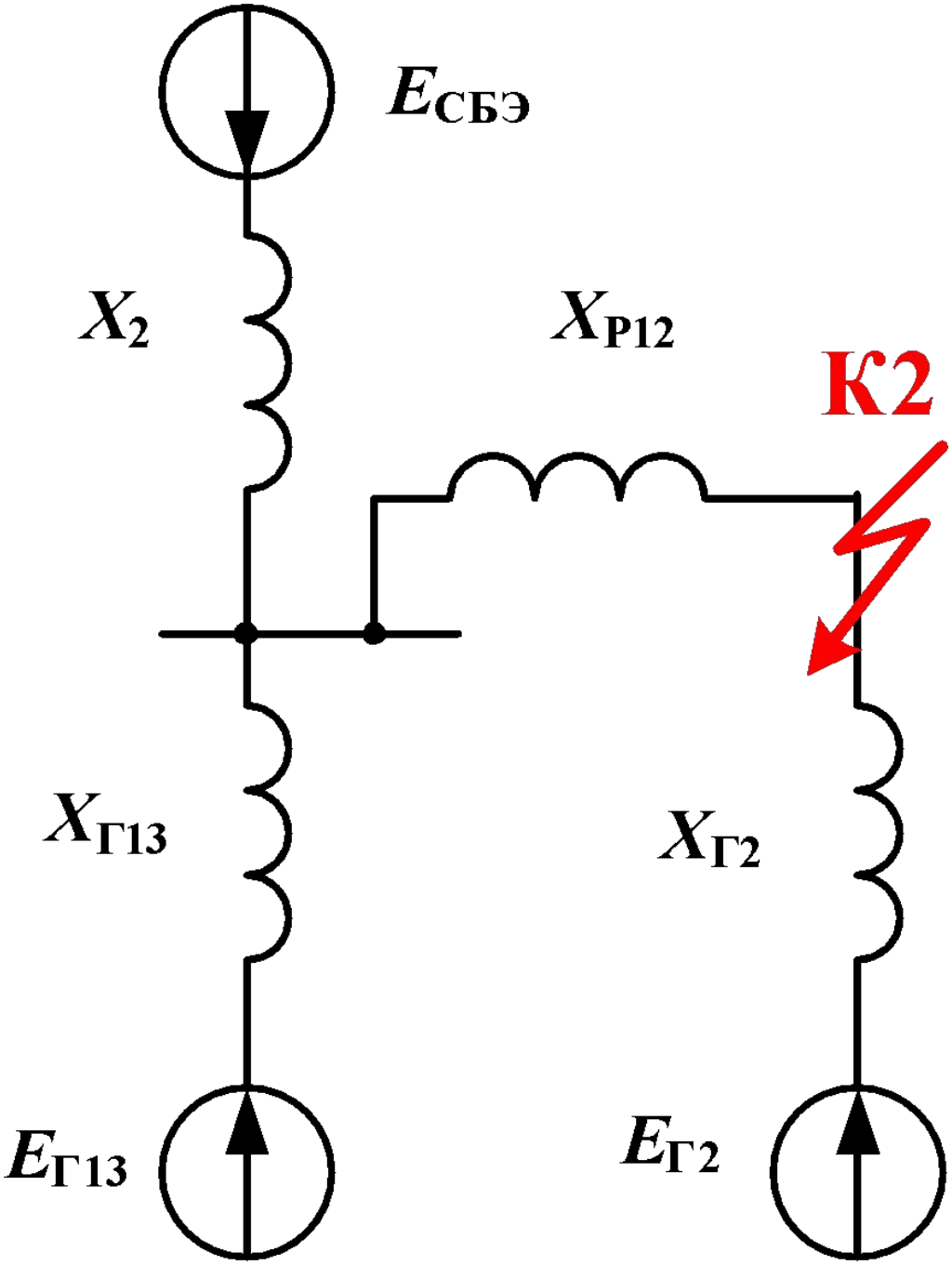
$$I_3 = \frac{E_{ГБ}}{X_{БЭ}} \cdot I_{БВН}$$

$$I^{(3)}_{К3\Sigma} = I_1 + I_2 + I_3$$

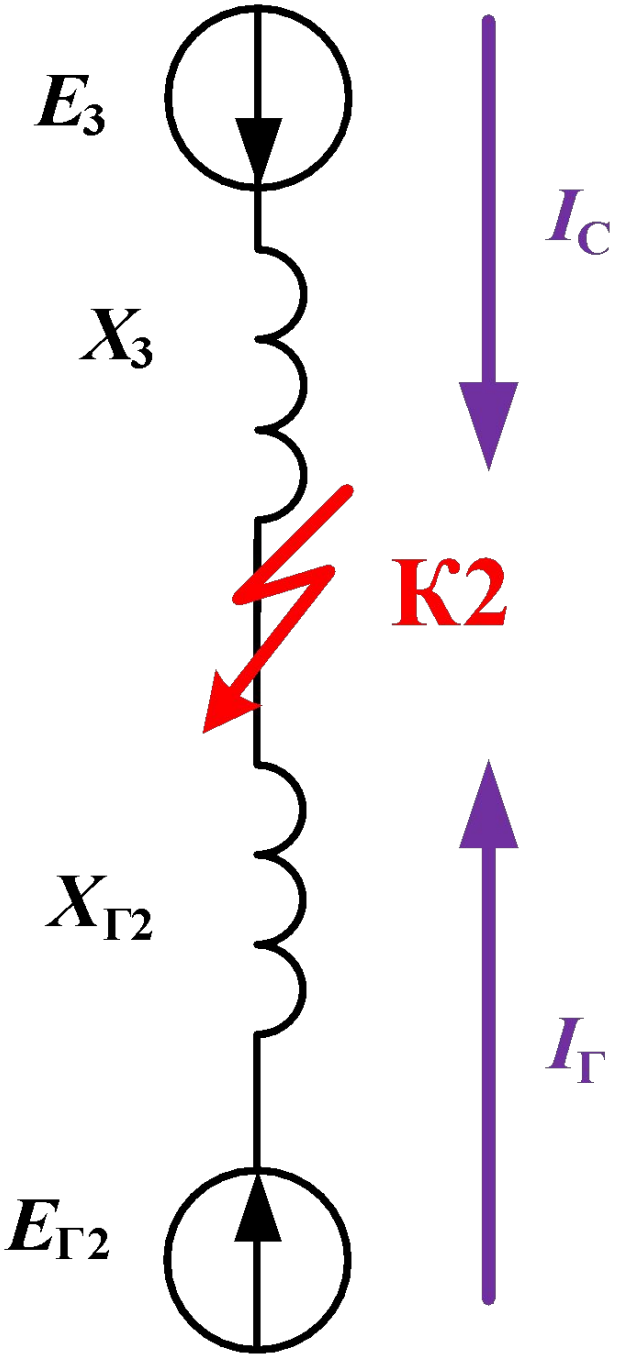

$E_С$
$X_{СЭ}$
К3
$X_{Т12}$
$X_{Р12}$
К2
$X_{БЭ}$
$E_{ГБ}$
$X_{Г13}$
$X_{Г2}$
$E_{Г13}$
$E_{Г2}$



$$X_{СБЭ} = X_{СЭ} // X_{БЭ}$$



$$X_2 = X_{СБЭ} + X_{Т12}$$



$$X_3 = X_{P12} + X_2 // X_{Г13}$$

$$I_C = \frac{E_3}{X_3} \cdot I_{БГ}$$

$$I_Г = \frac{E_{Г2}}{X_{Г2}} \cdot I_{БГ}$$