Prijenos i razdjela električne energije

2. međuispit

6. svibnja 2011.

Grupa B

1. zadatak

a)

$$L = 2 \cdot 10^{-7} \ln\left(\frac{D_m}{D_s}\right)$$

Faza a:

$$D_m = \sqrt[1\cdot 2]{D_{ab}D_{ac}} = \sqrt{13 \cdot 8} = 10.198m$$

$$D_s = \sqrt[2^2]{(r'd_s)(r'd_s)} = \sqrt{r'd_s} = 0.04669732326m$$

$$L_a = 1.077252011 \cdot 10^{-6}\frac{H}{m} \rightarrow X_a = 0.3384287005\frac{\Omega}{km}$$

Faza b:

$$D_m = \sqrt[1\cdot 2]{D_{ab}D_{bc}} = \sqrt{13 \cdot 11} = 11.958m$$

$$D_s = \sqrt[2^2]{(r'd_s)(r'd_s)} = \sqrt{r'd_s} = 0.04669732326m$$

$$L_b = 1.10909815 \cdot 10^{-6}\frac{H}{m} \rightarrow X_b = 0.3484334599\frac{\Omega}{km}$$

Faza c:

$$D_m = \sqrt[1\cdot 2]{D_{ac}D_{bc}} = \sqrt{11 \cdot 8} = 9.381m$$

$$D_s = \sqrt[2^2]{(r'd_s)(r'd_s)} = \sqrt{r'd_s} = 0.04669732326m$$

$$L_c = 1.060547368 \cdot 10^{-6}\frac{H}{m} \rightarrow X_c = 0.3331807821\frac{\Omega}{km}$$

b)
faza a = faza b = faza c

faza a:

I)

$$L_{aI} = 2 \cdot 10^{-7} \ln\left(\frac{D_m}{D_s}\right) = 1.077252011 \cdot 10^{-6} \frac{H}{m}$$

II)

$$L_{aII} = 2 \cdot 10^{-7} \ln\left(\frac{D_m}{D_s}\right) = 1.10909815 \cdot 10^{-6} \frac{H}{m}$$

III)

$$L_{aIII} = 2 \cdot 10^{-7} \ln\left(\frac{D_m}{D_s}\right) = 1.060547368 \cdot 10^{-6} \frac{H}{m}$$

$$L_a = \frac{1}{3}(L_{aI} + L_{aII} + L_{aIII}) = 1.082299176 \cdot 10^{-6} \frac{H}{m}$$

$$X_1 = 2\pi f L_a = 0.34 \frac{\Omega}{km}$$

(provjera se obavi tako da u a) dijelu zadatka zbrojite $X_a + X_b + X_c$ i podijelite s 3 i vidite da se dobije 0.34)

2. zadatak

$$L = 2 \cdot 10^{-7} \ln\left(\frac{D_m}{D_s}\right)$$

Faza a:

I)

$$D_m = \sqrt[1\cdot 2]{D_{ab} D_{ac}} = \sqrt{D \cdot 2D} = D\sqrt{2}$$

$$D_s = \sqrt[1^2]{r'} = r'$$

$$L_{aI} = 2 \cdot 10^{-7} \ln\left(\frac{D\sqrt{2}}{r'}\right)$$

II)

$$D_m = \sqrt[1\cdot 2]{D_{ab} D_{ac}} = \sqrt{D \cdot D} = D$$

$$D_s = \sqrt[1^2]{r'} = r'$$

$$L_{aII} = 2 \cdot 10^{-7} \ln\left(\frac{D}{r'}\right)$$

$$L_a = \frac{1}{2}(L_{aI} + L_{aII}) = 2 \cdot 10^{-7} \ln\left(\frac{D\sqrt[4]{2}}{r'}\right) = 1.459858776 \frac{mH}{km}$$

Faza b = Faza a → $L_b = 1.459858776 \frac{mH}{km}$

Faza c:

I)

$$D_m = \sqrt[1\cdot 2]{D_{ab} D_{ac}} = \sqrt{D \cdot 2D} = D\sqrt{2}$$

$$D_s = \sqrt[1^2]{r'} = r'$$

$$L_{cI} = 2 \cdot 10^{-7} \ln\left(\frac{D\sqrt{2}}{r'}\right)$$

II)

$$D_m = \sqrt[1\cdot 2]{D_{ab} D_{ac}} = \sqrt{D \cdot 2D} = D\sqrt{2}$$

$$D_s = \sqrt[1^2]{r'} = r'$$

$$L_{cII} = 2 \cdot 10^{-7} \ln\left(\frac{D\sqrt{2}}{r'}\right)$$

$$L_c = \frac{1}{2}(L_{cI} + L_{cII}) = 2 \cdot 10^{-7} \ln\left(\frac{D\sqrt{2}}{r'}\right) = 1.494516235 \frac{mH}{km}$$

3. zadatak

$$\frac{(31.188 + 29.668 + 29.816)}{3} = 30.224$$

$$\frac{(-3.908 - 6.743 - 5.606)}{3} = -5.419$$

$$[B^{abc}]_{prepleteno} = \begin{bmatrix} 30.224 & -5.419 & -5.419 \\ & 30.224 & -5.419 \\ & & 30.224 \end{bmatrix} \cdot 10^{-7} \frac{S}{km}$$

$$30.224 — 5.419 = 35.643$$

$$30.224 + 2(-5.419) = 19.386$$

$$[B^{012}]_{prepleteno} = \begin{bmatrix} 19.386 & 0 & 0 \\ 0 & 35.643 & 0 \\ 0 & 0 & 35.643 \end{bmatrix} \cdot 10^{-7} \frac{S}{km}$$

$$B_0 = 19.386 \cdot 10^{-7} \frac{S}{km} = 1.9386 \frac{\mu S}{km}$$

$$B_1 = 35.643 \cdot 10^{-7} \frac{S}{km} = 3.5643 \frac{\mu S}{km}$$

$$C_0 = \frac{B_0}{\omega} = 6.17 \frac{nF}{km}$$

$$C_1 = \frac{B_1}{\omega} = 11.35 \frac{nF}{km}$$

4. zadatak

	udaljenost
D12	12,64911064
D13	8,246211251
D14	22,26971037
D23	10,77032961
D24	18,15323663
D34	14,04065526

	impedancija	
	realni	imaginarni
Z12	0,05	0,282620742
Z13	0,05	0,309488658
Z14	0,05	0,247098514
Z23	0,05	0,292718467
Z24	0,05	0,25993349
Z34	0,05	0,276066295
Z11,Z22,Z33	0,14	0,730409479
Z44	1,57	0,776402183

[Zvod]	0,14 + j*0,730409479	0,05 + j*0,282620742	0,05 + j*0,309488658	0,05 + j*0,247095814
	0,05 + j*0,282620742	0,14 + j*0,730409479	0,05 + j*0,292718467	0,05 + j*0,25993349
	0,05 + j*0,309488658	0,05 + j*0,292718467	0,14 + j*0,730409479	0,05 + j*0,276066295
	0,05 + j*0,247095814	0,05 + j*0,25993349	0,05 + j*0,276066295	1,57 + j*0,776402183

[Zvod]prepl

0,14 + j*0,730409479	0,05 + j*0,294942622	0,05 + j*0,294942622	0,05 + j*0,261032766
0,05 + j*0,294942622	0,14 + j*0,730409479	0,05 + j*0,294942622	0,05 + j*0,261032766
0,05 + j*0,294942622	0,05 + j*0,294942622	0,14 + j*0,730409479	0,05 + j*0,261032766
0,05 + j*0,261032766	0,05 + j*0,261032766	0,05 + j*0,261032766	1,57 + j*0,776402183

Pivotiranje

[Zabc]prepl

0,166986 + j*0,700438	0,0769816 + j*0,264971	0,0769816 + j*0,264971
	0,166986 + j*0,700438	0,0769816 + j*0,264971
		0,166986 + j*0,700438

5. zadatak

$$C_A = \frac{1}{18 \cdot 10^9 \ln\left(\frac{D_m}{D_{ss}}\right)}$$

$$H_1 = \sqrt{(2h)^2 + D^2} = 32.5m$$

$$H_2 = \sqrt{(2h)^2 + (2D)^2} = 5\sqrt{61}m$$

$$D_m = \sqrt[3\cdot 3]{(2h \cdot H_1 \cdot H_2)(H_1 \cdot 2h \cdot H_1)(H_2 \cdot H_1 \cdot 2h)} = 32.96237997m$$

$$D_{ss} = \sqrt[3^2]{(r \cdot D \cdot 2D)(r \cdot D \cdot D)(r \cdot D \cdot 2D)} = 1.514298789m$$

$$C_A = \frac{1}{18 \cdot 10^9 \ln\left(\frac{32.96237997}{1.514298789}\right)} = 1.803509136 \cdot 10^{-11}\frac{F}{m}$$

$$\boldsymbol{C_z = \frac{1}{3}C_A = 6.011697119 \cdot 10^{-12}\frac{F}{km}}$$