

# Z\_6-kol2

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#ZADAZAK 6
#Zadatak se rjesava pomocu nadomijesne sheme s ideanim trafom (meze \
  i shema s reduciranim velicinama).
#Zadavanje varijabli:
var('U_1','R_1','X_r1','Y_p','R_2','X_r2','U_1g','Z_T','I_1','I_2','\
  I_0','Z_p','n','S_1','S_2','U_2','eta_')
#Definiranje realnih varijabli
assume(R_1,'real',X_r1,'real',R_2,'real',X_r2,'real',n,'real')
(U_1, R_1, X_r1, Y_p, R_2, X_r2, U_1g, Z_T, I_1, I_2, I_0, Z_p, n, S_1, S_2, U_2, eta_)

#Iz nadomijesne sheme slijede jednadzbe KZN-a, KZS-a u kojima su \
  ukonponirane jednadzbe idealnog trafoa:
KZN_A=U_1-I_1*(R_1+I*X_r1)-I_0*Z_p==0
KZN_B=I_2*(R_2+I*X_r2+Z_T)+U_1g/n==0
KZS=I_1+I_2/n-I_0==0
#Jos dodatno jednakost napona na poprecnoj grani i napona primara \
  idealnog trafoa:
KZN_C=I_0*Z_p==U_1g
#Susatv je jednadzbi
SUSjed=[KZN_A,KZN_B,KZN_C,KZS];show(SUSjed)
```

$$[-l_1(R_1 + iX_{r1}) - l_0Z_p + U_1 = 0, l_2(R_2 + iX_{r2} + Z_T) + \frac{U_{1g}}{n} = 0, l_0Z_p = U_{1g}, -l_0 + l_1 + \frac{l_2}{n} = 0]$$

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#a njegova su rjesenja:
RJES=solve(SUSjed,I_1,I_0,I_2,U_1g);RJES;show(RJES)
[[I_1 == (R_2*n^2 + I*X_r2*n^2 + Z_T*n^2 + Z_p)*U_1/((R_2*n^2 + I*X_r2*n^2 + Z_T*n^2 +
Z_p)*R_1 + (I*R_2*n^2 - X_r2*n^2 + I*Z_T*n^2)*X_r1 + (R_2*n^2 + I*X_r2*n^2 + Z_T*n^2 +
I*X_r1)*Z_p), I_0 == (R_2*n^2 + I*X_r2*n^2 + Z_T*n^2)*U_1/((R_2*n^2 + I*X_r2*n^2 + Z_T*n^2 +
Z_p)*R_1 + (I*R_2*n^2 - X_r2*n^2 + I*Z_T*n^2)*X_r1 + (R_2*n^2 + I*X_r2*n^2 + Z_T*n^2 +
I*X_r1)*Z_p), I_2 == -U_1*Z_p*n/((R_2*n^2 + I*X_r2*n^2 + Z_T*n^2 + Z_p)*R_1 + (I*R_2*n^2 -
X_r2*n^2 + I*Z_T*n^2)*X_r1 + (R_2*n^2 + I*X_r2*n^2 + Z_T*n^2 + I*X_r1)*Z_p), U_1g ==
(R_2*n^2 + I*X_r2*n^2 + Z_T*n^2)*U_1*Z_p/((R_2*n^2 + I*X_r2*n^2 + Z_T*n^2 + Z_p)*R_1 +
(I*R_2*n^2 - X_r2*n^2 + I*Z_T*n^2)*X_r1 + (R_2*n^2 + I*X_r2*n^2 + Z_T*n^2 + I*X_r1)*Z_p)]]
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$$I_1 = \frac{(R_2 n^2 + i X_{r2} n^2 + Z_T n^2 + Z_p) U_1}{(R_2 n^2 + i X_{r2} n^2 + Z_T n^2 + Z_p) R_1 + (i R_2 n^2 - X_{r2} n^2 + i Z_T n^2) X_{r1} + (R_2 n^2 + i X_{r2} n^2 + Z_T n^2 + i X_{r1}) Z_p}$$

$$I_0 = \frac{(R_2 n^2 + i X_{r2} n^2 + Z_T n^2 + Z_p) U_1}{(R_2 n^2 + i X_{r2} n^2 + Z_T n^2 + Z_p) R_1 + (i R_2 n^2 - X_{r2} n^2 + i Z_T n^2) X_{r1} + (R_2 n^2 + i X_{r2} n^2 + Z_T n^2 + i X_{r1}) Z_p}$$

$$I_2 = - \frac{U_1 Z_p n}{(R_2 n^2 + i X_{r2} n^2 + Z_T n^2 + Z_p) R_1 + (i R_2 n^2 - X_{r2} n^2 + i Z_T n^2) X_{r1} + (R_2 n^2 + i X_{r2} n^2 + Z_T n^2 + i X_{r1}) Z_p}$$

$$U_{1g} = \frac{(R_2 n^2 + i X_{r2} n^2 + Z_T n^2 + Z_p) U_1 Z_p}{(R_2 n^2 + i X_{r2} n^2 + Z_T n^2 + Z_p) R_1 + (i R_2 n^2 - X_{r2} n^2 + i Z_T n^2) X_{r1} + (R_2 n^2 + i X_{r2} n^2 + Z_T n^2 + i X_{r1}) Z_p}$$

#Izracun svih struja za zadane numericke podatke:

```
I_1=((R_2*n^2 + I*X_r2*n^2 + Z_T*n^2 + Z_p)*U_1/((R_2*n^2 + I*X_r2*n^2 + Z_T*n^2 + Z_p)*R_1 + (I*R_2*n^2 - X_r2*n^2 + I*Z_T*n^2)*X_r1 + (R_2*n^2 + I*X_r2*n^2 + Z_T*n^2 + I*X_r1)*Z_p)).subs(U_1=6300, R_1=0.5, X_r1=1, Z_p=1/(0.0002-I*0.0004), R_2=0.08, X_r2=0.2, n=10000/2000, Z_T=1+I*0.5); I_1
```

158.820031174011 - 108.512194086248\*I

```
I_2=(-U_1*Z_p*n/((R_2*n^2 + I*X_r2*n^2 + Z_T*n^2 + Z_p)*R_1 + (I*R_2*n^2 - X_r2*n^2 + I*Z_T*n^2)*X_r1 + (R_2*n^2 + I*X_r2*n^2 + Z_T*n^2 + I*X_r1)*Z_p)).subs(U_1=6300, R_1=0.5, X_r1=1, Z_p=1/(0.0002-I*0.0004), R_2=0.08, X_r2=0.2, n=10000/2000, Z_T=1+I*0.5); I_2
```

-788.197205947992 + 530.232250916455\*I

```
I_0=((R_2*n^2 + I*X_r2*n^2 + Z_T*n^2)*U_1/((R_2*n^2 + I*X_r2*n^2 + Z_T*n^2 + Z_p)*R_1 + (I*R_2*n^2 - X_r2*n^2 + I*Z_T*n^2)*X_r1 + (R_2*n^2 + I*X_r2*n^2 + Z_T*n^2 + I*X_r1)*Z_p)).subs(U_1=6300, R_1=0.5, X_r1=1, Z_p=1/(0.0002-I*0.0004), R_2=0.08, X_r2=0.2, n=10000/2000, Z_T=1+I*0.5); I_0
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1.18058998441299 - 2.46574390295688\*I

#Kompleksna je snaga primara:

```
S_1=(U_1*conjugate(I_1)).subs(U_1=6300); S_1
```

1.00056619639627e6 + 683626.822743362\*I

#Kompleksna je snaga sekundara:

```
S_2=(I_2*Z_T*conjugate(I_2)).subs(Z_T=1+I*0.5); S_2
```

902401.075376151 + 451200.537688076\*I

#Korisnost je omjer djelatnih snaga sekundara i primara:

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show(eta_==real(S_2)/real(S_1))
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$\eta = 0.901890428265836$