ANALIZA ELEKTROENERGETSKOG SUSTAVA

Predavanje br. 11.

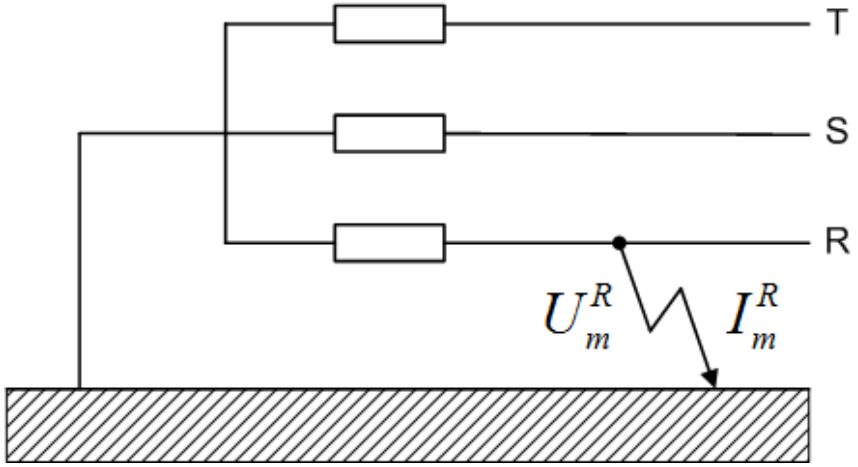
- Proračun jednopolnog kratkog spoja
  - U bolesnom čvorištu treba postaviti jednadžbe simetričnih komponenata:

$$^{R}U_m = 0$$

$$^{R}I_m = I_m^d + I_m^i + I_m^0$$

$$^{T}I_m = {}^{S}I_m = 0$$

$$\begin{vmatrix} ^{R}U_m \\ ^{S}U_m \\ ^{T}U_m \end{vmatrix} = \begin{vmatrix} 1 & 1 & 1 \\ 1 & a^2 & a \\ 1 & a^2 & a^2 \end{vmatrix} \cdot \begin{vmatrix} U_m^0 \\ U_m^d \\ U_m^i \end{vmatrix}$$



$$U_m^0 + U_m^d + U_m^i = 0$$

$$^S I_m = 0$$

$$^T I_m = 0$$

$$\longrightarrow$$

$$I_m^0 + a^2 \cdot I_m^d + a \cdot I_m^i = 0$$

$$I_m^0 + a \cdot I_m^d + a^2 \cdot I_m^i = 0$$

$$I_m^0 = I_m^d = I_m^i$$

$$U_m^d = \sum_{j=1}^{n} I_j \cdot Z_{m,j}^d + Z_{m,m}^d \cdot I_m^0$$

$$U_m^i = Z_{m,m}^i \cdot I_m^0$$

$$U_m^0 = Z_{m,m}^0 \cdot I_m^0$$

$$\sum_{j=1}^{n} I_j \cdot Z_{m,j}^d = U_m^Z \longrightarrow$$ prije kvara

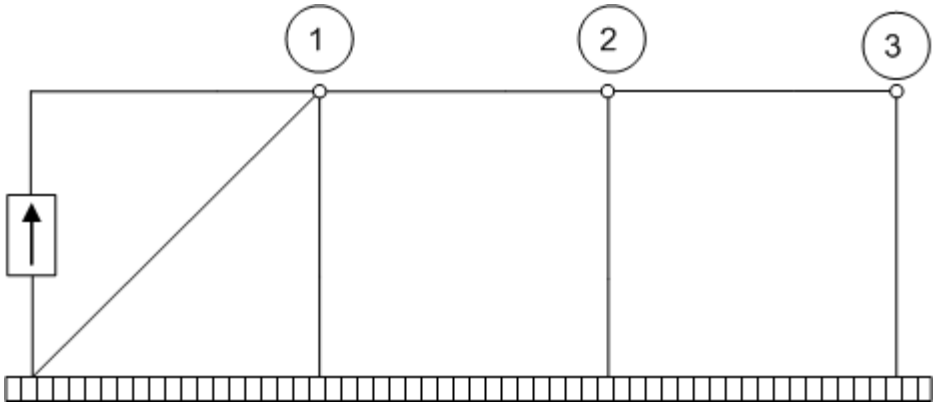
$$U_m^Z + Z_{mm}^d \cdot I_m^0 + Z_{mm}^i \cdot I_m^0 + Z_{mm}^0 \cdot I_m^0 = 0$$

$$I_m^0 = -\frac{U_m^Z}{Z_{mm}^d + Z_{mm}^i + Z_{mm}^0}$$

$$I_{KV} = -3 \cdot I_m^0 = \frac{3 \cdot U_m^Z}{Z_{mm}^d + Z_{mm}^i + Z_{mm}^0} = \frac{3 \cdot U_m^Z}{2 \cdot Z_{mm}^d + Z_{mm}^0}$$

U_m^Z - fazni napon trofazne mreže

- Primjer:



$$Z^d = Z^i = \begin{vmatrix} 0.385 & 0.154 & 0.077 \\ 0.154 & 0.461 & 0.230 \\ 0.077 & 0.230 & 0.615 \end{vmatrix}$$

$$Z^0 = \begin{vmatrix} 0.770 & 0.308 & 0.154 \\ 0.308 & 0.922 & 0.460 \\ 0.154 & 0.460 & 1.230 \end{vmatrix}$$

$$\begin{vmatrix} U_1^d \\ U_2^d \\ U_3^d \end{vmatrix} = Z^d \cdot \left\{ \begin{vmatrix} 1 \\ 0 \\ 0 \end{vmatrix} + \begin{vmatrix} I_1^d \\ 0 \\ 0 \end{vmatrix} \right\}$$

$$U_1^d = 0.385 \cdot 1 + 0.385 \cdot I_1^d$$

$$U_1^i = 0.385 \cdot I_1^i$$

$$U_1^0 = 0.77 \cdot I_1^0$$

$$I_1^0 = I_1^i = I_1^d = -\frac{0.385}{0.385 + 0.385 + 0.77} = -0.25\ A$$

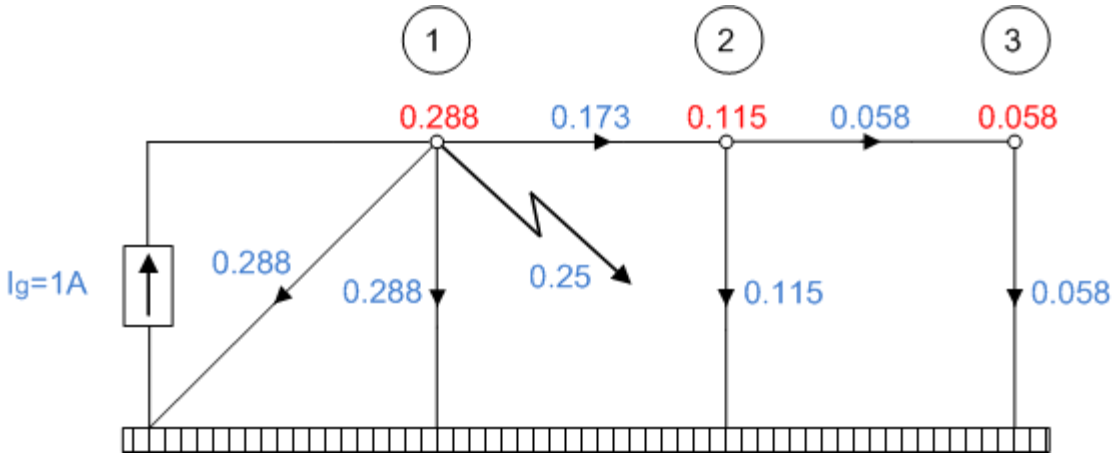
$$\begin{vmatrix} U_1^d \\ U_2^d \\ U_3^d \end{vmatrix} = \left| Z^d \right| \cdot \begin{vmatrix} 1 - 0.25 \\ 0 \\ 0 \end{vmatrix} = \begin{vmatrix} 0.288 \\ 0.115 \\ 0.058 \end{vmatrix}$$

$$\begin{vmatrix} U_1^i \\ U_2^i \\ U_3^i \end{vmatrix} = \left|Z^i\right| \cdot \begin{vmatrix} -0.25 \\ 0 \\ 0 \end{vmatrix} = \begin{vmatrix} -0.096 \\ -0.0385 \\ -0.0193 \end{vmatrix}$$

$$\begin{vmatrix} U_1^0 \\ U_2^0 \\ U_3^0 \end{vmatrix} = \left|Z^0\right| \cdot \begin{vmatrix} -0.25 \\ 0 \\ 0 \end{vmatrix} = \begin{vmatrix} -0.192 \\ -0.077 \\ -0.039 \end{vmatrix}$$

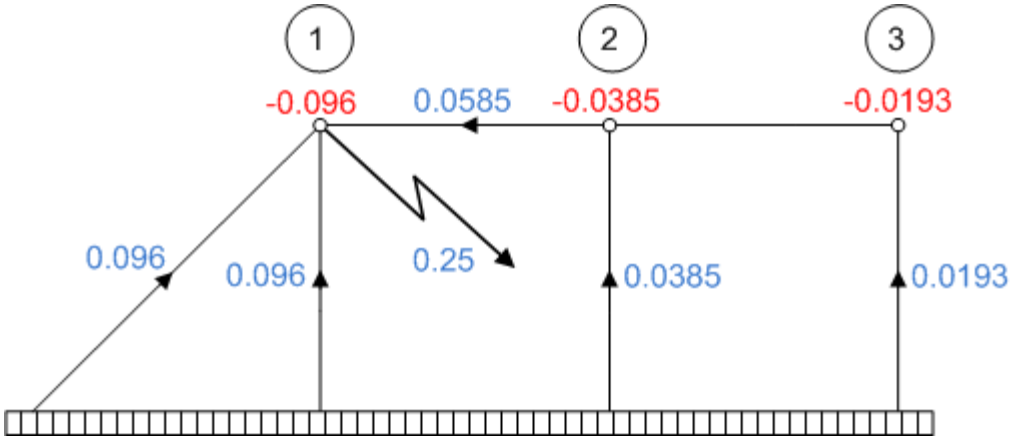
Struja bolesnog čvorišta u fazi R:

$$I_1^R = I^0 + I^d + I^i = 3 \cdot \left(-0.25\right) = -0.75$$

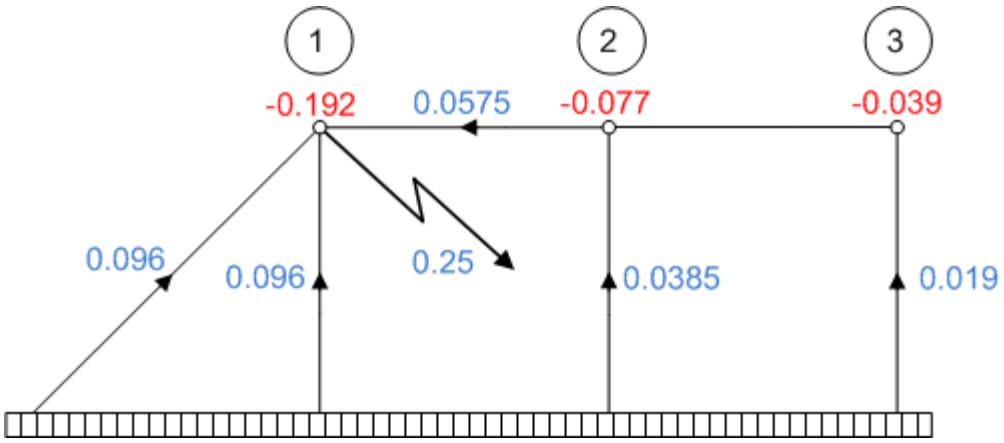


Direktna mreža

$$I_g^d = 0.712\ A$$



Inverzna mreža

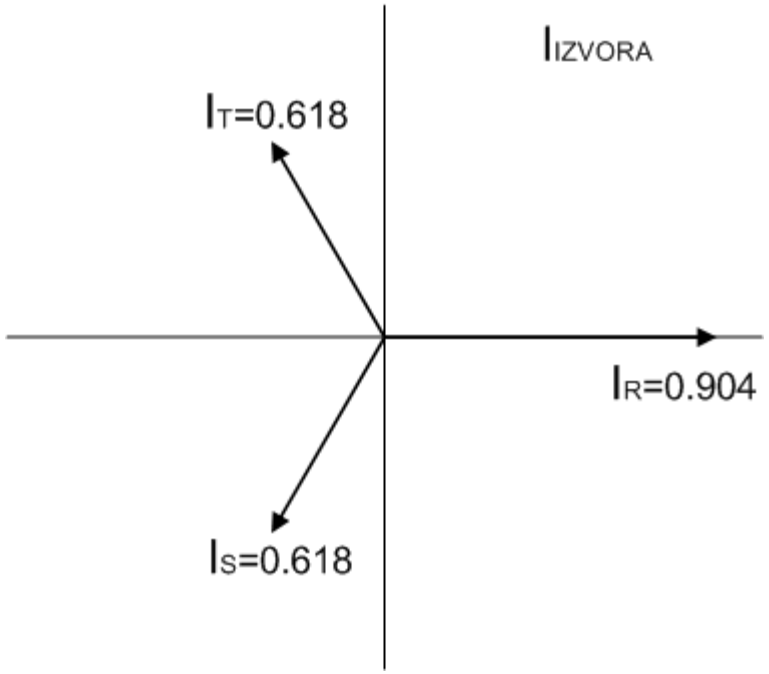


nulta mreža

$$\begin{vmatrix} U_1^R \\ U_1^S \\ U_1^T \end{vmatrix} = \begin{vmatrix} 1 & 1 & 1 \\ 1 & a^2 & a \\ 1 & a & a^2 \end{vmatrix} \cdot \begin{vmatrix} -0.192 \\ 0.288 \\ -0.096 \end{vmatrix} = \begin{vmatrix} 0 \\ 0.298 - j0.316 \\ -0.298 + j0.316 \end{vmatrix}$$

$$\begin{vmatrix} I_1^R \\ I_1^S \\ I_1^T \end{vmatrix} = \begin{vmatrix} 1 & 1 & 1 \\ 1 & a^2 & a \\ 1 & a & a^2 \end{vmatrix} \cdot \begin{vmatrix} -0.25 \\ -0.25 \\ -0.25 \end{vmatrix} = \begin{vmatrix} -0.75 \\ 0 \\ 0 \end{vmatrix}$$

$$\begin{vmatrix} I_{IZV}^{R} \\ I_{IZV}^{S} \\ I_{IZV}^{T} \end{vmatrix} = \begin{vmatrix} 1 & 1 & 1 \\ 1 & a^2 & a \\ 1 & a & a^2 \end{vmatrix} \cdot \begin{vmatrix} 0.096 \\ 0.712 \\ 0.096 \end{vmatrix} = \begin{vmatrix} 0.904 \\ -0.312 - j0.534 \\ -0.312 + j0.534 \end{vmatrix}$$

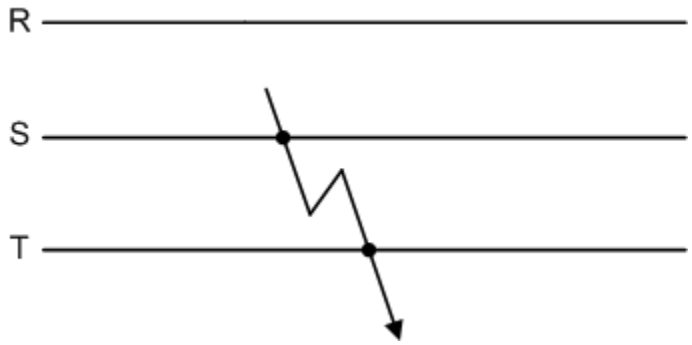


- Proračun dvopolnog kratkog spoja

$$\begin{vmatrix} U_1 \\ \vdots \\ U_m \\ \vdots \\ U_n \end{vmatrix}^d = \left|Z^d\right| \cdot \left\{ \begin{vmatrix} I_1 \\ I_2 \\ \vdots \\ I_n \end{vmatrix}^d + \begin{vmatrix} 0 \\ 0 \\ \vdots \\ I_m^d \\ \vdots \\ 0 \end{vmatrix} \right\} \quad ; \quad \begin{vmatrix} U_1 \\ \vdots \\ U_m \\ \vdots \\ U_n \end{vmatrix}^i = \left|Z^i\right| \cdot \begin{vmatrix} 0 \\ 0 \\ \vdots \\ I_m^i \\ \vdots \\ 0 \end{vmatrix}$$

  - Na mjestu kvara:

$$U_S = U_T$$
$$I_S = -I_T$$



$$U_S = U^0 + a^2 \cdot U^d + a \cdot U^i$$

$$U_T = U^0 + a \cdot U^d + a^2 \cdot U^i$$

$$U^0 + a^2 \cdot U^d + a \cdot U^i = U^0 + a \cdot U^d + a^2 \cdot U^i$$

$$\left(a^2 - a\right) \cdot U^d = \left(a^2 - a\right) \cdot U^i$$

$$U^d = U^i$$

- Analogno: $I^d = -I^i$
- Uvrstimo sada iz matričnih jednadžbi u ove izraze:

$$U_m^d = {}^Z U_m^d + Z_{mm}^d \cdot I_m^d$$

$$U_m^i = Z_{mm}^i \cdot I_m^i$$

$${}^Z U_m^d + Z_{mm}^d \cdot I_m^d = Z_{mm}^i \cdot I_m^i = -Z_{mm} \cdot I_m^d$$

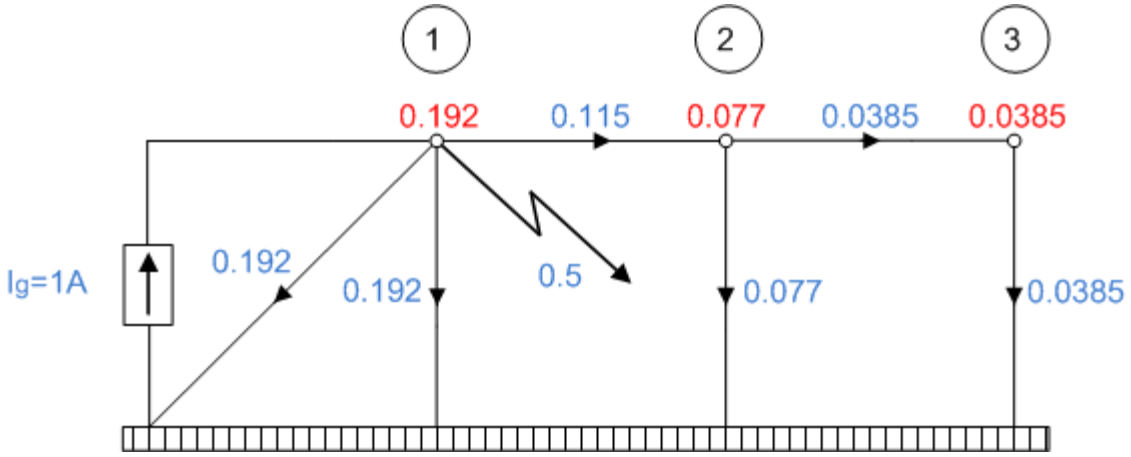
$$I_m^d = -\frac{{}^{Z}U_m^d}{Z_{mm}^d + Z_{mm}^i}$$

$$I_m^d = -\frac{0.385}{0.385 + 0.385} = -0.5\ A$$

$$I_m^i = 0.5\ A$$

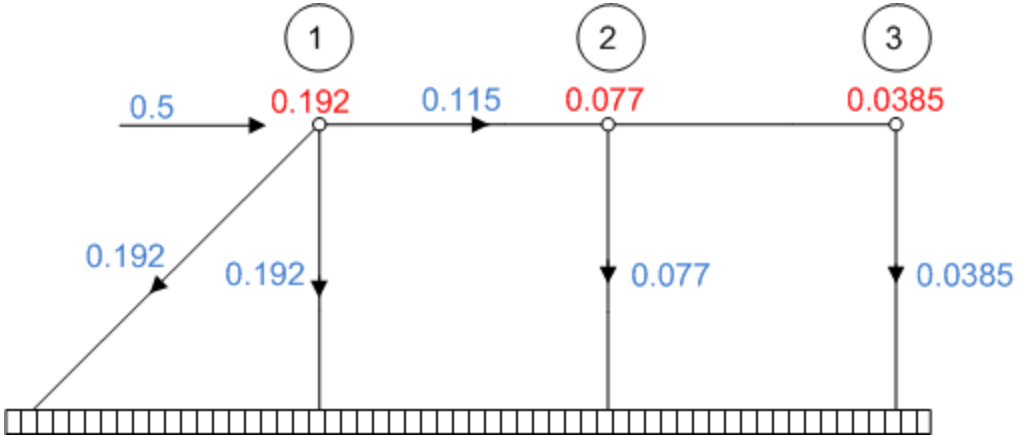
$$\begin{vmatrix} U_1^d \\ U_2^d \\ U_3^d \end{vmatrix}^B = \begin{vmatrix} 0.385 \\ 0.154 \\ 0.077 \end{vmatrix}^Z - \begin{vmatrix} 0.192 \\ 0.077 \\ 0.0385 \end{vmatrix} = \begin{vmatrix} 0.192 \\ 0.077 \\ 0.0385 \end{vmatrix}$$

$$\begin{vmatrix} U_1^i \\ U_2^i \\ U_3^i \end{vmatrix} = \left| Z^i \right| \cdot \begin{vmatrix} 0.5 \\ 0 \\ 0 \end{vmatrix} = \begin{vmatrix} 0.192 \\ 0.077 \\ 0.0385 \end{vmatrix}$$



Direktna mreža

$$I_g^d = 1\,A - 0.192\,A = 0.808\,A$$



Inverzna mreža

– Iz izvora po fazama R, S i T:

$$^{R}I_{IZV} = I^{d}_{IZV} + I^{i}_{IZV} = 0.808 - 0.192 = 0.616\ A$$

$$^{S}I_{IZV} = a^2 \cdot I^{d}_{IZV} + a \cdot I^{i}_{IZV} =$$

$$= \left(-0.5 - j0.866\right) \cdot 0.808 - \left(-0.5 + j0.866\right) \cdot 0.192 =$$

$$= -0.308 - j0.866\ A$$

$$^{T}I_{IZV} = \left(-0.5 + j0.866\right) \cdot 0.808 - \left(-0.5 - j0.866\right) \cdot 0.192 =$$

$$= -0.308 + j0.866\ A$$

– Na mjestu kvara (poprečne struje):

$$^{R}I_{m} = I^{d}_{IZV} + I^{i}_{IZV} = 0\ A$$

$$^{S}I_{m} = a^2 \cdot I^{d}_{m} + a \cdot I^{i}_{m} = \left(a^2 - a\right) \cdot I^{d}_{m} = \left(-j\sqrt{3}\right) \cdot \left(-0.5\right) = j0.866\ A$$

$$^{T}I_{m} = a \cdot I^{d}_{m} + a^2 \cdot I^{i}_{m} = \left(a - a^2\right) \cdot I^{d}_{m} = -j0.866\ A$$

– U grani 1-2:

$$I_{1-2}^{d} = 0.115 = I_{1-2}^{i}$$

$${}^{R}I_{1-2} = 0.23\ A$$

$${}^{S}I_{1-2} = a^2 \cdot I_{1-2}^{d} + a \cdot I_{1-2}^{i} = \left(a^2 + a\right) \cdot I_{1-2}^{d} = -I_{1-2}^{d} = -0.115\ A$$

$${}^{T}I_{1-2} = a \cdot I_{1-2}^{d} + a^2 \cdot I_{1-2}^{i} = \left(a + a^2\right) \cdot I_{1-2}^{d} = -0.115\ A$$

– U grani 1-0:

$${}^{R}I_{1-0} = I_{1-0}^{d} + I_{1-0}^{i} = 0.192 + 0.192 = 0.385\ A$$

$${}^{S}I_{1-0} = a^2 \cdot I_{1-0}^{d} + a \cdot I_{1-0}^{i} = \left(a^2 + a\right) \cdot I_{1-0}^{d} = -0.192\ A$$

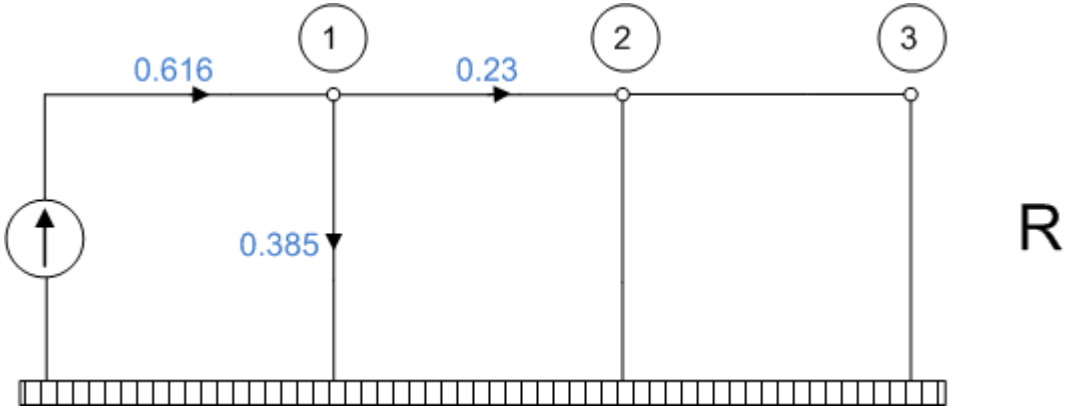
$${}^{T}I_{1-0} = a \cdot I_{1-0}^{d} + a^2 \cdot I_{1-0}^{i} = \left(a + a^2\right) \cdot I_{1-0}^{d} = -0.192\ A$$

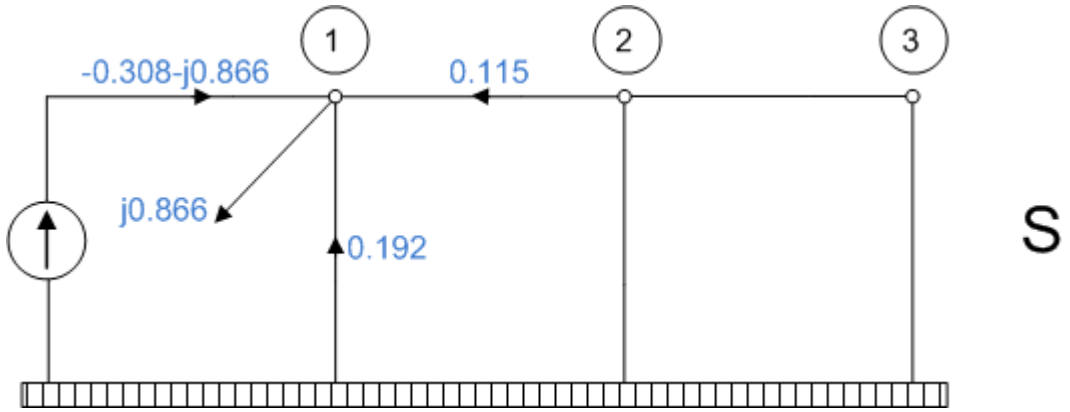
– U čvorištu 1:

$$^{R}U_1 = U_1^d + U_1^i = 0.192 + 0.192 = 0.385\,V$$

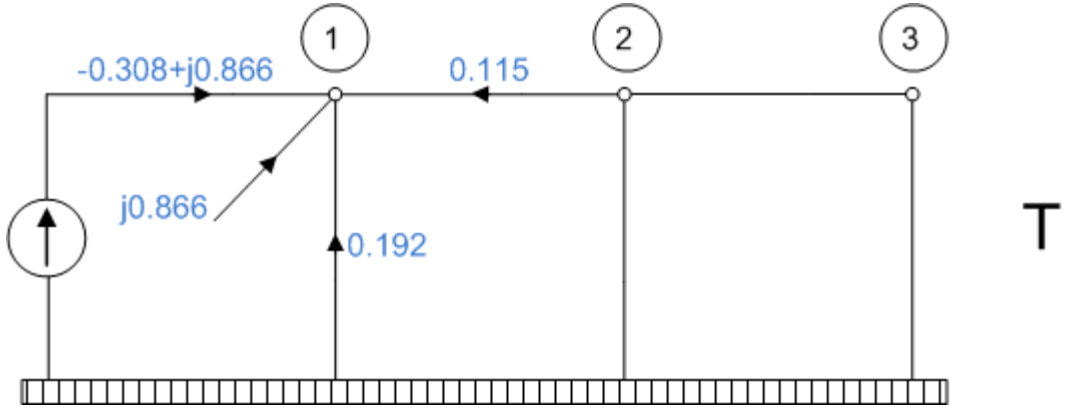
$$^{S}U_1 = a^2 \cdot U_1^d + a \cdot U_1^i = -0.192\,V$$

$$^{T}U_1 = a \cdot U_1^d + a^2 \cdot U_1^i = -0.192\,V$$




1
2
3
-0.308-j0.866
0.115
j0.866
0.192

S


1
2
3
-0.308+j0.866
0.115
j0.866
0.192

T

- Proračun dvopolnog kratkog spoja s zemljom

$$U^d = {}^{Z}U^d + Z^d \cdot I_m^d$$

$$U^i = Z^i \cdot I_m^i$$

$$U^0 = Z^0 \cdot I_m^0$$

$${}^{S}U = {}^{T}U = 0$$

$${}^{R}I = 0$$

$$U^0 + a^2 \cdot U^d + a \cdot U^i = U^0 + a \cdot U^d + a^2 \cdot U^i$$

$$U^0 = U^d = U^i$$

$${}^{R}I = I^0 + I^d + I^i = 0$$

$$I^i = -I^d - I^0$$

$$ {}^{Z}U_m^d + Z_{mm}^d \cdot I_m^d = Z_{mm}^i \cdot I_m^i = Z_{mm}^0 \cdot I_m^0 $$

$$ {}^{Z}U_m^d + Z_{mm}^d \cdot I_m^d = Z_{mm}^i \cdot I_m^i \longrightarrow I_m^i = \frac{1}{Z_{mm}^i}\left({}^{Z}U_m^d + Z_{mm}^d \cdot I_m^d \right) $$

$$ {}^{Z}U_m^d + Z_{mm}^d \cdot I_m^d = Z_{mm}^0 \cdot I_m^0 $$

$$ Z_{mm}^i \cdot I_m^i = Z_{mm}^0 \cdot I_m^0 \longrightarrow I_m^0 = \frac{Z_{mm}^i}{Z_{mm}^0} \cdot I_m^i $$

$$ {}^{Z}U_m^d + Z_{mm}^d \cdot I_m^d = Z_{mm}^i \cdot \left(-I_m^d - I_m^0 \right) $$

$$ {}^{Z}U_m^d + Z_{mm}^d \cdot I_m^d + Z_{mm}^i \cdot I_m^d + \frac{Z_{mm}^i}{Z_{mm}^0} \cdot \left({}^{Z}U_m^d + Z_{mm}^d \cdot I_m^d \right) = 0 $$

$$ {}^{Z}U_m^d \cdot \left(1 + \frac{Z_{mm}^i}{Z_{mm}^0} \right) + \left(Z_{mm}^d + Z_{mm}^i + \frac{Z_{mm}^d \cdot Z_{mm}^i}{Z_{mm}^0} \right) \cdot I_m^d = 0 $$

$$I_m^d = -{}^{Z}U_m^d \cdot \frac{Z_{mm}^0 + Z_{mm}^i}{Z_{mm}^d \cdot Z_{mm}^0 + Z_{mm}^i \cdot Z_{mm}^0 + Z_{mm}^d \cdot Z_{mm}^i}$$

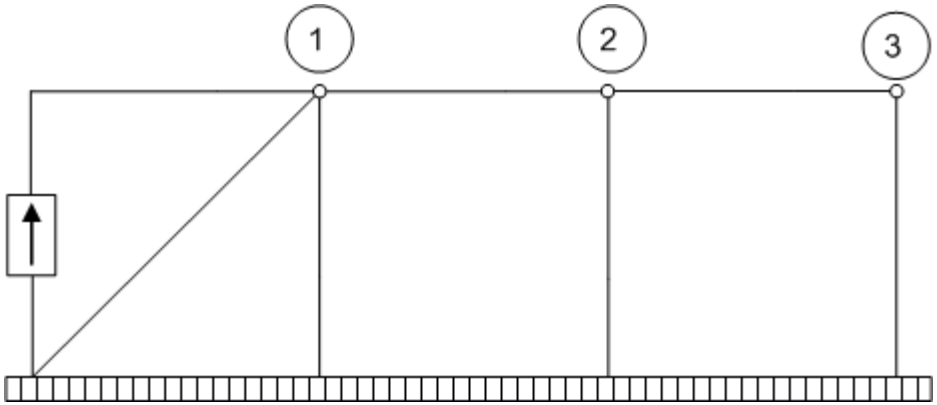
$$I_m^i = \frac{{}^{Z}U_m^d}{Z_{mm}^i} - {}^{Z}U_m^d \cdot \frac{Z_{mm}^d}{Z_{mm}^i} \cdot \frac{Z_{mm}^0 + Z_{mm}^i}{Z_{mm}^d \cdot Z_{mm}^0 + Z_{mm}^i \cdot Z_{mm}^0 + Z_{mm}^d \cdot Z_{mm}^i}$$

$$= {}^{Z}U_m^d \cdot \left(\frac{Z_{mm}^d \cdot Z_{mm}^0 + Z_{mm}^i \cdot Z_{mm}^0 + Z_{mm}^d \cdot Z_{mm}^i - Z_{mm}^d \cdot Z_{mm}^0 - Z_{mm}^d \cdot Z_{mm}^i}{Z_{mm}^i \cdot \left(Z_{mm}^d \cdot Z_{mm}^0 + Z_{mm}^i \cdot Z_{mm}^0 + Z_{mm}^d \cdot Z_{mm}^i \right)} \right)$$

$$= {}^{Z}U_m^d \cdot \left(\frac{Z_{mm}^0}{Z_{mm}^d \cdot Z_{mm}^0 + Z_{mm}^i \cdot Z_{mm}^0 + Z_{mm}^d \cdot Z_{mm}^i} \right)$$

$$I_m^0 = {}^{Z}U_m^d \cdot \left(\frac{Z_{mm}^i}{Z_{mm}^d \cdot Z_{mm}^0 + Z_{mm}^i \cdot Z_{mm}^0 + Z_{mm}^d \cdot Z_{mm}^i} \right)$$

- Primjer:



$$Z^d = Z^i = \begin{vmatrix} 0.385 & 0.154 & 0.077 \\ 0.154 & 0.461 & 0.230 \\ 0.077 & 0.230 & 0.615 \end{vmatrix}$$

$$Z^0 = \begin{vmatrix} 0.770 & 0.308 & 0.154 \\ 0.308 & 0.922 & 0.460 \\ 0.154 & 0.460 & 1.230 \end{vmatrix}$$

$$I_m^d = -0.385 \cdot \frac{0.77 + 0.385}{0.385 \cdot 0.77 + 0.385 \cdot 0.77 + 0.385 \cdot 0.385} = -0.60\ A$$

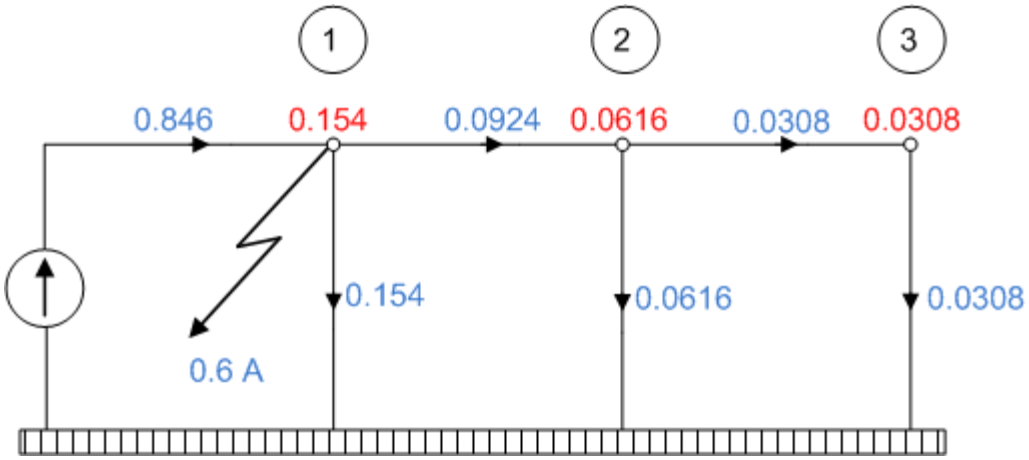
$$I_m^i = 0.385 \cdot \frac{0.77}{0.385 \cdot 1.925} = 0.4\ A$$

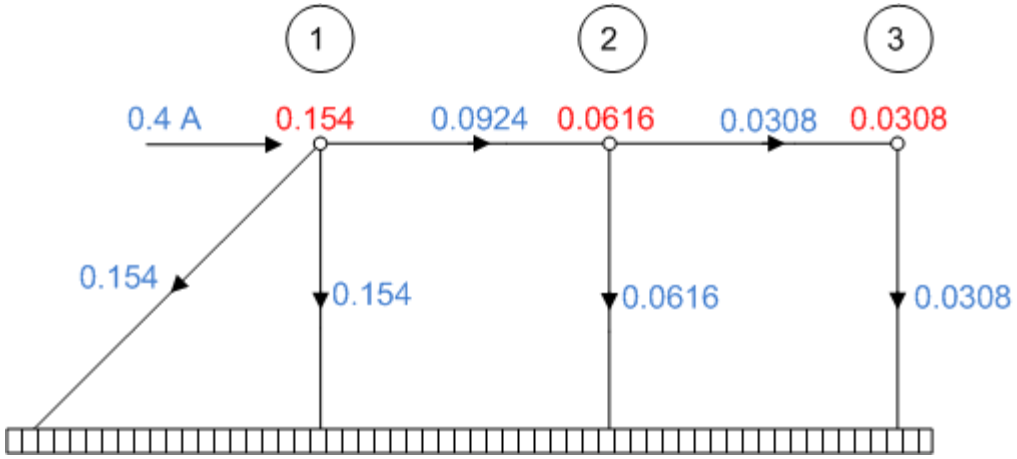
$$I_m^0 = 0.385 \cdot \frac{0.385}{0.385 \cdot 1.925} = 0.2\ A$$

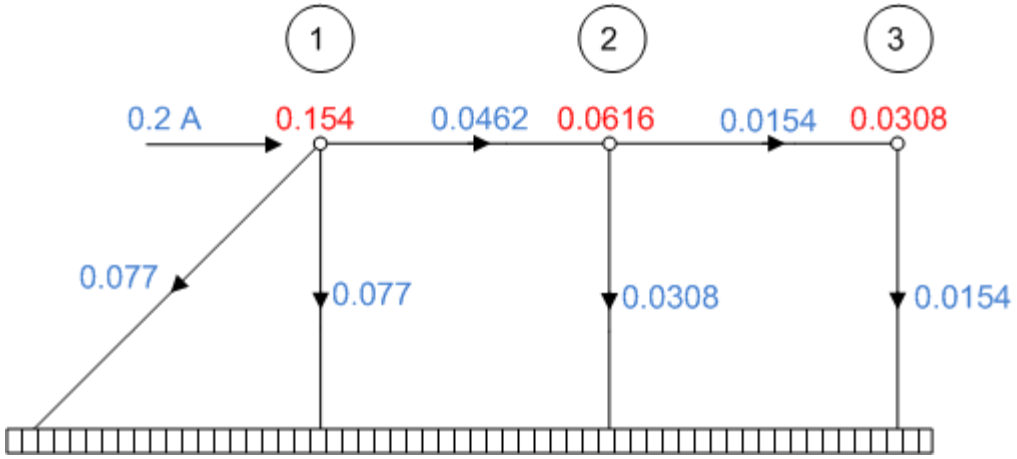
$$\begin{vmatrix} U_1^d \\ U_2^d \\ U_3^d \end{vmatrix}^B = \begin{vmatrix} U_1^d \\ U_2^d \\ U_3^d \end{vmatrix}^Z + \left|Z^d\right| \cdot \begin{vmatrix} I_m^d \\ 0 \\ 0 \end{vmatrix} = \begin{vmatrix} 0.385 \\ 0.154 \\ 0.077 \end{vmatrix} - \begin{vmatrix} 0.385 \cdot 0.6 \\ 0.154 \cdot 0.6 \\ 0.077 \cdot 0.6 \end{vmatrix} = \begin{vmatrix} 0.154 \\ 0.0616 \\ 0.0308 \end{vmatrix}$$

$$\begin{vmatrix} U_1^i \\ U_2^i \\ U_3^i \end{vmatrix}^B = \left|Z^i\right| \cdot \begin{vmatrix} I_m^i \\ 0 \\ 0 \end{vmatrix} = \begin{vmatrix} 0.385 \cdot 0.4 \\ 0.154 \cdot 0.4 \\ 0.077 \cdot 0.4 \end{vmatrix} = \begin{vmatrix} 0.154 \\ 0.0616 \\ 0.0308 \end{vmatrix}$$

$$\begin{vmatrix} U_1^0 \\ U_2^0 \\ U_3^0 \end{vmatrix}^B = \left|Z^0\right| \cdot \begin{vmatrix} I_m^0 \\ 0 \\ 0 \end{vmatrix} = \begin{vmatrix} 0.77 \cdot 0.2 \\ 0.308 \cdot 0.2 \\ 0.154 \cdot 0.2 \end{vmatrix} = \begin{vmatrix} 0.154 \\ 0.0616 \\ 0.0308 \end{vmatrix}$$




1
2
3
0.4 A
0.154
0.0924
0.0616
0.0308
0.0308
0.154
0.154
0.0616
0.0308


1
2
3
0.2 A
0.154
0.0462
0.0616
0.0154
0.0308
0.077
0.077
0.0308
0.0154

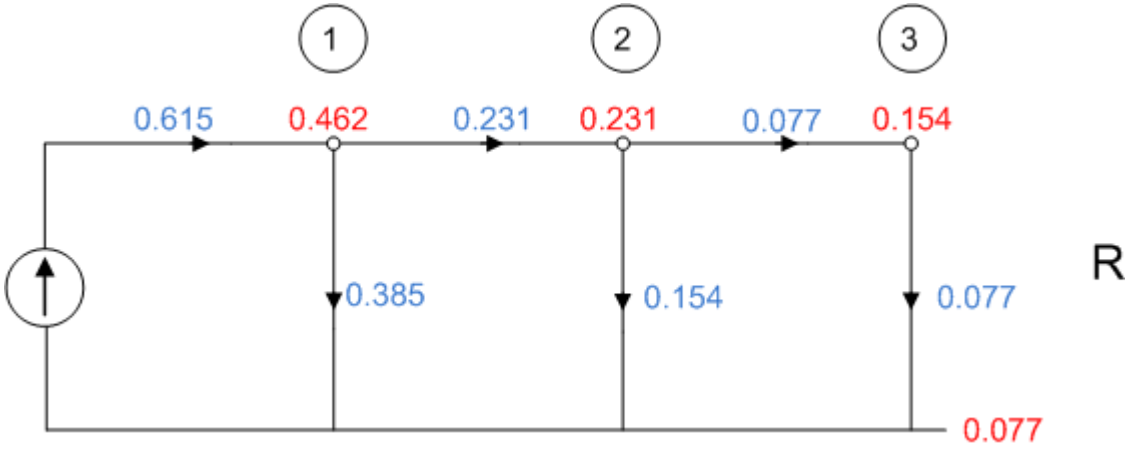
$$\begin{vmatrix} {}^{R}U_1 \\ {}^{S}U_1 \\ {}^{T}U_1 \end{vmatrix} = \begin{vmatrix} 1 & 1 & 1 \\ 1 & a^2 & a \\ 1 & a & a^2 \end{vmatrix} \cdot \begin{vmatrix} U_1^0 \\ U_1^d \\ U_1^i \end{vmatrix} =$$

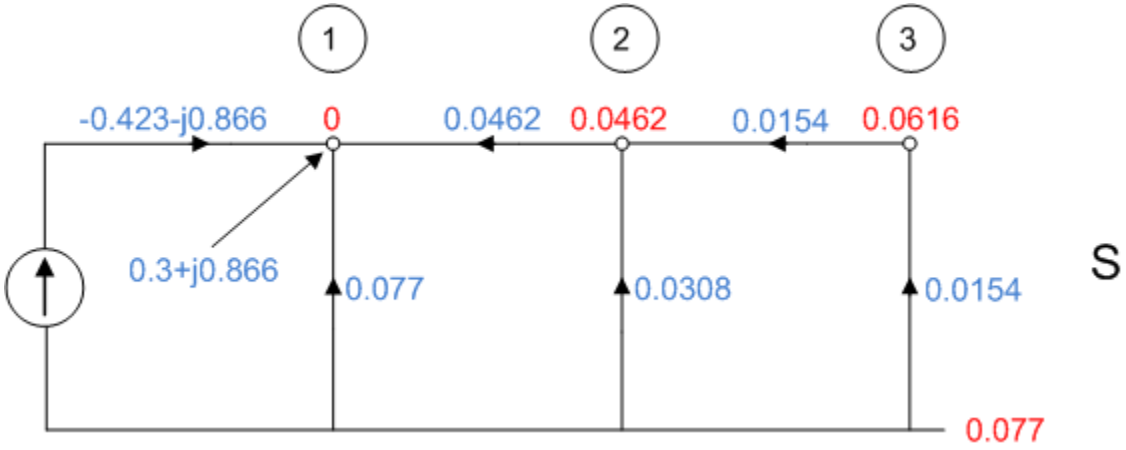
$$= \begin{vmatrix} 0.154+0.154+0.154 \\ 0.154+\left(-0.77-j0.133\right)+\left(-0.77+j0.133\right) \\ 0.154+\left(-0.77+j0.133\right)+\left(-0.77-j0.133\right) \end{vmatrix} = \begin{vmatrix} 0.462 \\ 0 \\ 0 \end{vmatrix}$$

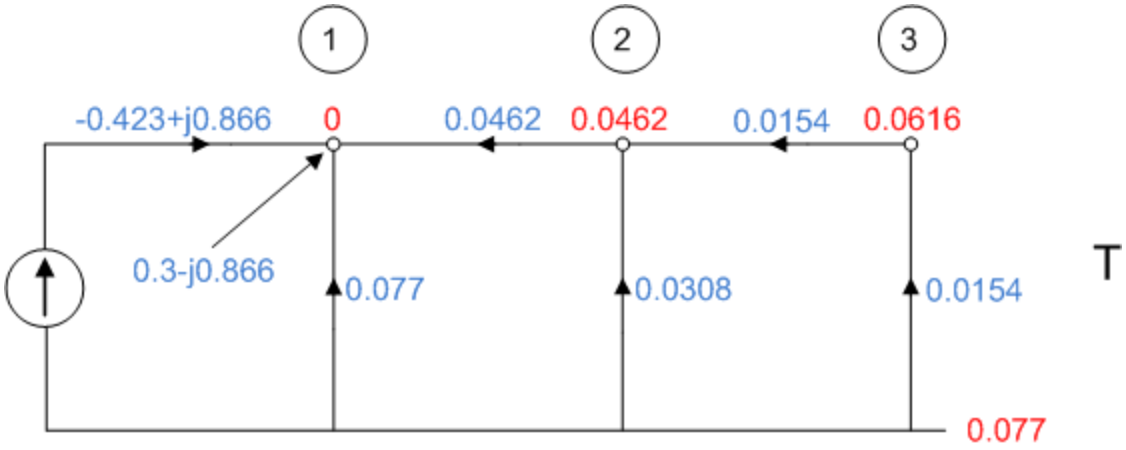
$$\begin{vmatrix} {}^{R}I_1 \\ {}^{S}I_1 \\ {}^{T}I_1 \end{vmatrix} = \begin{vmatrix} 1 & 1 & 1 \\ 1 & a^2 & a \\ 1 & a & a^2 \end{vmatrix} \cdot \begin{vmatrix} 0.2 \\ -0.6 \\ 0.4 \end{vmatrix}$$

$$= \begin{vmatrix} 0 \\ 0.2+0.3+j0.5196-0.2+j0.3464 \\ 0.2+0.3-j0.3464-0.2-j0.5196 \end{vmatrix} = \begin{vmatrix} 0 \\ 0.3+j0.866 \\ 0.3-j0.866 \end{vmatrix}$$

$$\begin{vmatrix} {}^{R}I_{IZV} \\ {}^{S}I_{IZV} \\ {}^{T}I_{IZV} \end{vmatrix} = \begin{vmatrix} 1 & 1 & 1 \\ 1 & a^2 & a \\ 1 & a & a^2 \end{vmatrix} \cdot \begin{vmatrix} -0.077 \\ 0.846 \\ -0.154 \end{vmatrix} = \begin{vmatrix} 0.615 \\ -0.423 - j0.846 \\ -0.423 + j0.866 \end{vmatrix}$$




1
2
3
-0.423-j0.866
0
0.0462
0.0462
0.0154
0.0616
0.3+j0.866
0.077
0.0308
0.0154
0.077
S


1
2
3
-0.423+j0.866
0
0.0462
0.0462
0.0154
0.0616
0.3-j0.866
0.077
0.0308
0.0154
0.077
T

$$\begin{vmatrix} {}^{R}I_{1-2} \\ {}^{S}I_{1-2} \\ {}^{T}I_{1-2} \end{vmatrix} = \begin{vmatrix} 1 & 1 & 1 \\ 1 & a^2 & a \\ 1 & a & a^2 \end{vmatrix} \cdot \begin{vmatrix} 0.0462 \\ 0.0924 \\ 0.0924 \end{vmatrix} = \begin{vmatrix} 0.231 \\ -0.0462 \\ -0.0462 \end{vmatrix}$$

$$\begin{vmatrix} {}^{R}I_{1-0} \\ {}^{S}I_{1-0} \\ {}^{T}I_{1-0} \end{vmatrix} = \begin{vmatrix} 1 & 1 & 1 \\ 1 & a^2 & a \\ 1 & a & a^2 \end{vmatrix} \cdot \begin{vmatrix} 0.077 \\ 0.154 \\ 0.154 \end{vmatrix} = \begin{vmatrix} 0.385 \\ -0.077 \\ -0.077 \end{vmatrix}$$

$$\begin{vmatrix} {}^{R}I_{2-0} \\ {}^{S}I_{2-0} \\ {}^{T}I_{2-0} \end{vmatrix} = \begin{vmatrix} 1 & 1 & 1 \\ 1 & a^2 & a \\ 1 & a & a^2 \end{vmatrix} \cdot \begin{vmatrix} 0.0308 \\ 0.0616 \\ 0.0616 \end{vmatrix} = \begin{vmatrix} 0.154 \\ -0.0308 \\ -0.0308 \end{vmatrix}$$

$$\begin{vmatrix} {}^{R}I_{2-3} \\ {}^{S}I_{2-3} \\ {}^{T}I_{2-3} \end{vmatrix} = \begin{vmatrix} 1 & 1 & 1 \\ 1 & a^2 & a \\ 1 & a & a^2 \end{vmatrix} \cdot \begin{vmatrix} 0.0154 \\ 0.0308 \\ 0.0308 \end{vmatrix} = \begin{vmatrix} 0.077 \\ -0.0154 \\ -0.0154 \end{vmatrix}$$

$$\begin{vmatrix} {}^{R}I_{3-0} \\ {}^{S}I_{3-0} \\ {}^{T}I_{3-0} \end{vmatrix} = \begin{vmatrix} 1 & 1 & 1 \\ 1 & a^2 & a \\ 1 & a & a^2 \end{vmatrix} \cdot \begin{vmatrix} 0.0154 \\ 0.0308 \\ 0.0308 \end{vmatrix} = \begin{vmatrix} 0.077 \\ -0.0154 \\ -0.0154 \end{vmatrix}$$