Sveučilište u Rijeci

TEHNIČKI FAKULTET

Sveučilišni preddiplomski studij elektrotehnike

Električna postrojenja

Konstrukcijski zadatak

Denis Mijolović

0069066432

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1. ZADATAK I PODACI ELEMENATA MREŽE

Zadatak broj: **31**

Za elektroenergetski sustav zadan shemom i podacima u priloženim tablicama (transformator T8 je van pogona) potrebno je za slučaj 2pz kratkog spoja na sabirnici 11, izračunati:

1. Strujne i naponske prilike na mjestu kratkog spoja,
2. Udio pojedinih izvora u struji kratkog spoja,

Tablica 1, Podaci o generatorima

Generatori	U_n (kV)	$\cos\rho_n$	S_n (MVA)	X_d'' %	X_d %	X_i %	R_g Ω	uzemljenje
G1	20	0,85	150	14	180	14	0,002	…
G2	10	0,9	100	16	200	16	0,005	…
G3	10	0,8	10	10	180	10	0,018	…

Tablica 2, Podaci o dvonamotnim transformatorima

	S_n (MVA)	U_{n1}/U_{n2}	u_k (%)	u_r (%)	R_0/R_d	X_0/X_d	Grupa spoja	uzemljenje	
								primar	sekundar
T1	150	110/20	16	0,5	1	0,95	YNd5	j22	…
T2	100	110/10	12	0,5	1	1	Yd5	…	,,,
T5	31,5	110/10	12	0,5	1	1	Yy0	…	…
T6	31,5	110/10	12	0,5	1	1	Yyn0	…	80
T7	1	10/0,4	5	1,03	1	1	Dyn5	…	kruto
T8	0,63	10/0,4	4,4	0,9	1	1	Dyn5	…	kruto

Tablica 3, Podaci o tronamotnim transformatorima

	$S_{n1}/S_{n2}/S_{n3}$ (MVA)	$U_{n1}/U_{n2}/U_{n3}$ (kV)	$u_{k12}/u_{k13}/u_{k23}$ (%)	$u_{k012}/u_{k013}/u_{k023}$ (%)	$u_{r12}/u_{r13}/u_{r23}$ (%)	Grupa spoja	uzemljenje		
							primar	sekundar	tercijar
T3	350/350/50	380/110/30	21/10/7	19,12/9,51/6,3	0,26/0,16/0,16	Yyn0d5	…	kruto	…
T4	350/350/50	380/110/30	21/10/7	19,12/9,51/6,3	0,26/0,16/0,16	YNy0d5	kruto	…	…

Tablica 4, Podaci o zračnim vodovima (dalekovodima)

Vod	U (kV)	Duljina (km)	Z_{dv} (Ω/km)	Z_{0v} (Ω/km)
ZV1, ZV1a	110	20	0,12 + j0,39	0,32 + j1,26
ZV2	110	10	0,12 + j0,39	0,32 + j1,26
ZV3	110	15	0,12 + j0,386	0,22 + j1,1

Tablica 5, Podaci o kabelima

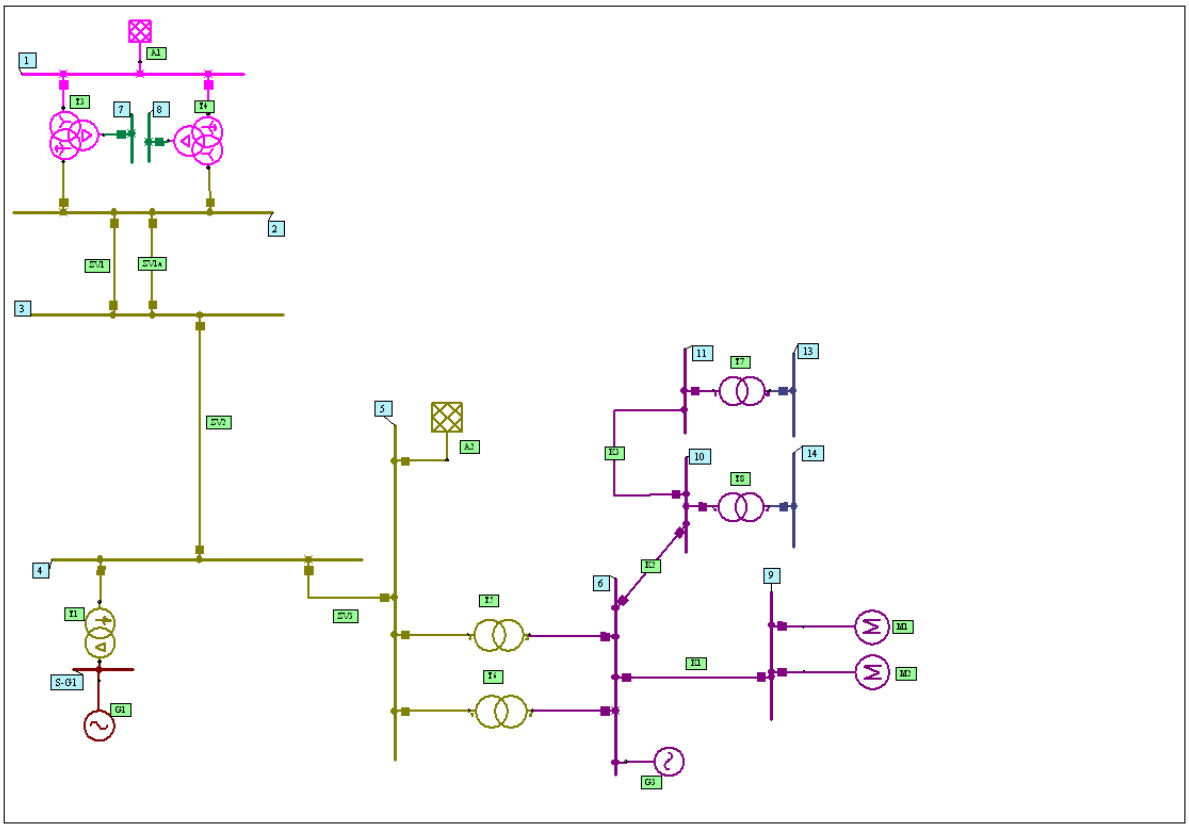
	U (kV)	Duljina (km)	Z_{dv} (Ω/km)	Z_{0v} (Ω/km)
K1	10	1	0,253 + j0,107	0,9361 + j0,963
K2	10	7	0,253 + j0,095	1,606 + j1,1875
K3	10	5,5	0,253 + j0,107	0,9361 + j0,963

Tablica 6, Podaci o aktivnim mrežama

	U (kV)	R_d/X_d	R_0/X_0	X_0/X_d	S''_{k3} (MVA)
A1	380	0,1	0,15	3	25011
A2	110	0,1	0,2	3,3	3048,4

Tablica 7, Podaci o motorima

	U (kV)	P (MW)	p	$\cos\rho_n$	η_n	I_p/I_n	R (Ω)
M1	10	5	1	0,88	0,975	5	0
M2	10	2	2	0,89	0,968	5,2	0
M3	10	2	2	0,89	0,968	5,2	0
M4	10	0,0031	2	0,85	0,959	4	0



Slika 1, Shema elektroenergetske mreže

2. *PRORAČUN NADOMJESNIH IMPEDANCIJA ELEMENATA MREŽE*

U_{REF} = 10 kV – odabrani refernetni (bazni) napon na koji se preračunavaju sve impendacije zbog kratkog spoja na sabirnici 11, koja se nalazi na 10 kV,

G1

$X''_{dG1} = x''_{dg1} \frac{U^2_{REF}}{S_{nG1}}$ = 0,0933 [Ω]

$R_{dG1} = R_{g1} \left(\frac{U_{REF}}{U_{nG1}}\right)^2$ = 0,0005 [Ω]

$X_{iG1} = x_{iG1} \frac{U^2_{REF}}{S_{nG1}}$ = 0,0933 [Ω]

$Z''_{dG1} = R_{dG1} + jX''_{dG1}$ = 0,0005 + j0,0933 [Ω]

$Z_{iG1} = R_{iG1} + jX_{iG1}$ = 0,0005 + j0,0933 [Ω]

$Z_{0G1} = \infty$

G2

$X''_{dG2} = x''_{dg2} \frac{U^2_{REF}}{S_{nG2}}$ = 0,16 [Ω]

$R_{dG2} = R_{g2} \left(\frac{U_{REF}}{U_{nG2}}\right)^2$ = 0,005 [Ω]

$X_{iG2} = x_{iG2} \frac{U^2_{REF}}{S_{nG2}}$ = 0,16 [Ω]

$Z''_{dG2} = R_{dG2} + jX''_{dG2}$ = 0,005 + j0,16 [Ω]

$Z_{iG2} = R_{iG2} + jX_{iG2}$ = 0,005 + j0,16 [Ω]

$Z_{0G2} = \infty$

G3

$X''_{dG3} = x''_{dg3} \frac{U^2_{REF}}{S_{nG3}}$ = 1 [Ω]

$R_{dG3} = R_{g3} \left(\frac{U_{REF}}{U_{nG3}}\right)^2$ = 0,018 [Ω]

$X_{iG3} = x_{iG3} \frac{U^2_{REF}}{S_{nG3}}$ = 1 [Ω]

$Z''_{dG3} = R_{dG3} + jX''_{dG3}$ = 0,018 + j1 [Ω]

$Z_{iG3} = R_{iG3} + jX_{iG3}$ = 0,018 + j1 [Ω]

$Z_{0G3} = \infty$

T1

$X_{dT1} = X_{iT1} = \frac{u_{k\%}}{100\%}\frac{U_{REF}^2}{S_{nT1}} = 0{,}1067\ [\Omega]$

$X_{0T1} = 0{,}95\ X_{dT1} = 0{,}1013\ [\Omega]$

$R_{dT1} = R_{iT1} = R_{0T1} = \frac{u_{r\%}}{100\%}\frac{U_{REF}^2}{S_{nT1}} = 0{,}0033\ [\Omega]$

$Z_{NT1} = Z_N \left(\frac{U_{REF}}{U_n}\right)^2 = j5{,}5\ [\Omega]$

$Z_{dT1} = Z_{iT1} = R_{dT1} + j\ X_{dT1} = 0{,}0033 + j0{,}1067\ [\Omega]$

$Z_{0T1} = R_{0T1} + j\ X_{0T1} + 3 \cdot Z_{NT1} = 0{,}0033 + j16{,}6\ [\Omega]$

T2

$X_{dT2} = X_{iT2} = \frac{u_{k\%}}{100\%}\frac{U_{REF}^2}{S_{nT2}} = 0{,}12\ [\Omega]$

$X_{0T2} = X_{dT2} = 0{,}12\ [\Omega]$

$R_{dT2} = R_{iT2} = R_{0T2} = \frac{u_{r\%}}{100\%}\frac{U_{REF}^2}{S_{nT2}} = 0{,}005\ [\Omega]$

$Z_{dT2} = Z_{iT2} = Z_{0T2} = R_{dT2} + j\ X_{dT2} = 0{,}005 + j0{,}12\ [\Omega]$

T5

$X_{dT5} = X_{iT5} = \frac{u_{k\%}}{100\%}\frac{U_{REF}^2}{S_{nT5}} = 0{,}38095\ [\Omega]$

$X_{0T5} = X_{dT5} = 0{,}38095\ [\Omega]$

$R_{dT5} = R_{iT5} = R_{0T5} = \frac{u_{r\%}}{100\%}\frac{U_{REF}^2}{S_{nT5}} = 0{,}015873\ [\Omega]$

$Z_{dT5} = Z_{iT5} = Z_{0T5} = R_{dT5} + j\ X_{dT5} = 0{,}015873 + j0{,}38095\ [\Omega]$

T6

$X_{dT6} = X_{iT6} = \frac{u_{k\%}}{100\%}\frac{U_{REF}^2}{S_{nT6}} = 0{,}38095\ [\Omega]$

$X_{0T6} = X_{dT6} = 0{,}38095\ [\Omega]$

$R_{dT6} = R_{iT6} = R_{0T6} = \frac{u_{r\%}}{100\%}\frac{U_{REF}^2}{S_{nT6}} = 0{,}015873\ [\Omega]$

$Z_{dT6} = Z_{iT6} = Z_{0T6} = R_{dT6} + j\ X_{dT6} = 0{,}015873 + j0{,}38095\ [\Omega]$

$Z_{NT6} = Z_N \left(\frac{U_{REF}}{U_n}\right)^2 = 80\ [\Omega]$

T7

$X_{dT7} = X_{iT7} = X_{0T7} = \frac{u_{k\%}}{100\%}\frac{U_{REF}^2}{S_{nT7}} = 5\ [\Omega]$

$R_{dT7} = R_{iT7} = R_{0T7} = \frac{u_{r\%}}{100\%}\frac{U_{REF}^2}{S_{nT7}} = 1{,}03\ [\Omega]$

$Z_{dT7} = Z_{iT7} = Z_{0T5} = R_{dT7} + \mathrm{j}\ X_{dT7} = 1{,}03 + \mathrm{j}5\ [\Omega]$

T3 i T4 – tronamotni transformatori jednakih podataka za direktni i inverzni sustav (različita shema kod nultog sustava)

$X_{d12} = X_{i12} = \frac{u_{k12\%}}{100\%}\frac{U_{REF}^2}{S_{n12}} = 0{,}06\ [\Omega]$

$X_{d13} = X_{i13} = \frac{u_{k13\%}}{100\%}\frac{U_{REF}^2}{S_{n13}} = 0{,}2\ [\Omega]$

$X_{d23} = X_{i23} = \frac{u_{k23\%}}{100\%}\frac{U_{REF}^2}{S_{n23}} = 0{,}14\ [\Omega]$

$X_{d1} = X_{i1} = \frac{1}{2}(X_{d12} + X_{d13} - X_{d23}) = 0{,}06\ [\Omega]$

$X_{d2} = X_{i2} = \frac{1}{2}(X_{d12} + X_{d23} - X_{d13}) = 0\ [\Omega]$

$X_{d3} = X_{i3} = \frac{1}{2}(X_{d13} + X_{d23} - X_{d12}) = 0{,}14\ [\Omega]$

$R_{d12} = R_{i12} = \frac{u_{r12\%}}{100\%}\frac{U_{REF}^2}{S_{n12}} = 0{,}0007486\ [\Omega]$

$R_{d13} = R_{i13} = \frac{u_{r13\%}}{100\%}\frac{U_{REF}^2}{S_{n13}} = 0{,}0032\ [\Omega]$

$R_{d23} = R_{i23} = \frac{u_{r23\%}}{100\%}\frac{U_{REF}^2}{S_{n23}} = 0{,}0032\ [\Omega]$

$R_{d1} = R_{i1} = \frac{1}{2}(R_{d12} + R_{d13} - R_{d23}) = 0{,}00037143\ [\Omega]$

$R_{d2} = R_{i2} = \frac{1}{2}(R_{d12} + R_{d23} - R_{d13}) = 0{,}00037143\ [\Omega]$

$R_{d3} = R_{i3} = \frac{1}{2}(R_{d13} + R_{d23} - R_{d12}) = 0{,}0028286\ [\Omega]$

$Z_{d1} = Z_{i1} = R_{d1} + \mathrm{j}X_{d1} = 0{,}00037143 + \mathrm{j}0{,}06\ [\Omega]$

$Z_{d2} = Z_{i2} = R_{d2} + \mathrm{j}X_{d2} = 0{,}00037143\ [\Omega]$

$Z_{d3} = Z_{i3} = R_{d3} + \mathrm{j}X_{d3} = 0{,}0028286 + \mathrm{j}0{,}14\ [\Omega]$

$X_{012} = \frac{u_{k012\%}}{100\%}\frac{U_{REF}^2}{S_{n12}} = 0{,}027171\ [\Omega]$

$X_{013} = \frac{u_{k013\%}}{100\%}\frac{U_{REF}^2}{S_{n13}} = 0{,}1902\ [\Omega]$

$X_{023} = \frac{u_{k023\%}}{100\%} \frac{U_{REF}^2}{S_{n23}} = 0{,}126\ [\Omega]$

$X_{01} = \frac{1}{2}(X_{012} + X_{013} - X_{023}) = 0{,}045686\ [\Omega]$

$X_{02} = \frac{1}{2}(X_{012} + X_{023} - X_{013}) = -0{,}018514\ [\Omega]$

$X_{03} = \frac{1}{2}(X_{013} + X_{023} - X_{012}) = 0{,}14451\ [\Omega]$

$Z_{01} = R_{01} + jX_{01} = 0{,}00037143 + j0{,}045686\ [\Omega]$

$Z_{02} = R_{02} + jX_{02} = 0{,}00037143 - j0{,}018514\ [\Omega]$

$Z_{03} = R_{03} + jX_{03} = 0{,}0028286 + j0{,}14451\ [\Omega]$

ZV1, ZV1a

$Z_{dV1} = Z_{iV1} = Z_{dV1a} = Z_{iV1a} = Z_{dV1} \cdot l \cdot \left(\frac{U_{REF}}{U_n}\right)^2 = 0{,}019835 + j0{,}064463\ [\Omega]$

$Z_{0V1} = Z_{0V1a} = Z_0 \cdot l \cdot \left(\frac{U_{REF}}{U_n}\right)^2 = 0{,}052893 + j0{,}20826i\ [\Omega]$

ZV2

$Z_{dV2} = Z_{iV2} = Z_{dV2} \cdot l \cdot \left(\frac{U_{REF}}{U_n}\right)^2 = 0{,}0099174 + j0{,}032231\ [\Omega]$

$Z_{0V2} = Z_0 \cdot l \cdot \left(\frac{U_{REF}}{U_n}\right)^2 = 0{,}026446 + j0{,}10413\ [\Omega]$

ZV3

$Z_{dV3} = Z_{iV3} = Z_{dV3} \cdot l \cdot \left(\frac{U_{REF}}{U_n}\right)^2 = 0{,}014876 + j0{,}047851\ [\Omega]$

$Z_{0V3} = Z_0 \cdot l \cdot \left(\frac{U_{REF}}{U_n}\right)^2 = 0{,}027273 + j0{,}13636\ [\Omega]$

K1

$Z_{dK1} = Z_{iK1} = Z_{dK1} \cdot l \cdot \left(\frac{U_{REF}}{U_n}\right)^2 = 0{,}253 + j0{,}107\ [\Omega]$

$Z_{0K1} = Z_{0K1} \cdot l \cdot \left(\frac{U_{REF}}{U_n}\right)^2 = 0{,}9361 + j0{,}963\ [\Omega]$

K2

$Z_{dK2} = Z_{iK2} = Z_{dK2} \cdot l \cdot \left(\frac{U_{REF}}{U_n}\right)^2 = 1{,}771 + j0{,}665\ [\Omega]$

$Z_{0K2} = Z_{0K2} \cdot l \cdot \left(\frac{U_{REF}}{U_n}\right)^2 = 11{,}242 + j8{,}3125\ [\Omega]$

K3

$Z_{dK3} = Z_{iK3} = Z_{dK3} \cdot l \cdot \left(\frac{U_{REF}}{U_n}\right)^2 = 1{,}3915 + j0{,}5885\ [\Omega]$

$Z_{0K3} = Z_{0K3} \cdot l \cdot \left(\frac{U_{REF}}{U_n}\right)^2 = 5{,}1486 + j5{,}2965\ [\Omega]$

A1

$X_{dA1} = X_{iA1} = \frac{U_{REF}^2}{S_{k3}''} = 0{,}0039982\ [\Omega]$

$X_{0A1} = 3 \cdot X_{dA1} = 0{,}011995\ [\Omega]$

$R_{dA1} = 0{,}1 \cdot X_{dA1} = 0{,}00039982\ [\Omega]$

$R_{0A1} = 0{,}15 \cdot X_{0A1} = 0{,}0017992\ [\Omega]$

$Z_{dA1} = Z_{iA1} = R_{dA1} + jX_{dA1} = 0{,}00039982 + j0{,}0039982\ [\Omega]$

$Z_{0A1} = R_{0A1} + jX_{OA1} = 0{,}0017992 + j0{,}011995\ [\Omega]$

A2

$X_{dA2} = X_{iA2} = \frac{U_{REF}^2}{S_{k3}''} = 0{,}032804\ [\Omega]$

$X_{0A2} = 3{,}3 \cdot X_{dA2} = 0{,}098412\ [\Omega]$

$R_{dA2} = 0{,}1 \cdot X_{dA2} = 0{,}0032804\ [\Omega]$

$R_{0A2} = 0{,}2 \cdot X_{0A2} = 0{,}019682\ [\Omega]$

$Z_{dA2} = Z_{iA2} = R_{dA2} + jX_{dA2} = 0{,}0032804 + j0{,}032804\ [\Omega]$

$Z_{0A2} = R_{0A2} + jX_{OA2} = 0{,}019682 + j0{,}098412\ [\Omega]$

M1

$X_{dM1} = X_{iM1} = \frac{1}{\frac{I_p}{I_n}} \frac{U_{REF}^2}{P_n} \eta \cdot \cos\varphi = 3{,}432\ [\Omega]$

$X_{0M1} = \infty \longrightarrow Z_{0M1} = \infty$ - nije uzemljen

$Z_{dM1} = Z_{iM1} = j3{,}432\ [\Omega]$

M2

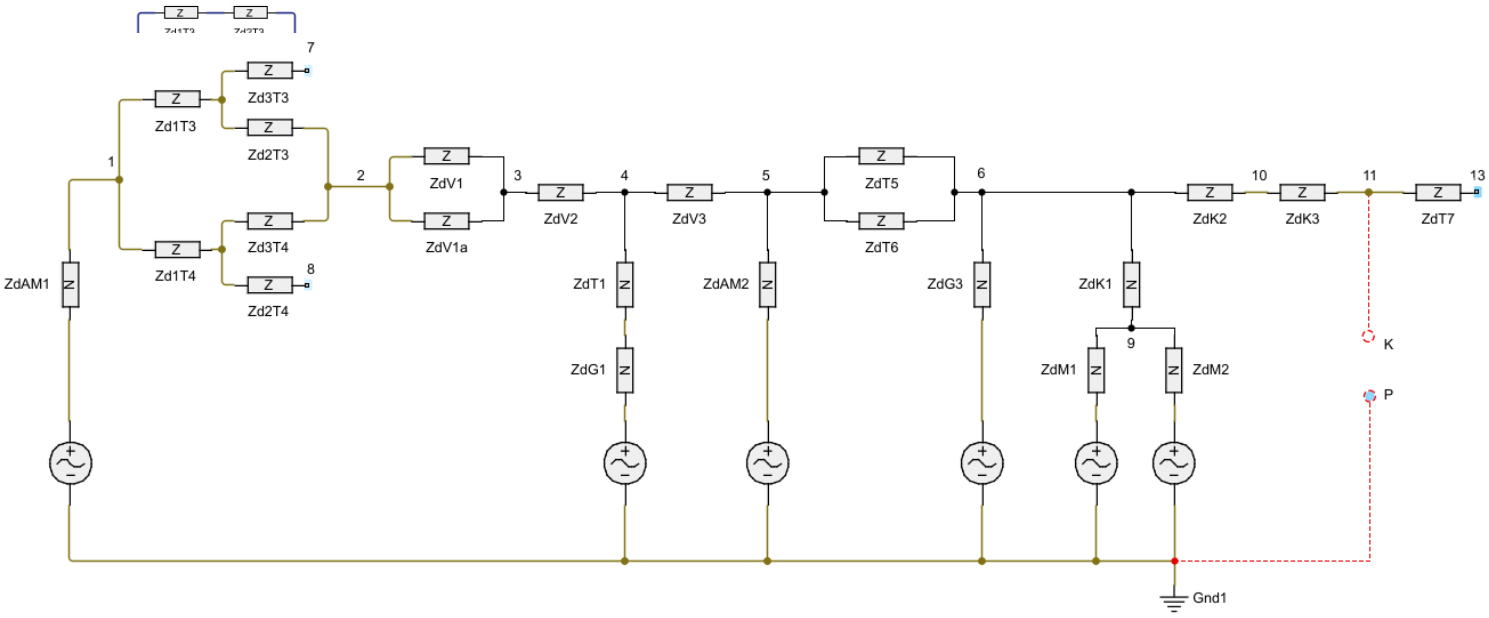
$X_{dM2} = X_{iM2} = \frac{1}{\frac{I_p}{I_n}} \frac{U_{REF}^2}{P_n} \eta \cdot \cos\varphi = 8{,}2838\ [\Omega]$

$X_{0M2} = \infty \longrightarrow Z_{0M2} = \infty$ - nije uzemljen

$Z_{dM2} = Z_{iM2} = j8{,}2838i\ [\Omega]$

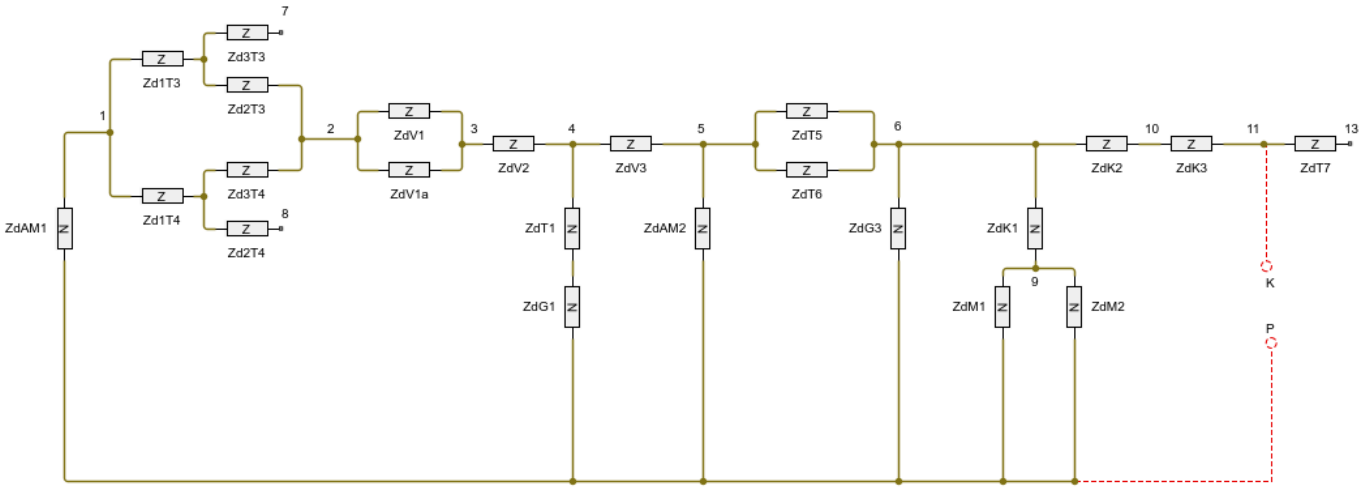
3. NADOMJESNE SHEME EEM U SUSTAVU SIMETRIČNIH KOMPONENTI

3.1.Nadomjesna shema za direktni sustav



Z''_{dUK} = 3,1707 + j1,4191 [Ω]

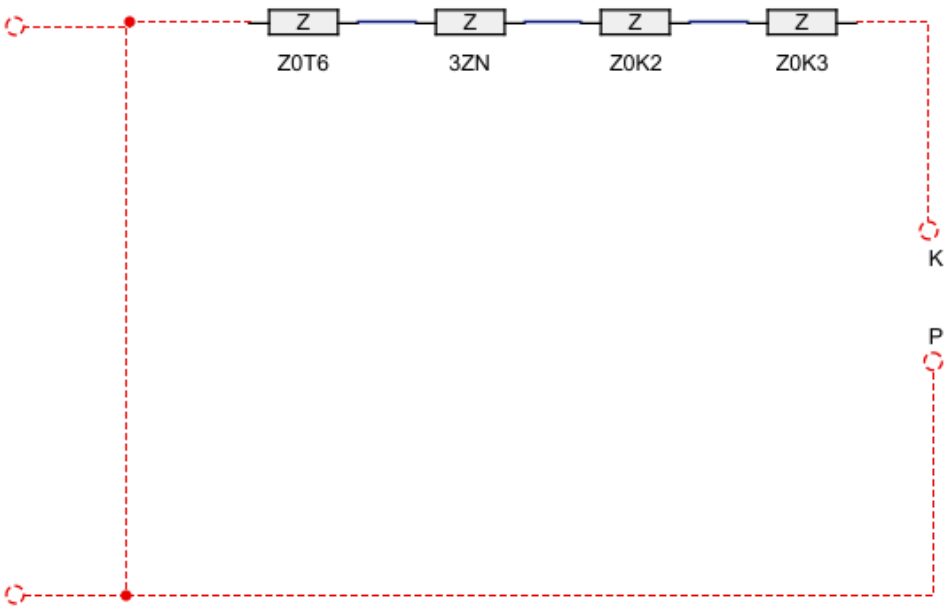
3.2.Nadomjesna shema EEM u inverznom sustavu



$$Z_{iUK} = Z''_{dUK} = 3{,}1707 + j1{,}4191\ [\Omega]$$

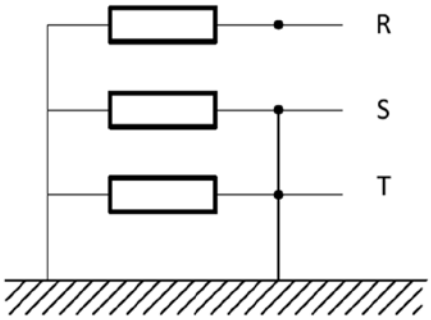
3.3.Nadomjesna shema EEM u nultom sustavu

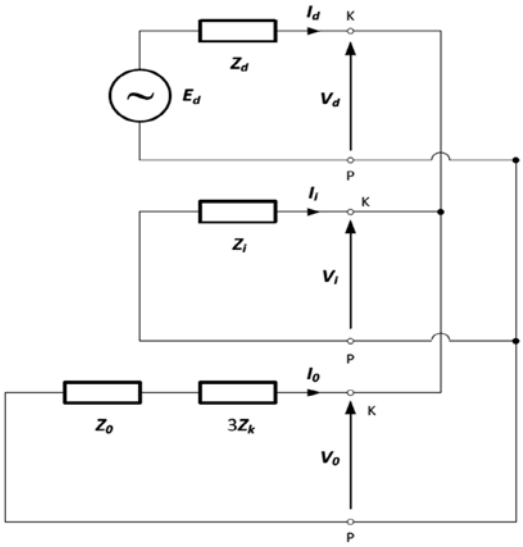
NULTI SUSTAV



Z_{0UK} = 96.4064 + j13.9900 [Ω]

3.4.U - I prilike na mjestu kvara (sabirnica 11)





Slika 3,4, Nadomjesna shema 2pz KS s pripadajućim vrijednostima impedancija

U-I prilike na mjestu KS ako je KS nastao među fazama S i T :

$\bar{V}_S = 0$, $\bar{V}_T = 0$, $\bar{V}_d = \bar{V}_i = \bar{V}_0$

$\bar{I}_R = 0$, $\bar{I}_d'' + \bar{I}_i + \bar{I}_0 = 0$

$$\bar{I}''_{K2pz} = -\frac{\sqrt{3}\cdot U_{REF}\cdot Z_i}{Z_d Z_i + Z_d Z_0 + Z_i Z_0} = 0{,}087399 \angle 171{,}468784^o \text{ [kA]}$$

$$\bar{I}''_d = \frac{U_{REF}}{\sqrt{3}} \cdot \frac{Z_0 + Z_i}{Z_d Z_i + Z_d Z_0 + Z_i Z_0} = 0{,}845051 \angle -23{,}846432^o \text{ [kA]}$$

$$\bar{I}_i = -\frac{U_{REF}}{\sqrt{3}} \cdot \frac{Z_0}{Z_d Z_i + Z_d Z_0 + Z_i Z_0} = 0{,}816988 \angle 155{,}613912^o \text{ [kA]}$$

$$\bar{I}_0 = -\frac{U_{REF}}{\sqrt{3}} \cdot \frac{Z_i}{Z_d Z_i + Z_d Z_0 + Z_i Z_0} = 0{,}029133 \angle 171{,}468784^o \text{ [kA]}$$

$$\bar{I}_s = \frac{U_{REF}}{\sqrt{3}} \cdot \frac{Z_i(a^2-1)+Z_0(a^2-a)}{Z_d Z_i + Z_d Z_0 + Z_i Z_0} = \ 1{,}451700 \ \angle \text{-}115{,}773304^{o}\ [\text{kA}]$$

$$\bar{I}_T = \frac{U_{REF}}{\sqrt{3}} \cdot \frac{Z_i(a-1)+Z_0(a-a^2)}{Z_d Z_i + Z_d Z_0 + Z_i Z_0} = \ 1{,}428235 \ \angle 67{,}577203^{o}\ [\text{kA}]$$

$\bar{V}_d = \bar{E}_d - \bar{I}''_d \cdot Z''_{dUK} = 2{,}838042 \angle \text{-}0{,}27 \text{-}77{,}6486754384^{o}$ [kV]

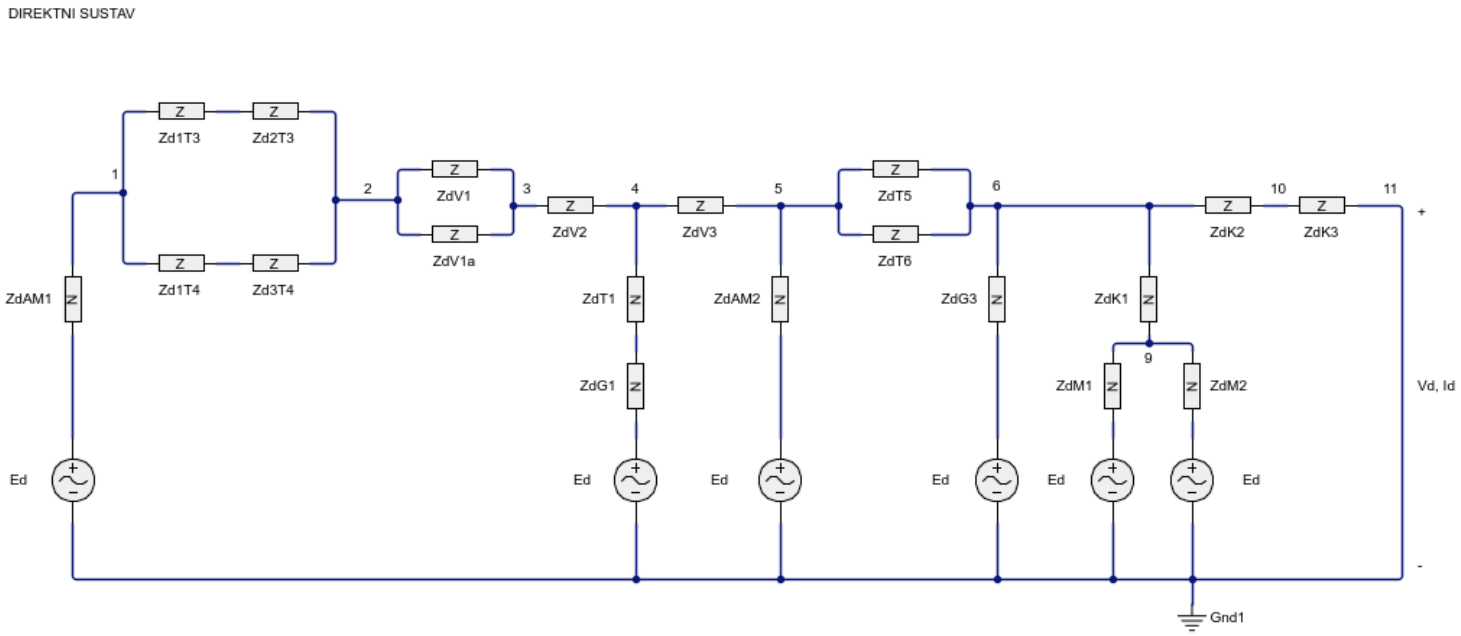
$\bar{V}_i = - \bar{I}_i \cdot Z_{iUK} = 2{,}838042 \angle \text{-}0{,}274384^{o}$[kV]

$\bar{V}_0 = - \bar{I}_0 \cdot Z_{0UK} = 2{,}838042 \angle \text{-}0{,}274384^{o}$ [kV]

$\bar{V}_R = \bar{V}_d + \bar{V}_i + \bar{V}_0 = 8{,}514126 \ \angle \text{-}0{,}274384^{o}$ [kV]

4. UDIO POJEDINIH IZVORA U STRUJI KRATKOG SPOJA

DIREKTNI SUSTAV



$\bar{I}_{dM1} = 0{,}402266 \angle 75{,}782591º$ [kA]

$\bar{I}_{dM2} = 0{,}166659 \angle 75{,}782591º$ [kA]

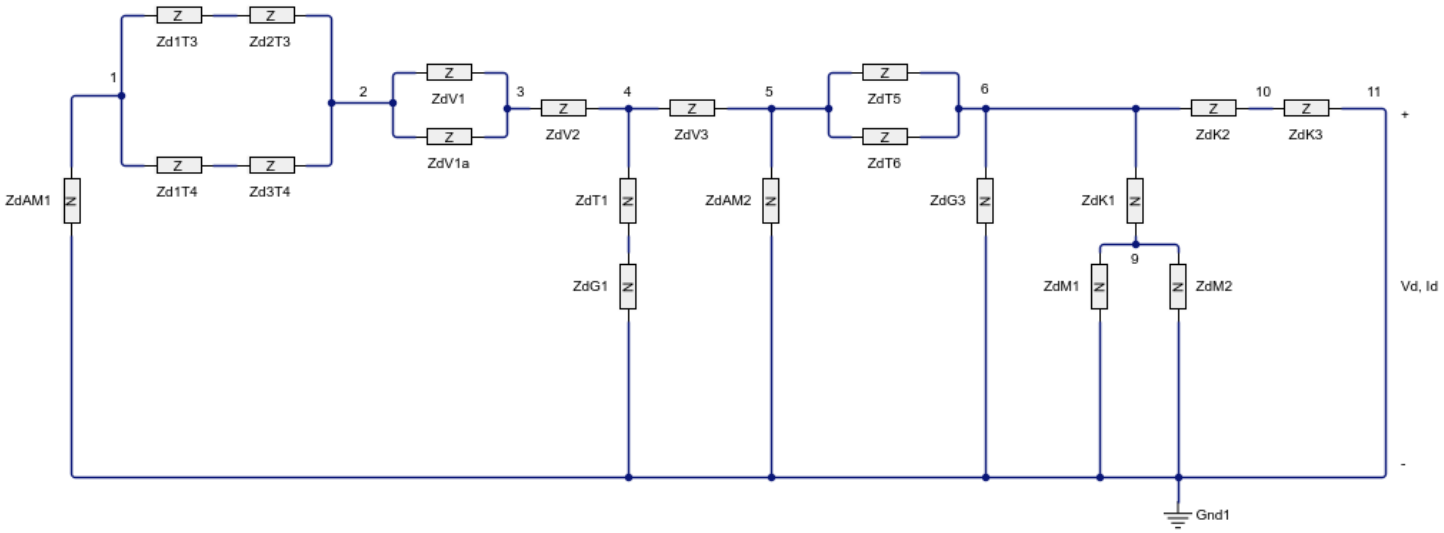
$\bar{I}_{dG1} = 28{,}888772 \angle 91{,}065720º$ [kA]

$\bar{I}_{dG2} = 1{,}112485 \angle -83{,}378530º$ [kA]

$\bar{I}_{dAM1} = 19{,}234885 \angle -85{,}285946º$ [kA]

$\bar{I}_{dAM2} = 175{,}287157 \angle 95{,}678278º$ [kA]

INVERZNI SUSTAV



$I_{dM1} = 1{,}296082 \angle -85{,}628237º$ [kA]

$\bar{I}_{dM2} = 0{,}536967 \angle -85{,}628237º$ [kA]

$\bar{I}_{dG1} = 0{,}385397 \angle -77{,}866433º$ [kA]

$\bar{I}_{dG2} = 1{,}075542 \angle -83{,}918187º$ [kA]

$\bar{I}_{dAM1} = 39{,}445081 \angle -74{,}255016º$ [kA]

$\bar{I}_{dAM2} = 2{,}338459 \angle -73{,}253874º$ [kA]

NULTI SUSTAV

Obzirom da se nulta struja može zatvarati samo preko uzemljenog transformatora T6, te kabela K2 i K3, izvori EMS-a u zadanom EES-u ne sudjeluju u nultoj struji,

Udio aktivne mreže 1 (A1) u struji kratkog spoja:

$I_{A1R} = (I_{dA1}+I_{iA1}) \cdot \frac{U_{REF}}{U_n} = 1{,}537910 \angle -77{,}865691^o$ [kA]

$I_{A1S} = (a^2 \cdot I_{dA1}+a \cdot I_{iA1}) \cdot \frac{U_{REF}}{U_n} = 0{,}996058 \angle 74{,}468729$ [kA]

$I_{A1T} = (a \cdot I_{dlijevo}+a^2 \cdot I_{ilijevo}) \cdot \frac{U_{REF}}{U_n} = 0{,}802414 \angle 137{,}329307^o$ [kA]

Udio aktivne mreže 2 (A2) u struji kratkog spoja:

$I_{A2R} = (I_{dA2}+I_{iA2}) \cdot \frac{U_{REF}}{U_n} = 15{,}726616 \angle 95{,}529595^o$ [kA]

$I_{A2S} = (a^2 \cdot I_{dA2}+a \cdot I_{iA2}) \cdot \frac{U_{REF}}{U_n} = 16{,}005433 \angle -23{,}601858^o$ [kA]

$I_{A2T} = (a \cdot I_{dA2}+a^2 \cdot I_{iA2}) \cdot \frac{U_{REF}}{U_n} = 16{,}075655 \angle -144{,}892977^o$ [kA]

Udio generatora 1 (G1) u struji kratkog spoja:

$I_{G1R} = (I_{dG1} \cdot e^{\frac{-jk\pi}{6}}+I_{iG1} \cdot e^{\frac{jk\pi}{6}}) \cdot \frac{U_{REF}}{U_n} = 2{,}131593 \angle -77{,}865691^o$ [kA]

$I_{G1S} = (a^2 \cdot I_{dG1} \cdot e^{\frac{-jk\pi}{6}}+a \cdot I_{iG1} \cdot e^{\frac{jk\pi}{6}}) \cdot \frac{U_{REF}}{U_n} = 1{,}380569 \angle 74{,}468729^o$ [kA]

$I_{G1T} = (a \cdot I_{dG1} \cdot e^{\frac{-jk\pi}{6}}+a^2 \cdot I_{iG1} \cdot e^{\frac{jk\pi}{6}}) = 1{,}112171 \angle 137{,}329307^o$ [kA]

Udio generatora 3 (G3) u struji kratkog spoja:

$I_{G3R} = (I_{dG3}+I_{iG3}) \cdot \frac{U_{REF}}{U_n} = 12{,}619660 \angle 95{,}529595^o$ [kA]

$I_{G3S} = (a^2 \cdot I_{dG3}+a \cdot I_{iG3}) \cdot \frac{U_{REF}}{U_n} = 14{,}031268 \angle -13{,}206055^o$ [kA]

$I_{G3T} = (a \cdot I_{dG3}+a^2 \cdot I_{iG3}) \cdot \frac{U_{REF}}{U_n} = 14{,}803910 \angle -152{,}876381^o$ [kA]

Udio asinkronog motora 1 u struji kratkog spoja:

$I_{M1R} = (I_{dM1}+I_{iM1}) \cdot \frac{U_{REF}}{U_n} = 0{,}913768 \angle -79{,}355665^o$ [kA]

$I_{M1S} = (a^2 \cdot I_{dM1}+a \cdot I_{iM1}) \cdot \frac{U_{REF}}{U_n} = 1{,}405147 \angle 18{,}915227^o$ [kA]

$I_{M1T} = (a \cdot I_{dM1}+a^2 \cdot I_{iM1}) \cdot \frac{U_{REF}}{U_n} = 1{,}648659 \angle 163{,}961203^o$ [kA]

Udio asinkronog motora 2 u struji kratkog spoja:

$I_{M2R} = (I_{dM2}+I_{iM2}) \cdot \frac{U_{REF}}{U_n} = 0{,}382709 \angle -77{,}648675^{o}$ [kA]

$I_{M2S} = (a^2 \cdot I_{dM2}+a \cdot I_{iM2}) \cdot \frac{U_{REF}}{U_n} = 0{,}592890 \angle 18{,}377599^{o}$ [kA]

$I_{M2T} = (a \cdot I_{dM2}+a^2 \cdot I_{iM2}) \cdot \frac{U_{REF}}{U_n} = 0{,}671075 \angle 163{,}826558^{o}$ [kA]