Mehmet Kose
19010222??

1 Soru

$V_a = 110 \angle 0°$

Line = $5 + 18j\ \Omega$ Toplam = $24 + 30,919j\ \Omega$

Load = $19 + 29,029j\ \Omega$

$I_a = \frac{110}{24 + 30,919\Omega} = 1,7233 - 2,2201j = 2,81 \angle -52,18°$ Amper

$V_{AN} = 110 - I_a \cdot Load = 97,5 \angle 4,61°$ Volt

Kompleks Power = $V \cdot I^* = (97,5 \angle 4,61°) \cdot (2,81 \angle -52,18°) =$

$= 150,07 + 229,28j$ VA

a-) Aktif P: 150,07 Watt güç fk. = 0,5476

Reaktif P = 229,28 VAR Açı = 56,7945°

Apparent P = 274,023 VA

gf = 1 için $S \cdot 1 = P$ yani $P = 150,07 \cdot 1 = 150,07$

$X_c = \frac{V^2}{Q} = \frac{97,5^2}{229,28} = 41,4648\ \Omega$

Toplam Aktif = $3 \cdot 150,07 = 450,21$ Watt

Toplam Reaktif = $3 \cdot 229,28 = 687,84$ VAR

Toplam Görünen = $3 \cdot 274,023 = 822,069$ VA

Toplam Kompleks = $3 \cdot (150,07 + 229,28j) = 450,21 + 687,84j$ VA

) $I_a = 2,81 \angle -52,18°$ Amper

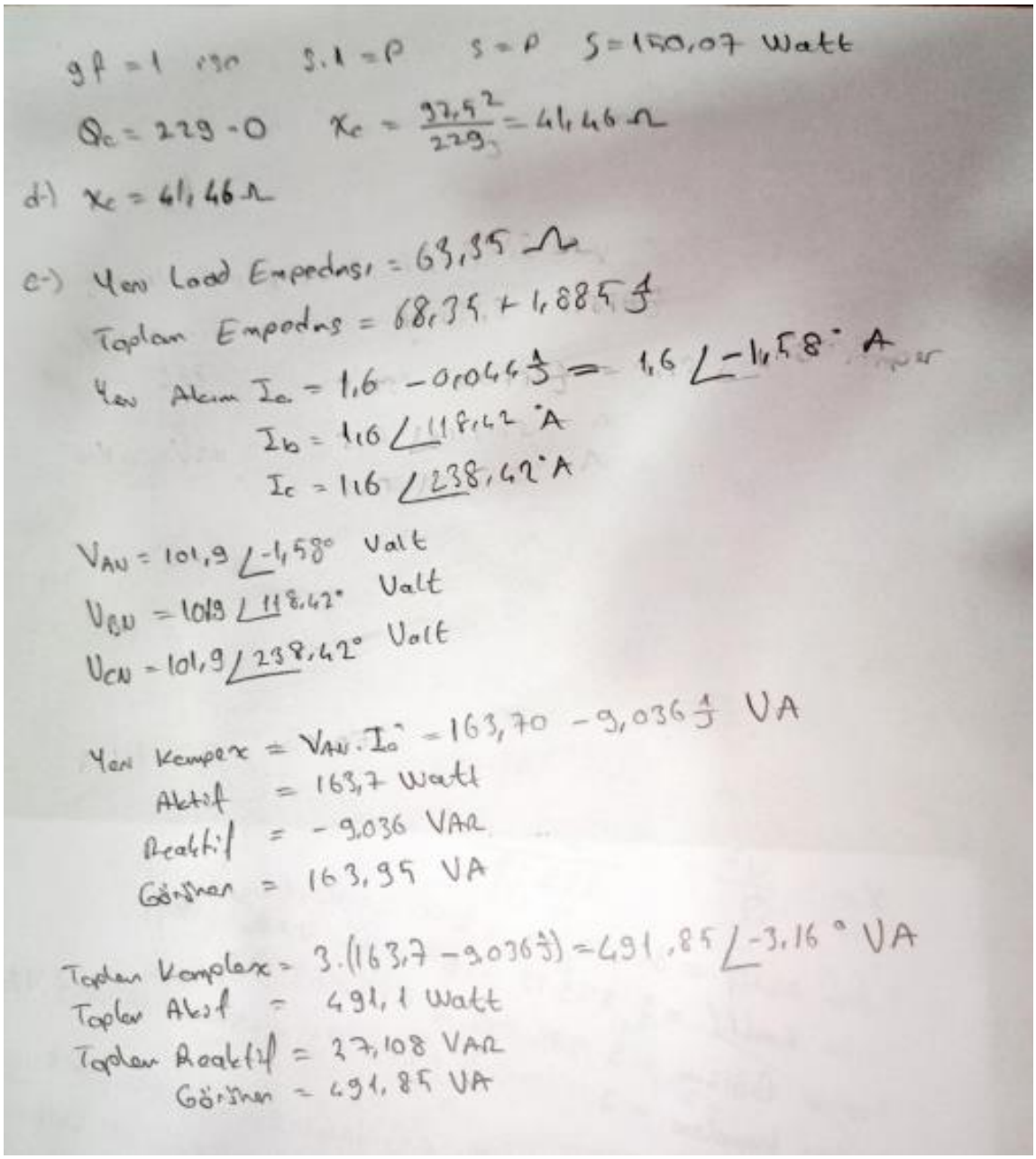
$I_b = 2,81 \angle 67,82°$ Amper

$I_c = 2,81 \angle 187,82°$ Amper

c-) $V_{AN} = 97,5 \angle 4,61°$ Volt

$V_{BN} = 97,5 \angle 124,61°$ Volt

$V_{CN} = 97,5 \angle 244,61°$ Volt




```
Line_Empedans =   5.0000 + 1.8850i
Load_A_Empedans =  19.0000 +29.0290i
Empedans =  24.0000 +30.9140i
Va =   110
Ia_Complex =   1.7236 - 2.2201i
Ia_phase_degree =  -52.1761
Ia_Genlik =    2.8107
VAN_Complex =  97.1970 + 7.8517i
VAN_phase_degree =    4.6184
VAN_genlik =   97.5136
Iaconj =   1.7236 + 2.2201i
KomplexP_A =   1.5010e+02 + 2.2932e+02i
AktiveP_A =  150.0971
ReaktiveP_A =  229.3246
ApperentP_A =  274.0783
Compansation Empedans =   0.0000 -41.4648i
```

```
New_Load_A_Empedans =  63.3517 + 0.0000i
New_Empedans =  68.3517 + 1.8850i
New_Ia_Complex =   1.6081 - 0.0443i
New_Ia_phase_degree =   -1.5797
New_Ia_genlik =    1.6087
New_VAN_Complex =   1.0188e+02 - 2.8095e+00i
New_VAN_phase_degree =   -1.5797
New_VAN_Genlik =  101.9146
newIaconj =   1.6081 + 0.0443i
New_KomplexP_A =   1.6395e+02 + 6.4837e-14i
New_AktiveP_A =  163.9512
New_ReaktiveP_A =   6.4837e-14
New_ApperentP_A =  163.9512
```

Soru 2 a Şıkkı İçin

hat empedansı = 5 + 1,8850 j Toplam Empedans = 34 + 34,6840 j

Yük = 29 + 32,7990 j

$V_a = 110$

$I_a = \frac{V_a}{\text{Empedans}} = \frac{110\angle 0°}{34+34,6840j} = 1,5854 - 1,6173j = 2,2648\angle -45,57°$ Amper

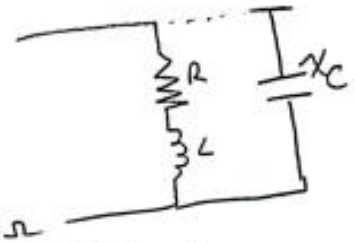
$V_{AN} = I_a \cdot Load = 99,0242 + 5,0981j = 99,1553\angle 2,9472$ Volt

Kompleks = $V_{AN} \cdot I_a^a = 148,75 + 168,24j$ VA

Aktif P = 148,75 watt

Reaktif P = 168,24 VAR

Görünen P = 224,5674 VA



$X_c = \frac{(99,15)^2}{168,24} = 58,44\ \Omega$

Yen Yük = (R+L) // X_c = 66,0957 Ω

Yen Toplam Empedans = 71,0957 + 1,8854 j Ω

Yen Akım = 1,5461 − 0,041 j Amper = 1,54 ∠ −1,5188°

Yen V_{AN} = 102,228 ∠ −1,5188 Volt = 102,19 − 2,7095 j Volt

Yen Kompleks Güç = 158,1128 VA

Aktif " = 158,1128 Watt

Reaktif " ≃ 0 VAR

Görünen " = 158,1128 VA

```
Line_Empedans =   5.0000 + 1.8850i
Load_A_Empedans =  29.0000 +32.7990i
Empedans =  34.0000 +34.6840i
Va =   110
Ia_Complex =   1.5854 - 1.6173i
Ia_phase_degree =  -45.5706
Ia_Genlik =    2.2648
VAN_Complex =  99.0242 + 5.0981i
VAN_phase_degree =    2.9472
VAN_genlik =   99.1553
Iaconj =   1.5854 + 1.6173i
KomplexP_A =   1.4875e+02 + 1.6824e+02i
AktiveP_A =  148.7507
ReaktiveP_A =  168.2371
ApperentP_A =  224.5674
Compansation_Empedans =   0.0000 -58.4400i
```

```
New_Load_A_Empedans =  66.0957 - 0.0000i
New_Empedans =  71.0957 + 1.8850i
New_Ia_Complex =   1.5461 - 0.0410i
New_Ia_phase_degree =   -1.5188
New_Ia_genlik =    1.5467
New_VAN_Complex =   1.0219e+02 - 2.7095e+00i
New_VAN_phase_degree =   -1.5188
New_VAN_Genlik =  102.2280
newIaconj =   1.5461 + 0.0410i
New_KomplexP_A =   1.5811e+02 - 1.0658e-14i
New_AktiveP_A =  158.1128
New_ReaktiveP_A =  -1.0658e-14
New_ApperentP_A =  158.1128
```

2. Soru B Şıkkı

Hat Empedansı = $5 + 1,8850j\ \Omega$ Yük = $19 + 29,0290j\ \Omega$

Toplam Empedans = $24 + 30,9140j\ \Omega$

$V_b = -55 + 95,2628j = 110\angle 120°$ Volt

$I_b = \frac{V_b}{\text{Toplam Emp.}} = \frac{110\angle 120°}{24 + 30,9143} = 2,8107\angle 67,8239°$ Amper

$V_{BN} = 97,5136\angle -55,3816°$ Volt

Komplex Power = $V \cdot I_b^* = 150,1 + 229,32j$ VA

Aktive Pow = 150,1 Watt

Reaktive Power = 229,32 VAR

Görünen Güç = 274,0783 VA

Kompanzasyon için g.f = 1 ise $X_C = \frac{(97,5136)^2}{229,32} = 41,66\ \Omega$

Yeni Yük Empedansı = $63,3517 + 0i\ \Omega$

Toplam Emp = $63,3517 + 1,8850j\ \Omega$

Yeni Akım $I_b = 1,6\angle -61,58°$ Amper $= \frac{110\angle 120}{68,35 + 1,89j}$

Yeni $V_{BN} = I_b \cdot Load = 101,91\angle -61,58°$ Volt

Komplex güç = $V_{BN} \cdot I_b^* = 163,95$ VA

Aktif g = 163 Watt

Reaktif g = 0 VAR

Görünen g = 163,95 VA

```
Line_Empedans =    5.0000 + 1.8850i
Load_B_Empedans =  19.0000 +29.0290i
Empedans =  24.0000 +30.9140i
Vb = -55.0000 +95.2628i
Ib_Complex =   1.0609 + 2.6028i
Ib_phase_degree =   67.8239
Ib_Genlik =    2.8107
VBN_Complex = -55.3983 +80.2492i
VBN_phase_degree =  -55.3816
VBN_genlik =   97.5136
Ibconj =  1.0609 - 2.6028i
KomplexP_B =   1.5010e+02 + 2.2932e+02i
AktiveP_B =  150.0971
ReaktiveP_B =  229.3246
ApperentP_B =  274.0783
Compansation_Empedans =   0.0000 -41.4648i
```

```
New_Load_B_Empedans =  63.3517 + 0.0000i
New_Empedans =  68.3517 + 1.8850i
New_Ib_Complex =  -0.7656 + 1.4148i
New_Ib_phase_degree =  -61.5797
New_Ib_genlik =    1.6087
New_VBN_Complex = -48.5048 +89.6319i
New_VBN_phase_degree =  -61.5797
New_VBN_Genlik =  101.9146
newIbconj =  -0.7656 - 1.4148i
New_KomplexP_B =   1.6395e+02 + 7.1054e-14i
New_AktiveP_B =  163.9512
New_ReaktiveP_B =   7.1054e-14
New_ApperentP_B =  163.9512
```

2. Soru c hatti: $Y_{dc} = 39 + 40,339j\ \Omega$
hat - $5 + 1,885j\ \Omega$

Toplam Empedans $= 44 + 42,2245j\ \Omega$

$I_c = \frac{V_c}{44+42,2245j} = 1,8038 \angle -16,18°$ Amper

$V_{cN} = I_c \cdot Y_{dc} = 101,2094 \angle 62,1469°$ Volt $= -47,2857 - 89,68j$

Kompleks Güç $= 126,89 + 131,25j$ VA

Aktif = 126,89 Watt

Reaktif = 131,25 VA

Görünen güç = 182,5612 VA

X_c kompanzasyon $pf = 1$ için $\cos(0)$ $P \simeq S$

$X_c = \frac{(101,2094)^2}{136,25} = 72,0644\ \Omega$

Yeni $Y_{dc} = 80,724 + 0j\ \Omega$ Toplam Empedans $= 85,72 + 1,885j\ \Omega$

Yeni Akım $I_c = \frac{110 \angle 24,0°\ V}{85,72 + 1,885j} = 1,2829 \angle 58,7403°$ Amper

$V_{cN} = I_c \cdot Y_{dc} = 103,559 \angle 58,74°$ Volt

Yeni Kompleks Güç $= V_{cN} I_c^* = 132,85$ VA

Aktif $\simeq 132,85$ Watt

Reaktif $\simeq 0$ VAR

Görünür güç $= 132,85$ VA

```
Line_Empedans =   5.0000 + 1.8850i
Load_C_Empedans =  39.0000 +40.3390i
Empedans =  44.0000 +42.2240i
Vc = -55.0000 -95.2628i
Ic_Complex =  -1.7323 - 0.5026i
Ic_phase_degree =   16.1800
Ic_Genlik =    1.8038
VCN_Complex = -47.2857 -89.4841i
VCN_phase_degree =   62.1469
VCN_genlik =  101.2094
Icconj =  -1.7323 + 0.5026i
KomplexP_C =   1.2689e+02 + 1.3125e+02i
AktiveP_C =  126.8935
ReaktiveP_C =  131.2502
ApperentP_C =  182.5612
Compansation_Empedans =   0.0000 -78.0444i
```

```
New_Load_C_Empedans =  80.7240 + 0.0000i
New_Empedans =  85.7240 + 1.8850i
New_Ic_Complex =  -0.6657 - 1.0966i
New_Ic_phase_degree =   58.7403
New_Ic_genlik =    1.2829
New_VCN_Complex = -53.7386 -88.5248i
New_VCN_phase_degree =   58.7403
New_VCN_Genlik =  103.5590
newIcconj =  -0.6657 + 1.0966i
New_KomplexP_C =   1.3285e+02 + 3.5527e-14i
New_AktiveP_C =  132.8536
New_ReaktiveP_C =   3.5527e-14
New_ApperentP_C =  132.8536
```

1. SORU MATLAB KODLARI

```
clear all
diary devre_Soru_1_cevaplar.txt
Line_Empedans = 5 + 1.885j
Load_A_Empedans = 19 + j*377*77*10.^-3
Empedans = Line_Empedans + Load_A_Empedans
Va = 110  % volt
Ia_Complex = Va / Empedans  % amper
Ia_phase_degree = atand( imag(Ia_Complex)/ real(Ia_Complex))
Ia_Genlik = abs(Ia_Complex)
VAN_Complex = Va - (Ia_Complex * Line_Empedans)  %volt
VAN_phase_degree = atand ( (imag(VAN_Complex)) / real(VAN_Complex) )
VAN_genlik  = abs(VAN_Complex)
Iaconj = conj(Ia_Complex)

KomplexP_A = VAN_Complex *Iaconj  % VA birim
AktiveP_A = real(KomplexP_A)  % WATT birim
ReaktiveP_A = imag(KomplexP_A)  % VAR birim
ApperentP_A = sqrt((ReaktiveP_A.^2) + AktiveP_A.^2)  % VA
%Power_Factor_A = AktiveP_A/ApperentP_A
%phasedifferenceVoltageAndCurrent = acosd(Power_Factor_A) % degree

% 2. kisim
Compansation_Empedans = -1j*(VAN_genlik.^2  / ReaktiveP_A )% Xc
Vkare/reaktif P
New_Load_A_Empedans = (Load_A_Empedans * Compansation_Empedans ) / (
Load_A_Empedans + Compansation_Empedans )
New_Empedans = Line_Empedans + New_Load_A_Empedans
New_Ia_Complex = Va / New_Empedans
New_Ia_phase_degree = atand(imag(New_Ia_Complex)/real(New_Ia_Complex))
New_Ia_genlik = abs(New_Ia_Complex)
New_VAN_Complex = New_Ia_Complex*New_Load_A_Empedans
New_VAN_phase_degree =
atand(imag(New_VAN_Complex)/real(New_VAN_Complex))
New_VAN_Genlik = abs(New_VAN_Complex)
newIaconj = conj(New_Ia_Complex)
New_KomplexP_A = New_VAN_Complex*newIaconj
New_AktiveP_A = real(New_KomplexP_A)  % WATT birim
New_ReaktiveP_A = imag(New_KomplexP_A)  % VAR birim
New_ApperentP_A = sqrt((New_ReaktiveP_A.^2) + New_AktiveP_A.^2) % VA



diary off
```

2. SORU A HATTI KODLAR

```
clear all

diary devre_Soru_2_a_sikki.txt
Line_Empedans = 5 + 1.885j
Load_A_Empedans = (19+10) + j*377*(77+10)*10.^-3
Empedans = Line_Empedans + Load_A_Empedans
Va = 110 % volt
Ia_Complex = Va / Empedans  % amper
Ia_phase_degree = atand( imag(Ia_Complex)/
real(Ia_Complex))
Ia_Genlik = abs(Ia_Complex)
VAN_Complex = Va - (Ia_Complex * Line_Empedans)  %volt
VAN_phase_degree = atand ( (imag(VAN_Complex)) /
real(VAN_Complex) )
VAN_genlik  = abs(VAN_Complex)
Iaconj = conj(Ia_Complex)

KomplexP_A = VAN_Complex *Iaconj  % VA birim
AktiveP_A = real(KomplexP_A)  % WATT birim
ReaktiveP_A = imag(KomplexP_A)  % VAR birim
ApperentP_A = sqrt((ReaktiveP_A.^2) + AktiveP_A.^2)  %
VA
%Power_Factor_A = AktiveP_A/ApperentP_A
%phasedifferenceVoltageAndCurrent =
acosd(Power_Factor_A) % degree


% 2. kisim
Compansation_Empedans = -1j*(VAN_genlik.^2  /
ReaktiveP_A )% Xc Vkare/reaktif P
New_Load_A_Empedans = (Load_A_Empedans *
Compansation_Empedans ) / ( Load_A_Empedans +
Compansation_Empedans )
New_Empedans = Line_Empedans + New_Load_A_Empedans
New_Ia_Complex = Va / New_Empedans
New_Ia_phase_degree =
atand(imag(New_Ia_Complex)/real(New_Ia_Complex))
New_Ia_genlik = abs(New_Ia_Complex)
New_VAN_Complex = New_Ia_Complex*New_Load_A_Empedans
New_VAN_phase_degree =
atand(imag(New_VAN_Complex)/real(New_VAN_Complex))
New_VAN_Genlik = abs(New_VAN_Complex)

newIaconj = conj(New_Ia_Complex)
New_KomplexP_A = New_VAN_Complex*newIaconj
New_AktiveP_A = real(New_KomplexP_A)  % WATT birim
New_ReaktiveP_A = imag(New_KomplexP_A)  % VAR birim
New_ApperentP_A = sqrt((New_ReaktiveP_A.^2) +
New_AktiveP_A.^2)


diary off
```

3. SORU B HATTI KODLAR

```
clear all
diary devre_Soru_2_b_sikki.txt
Line_Empedans = 5 + 1.885j
Load_B_Empedans = (19) + j*377*(77)*10.^-3
Empedans = Line_Empedans + Load_B_Empedans
Vb = -55 + 55*sqrt(3)*j  % volt
Ib_Complex = Vb / Empedans  % amper
Ib_phase_degree = atand( imag(Ib_Complex)/
real(Ib_Complex))
Ib_Genlik = abs(Ib_Complex)
VBN_Complex = Vb - (Ib_Complex * Line_Empedans)  %volt
VBN_phase_degree = atand ( (imag(VBN_Complex)) /
real(VBN_Complex) )
VBN_genlik  = abs(VBN_Complex)
Ibconj = conj(Ib_Complex)

KomplexP_B = VBN_Complex *Ibconj  % VA birim
AktiveP_B = real(KomplexP_B)  % WATT birim
ReaktiveP_B = imag(KomplexP_B)  % VAR birim
ApperentP_B = sqrt((ReaktiveP_B.^2) + AktiveP_B.^2)  %
VA
%Power_Factor_A = AktiveP_A/ApperentP_A
%phasedifferenceVoltageAndCurrent =
acosd(Power_Factor_A) % degree


% 2. kisim
Compansation_Empedans = -1j*(VBN_genlik.^2  /
ReaktiveP_B )% Xc Vkare/reaktif P
New_Load_B_Empedans = (Load_B_Empedans *
Compansation_Empedans ) / ( Load_B_Empedans +
Compansation_Empedans )
New_Empedans = Line_Empedans + New_Load_B_Empedans
New_Ib_Complex = Vb / New_Empedans
New_Ib_phase_degree =
atand(imag(New_Ib_Complex)/real(New_Ib_Complex))
New_Ib_genlik = abs(New_Ib_Complex)
New_VBN_Complex = New_Ib_Complex*New_Load_B_Empedans
New_VBN_phase_degree =
atand(imag(New_VBN_Complex)/real(New_VBN_Complex))
New_VBN_Genlik = abs(New_VBN_Complex)

newIbconj = conj(New_Ib_Complex)
New_KomplexP_B = New_VBN_Complex*newIbconj
New_AktiveP_B = real(New_KomplexP_B)  % WATT birim
New_ReaktiveP_B = imag(New_KomplexP_B)  % VAR birim
New_ApperentP_B = sqrt((New_ReaktiveP_B.^2) +
New_AktiveP_B.^2)


diary off
```

2. SORU C HATTI KODLAR

```
clear all

diary devre_Soru_2_c_sikki.txt
Line_Empedans = 5 + 1.885j
Load_C_Empedans = (19+20) + j*377*(77+30)*10.^-3
Empedans = Line_Empedans + Load_C_Empedans
Vc = -55 - 55*sqrt(3)*j  % volt
Ic_Complex = Vc / Empedans  % amper
Ic_phase_degree = atand( imag(Ic_Complex)/
real(Ic_Complex))
Ic_Genlik = abs(Ic_Complex)
VCN_Complex = Vc - (Ic_Complex * Line_Empedans)  %volt
VCN_phase_degree = atand ( (imag(VCN_Complex)) /
real(VCN_Complex) )
VCN_genlik  = abs(VCN_Complex)
Icconj = conj(Ic_Complex)

KomplexP_C = VCN_Complex *Icconj  % VA birim
AktiveP_C = real(KomplexP_C)  % WATT birim
ReaktiveP_C = imag(KomplexP_C)  % VAR birim
ApperentP_C = sqrt((ReaktiveP_C.^2) + AktiveP_C.^2)  %
VA
%Power_Factor_A = AktiveP_A/ApperentP_A
%phasedifferenceVoltageAndCurrent =
acosd(Power_Factor_A) % degree


% 2. kisim
Compansation_Empedans = -1j*(VCN_genlik.^2  /
ReaktiveP_C )% Xc Vkare/reaktif P
New_Load_C_Empedans = (Load_C_Empedans *
Compansation_Empedans ) / ( Load_C_Empedans +
Compansation_Empedans )
New_Empedans = Line_Empedans + New_Load_C_Empedans
New_Ic_Complex = Vc / New_Empedans
New_Ic_phase_degree =
atand(imag(New_Ic_Complex)/real(New_Ic_Complex))
New_Ic_genlik = abs(New_Ic_Complex)
New_VCN_Complex = New_Ic_Complex*New_Load_C_Empedans
New_VCN_phase_degree =
atand(imag(New_VCN_Complex)/real(New_VCN_Complex))
New_VCN_Genlik = abs(New_VCN_Complex)

newIcconj = conj(New_Ic_Complex)
New_KomplexP_C = New_VCN_Complex*newIcconj
New_AktiveP_C = real(New_KomplexP_C)  % WATT birim
New_ReaktiveP_C = imag(New_KomplexP_C)  % VAR birim
New_ApperentP_C = sqrt((New_ReaktiveP_C.^2) +
New_AktiveP_C.^2)



diary off
```

Soru 1 devre simülasyon görüntüleri aşağıdadır

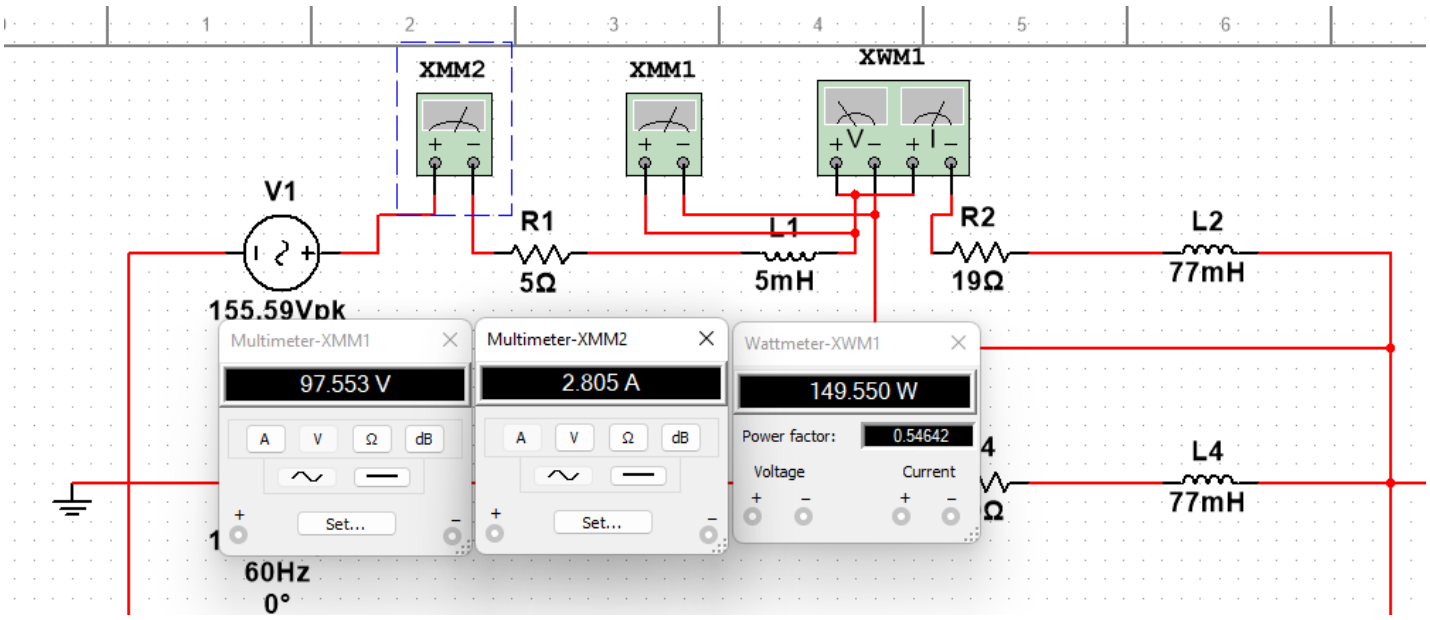


Figure 1kompanzasyon öncesi aktif güç Van ve akım

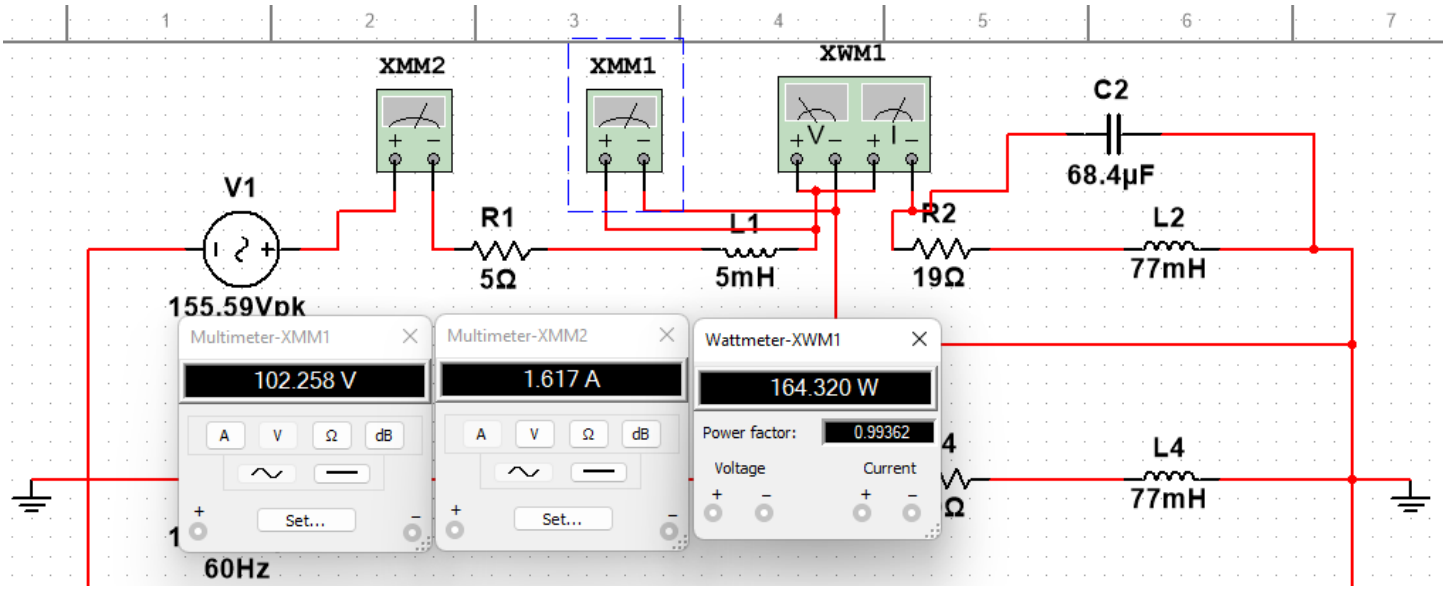


Figure 2 kompanzasyon sonrası aktif güç, akım ve Van

Hata oranları %1'den aşağıdadır.

	hat	önce			kompanzasyon ile		
		VAN	AKIM	aktif güç	VAN	AKIM	aktif güç
A	hesap	97.5	2.81	150.07	101.9	1.6	163.7
	simülasyon	97.53	2.805	149.5	102.26	1.617	164.32

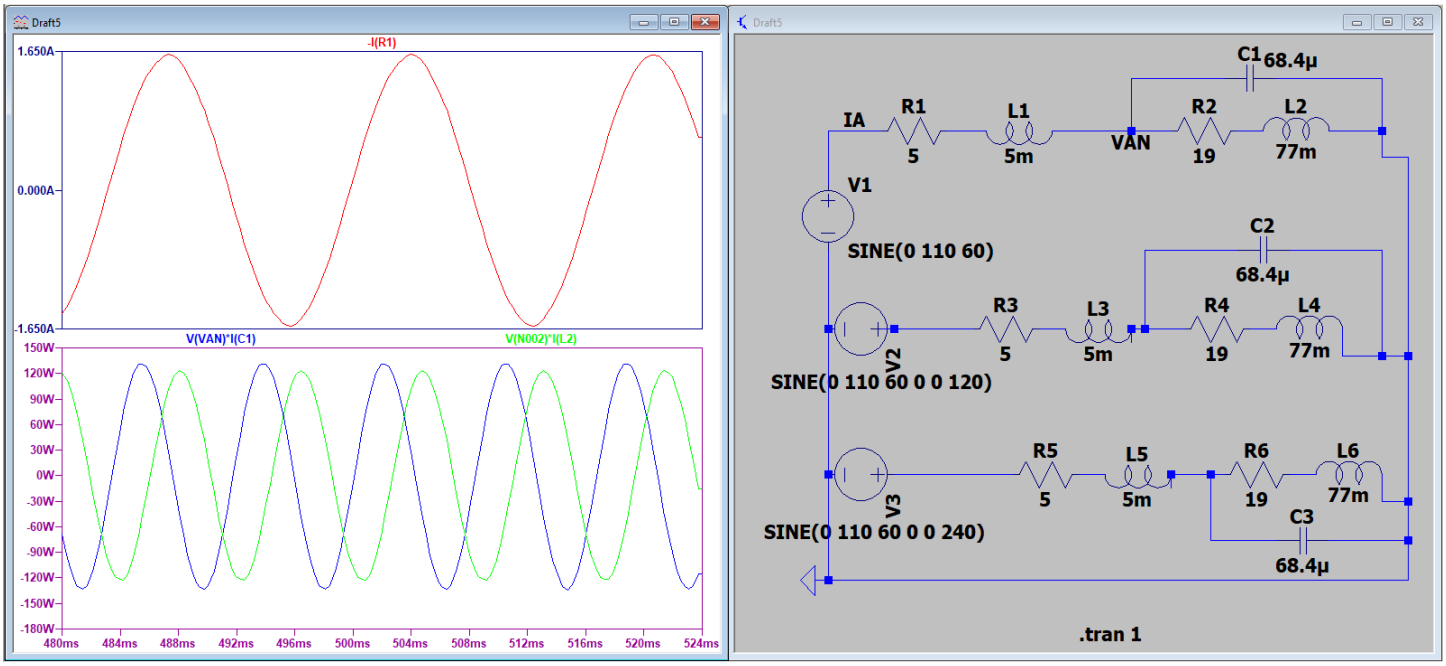


Figure 3Spice güç ve akım ölçümü

Spice çıktısında da görülmektedir ki bobin ve capasitör güçleri hesaplanan değerlerdedir.

Devre 2. Simülasyon görüntüleri aşağıdadır

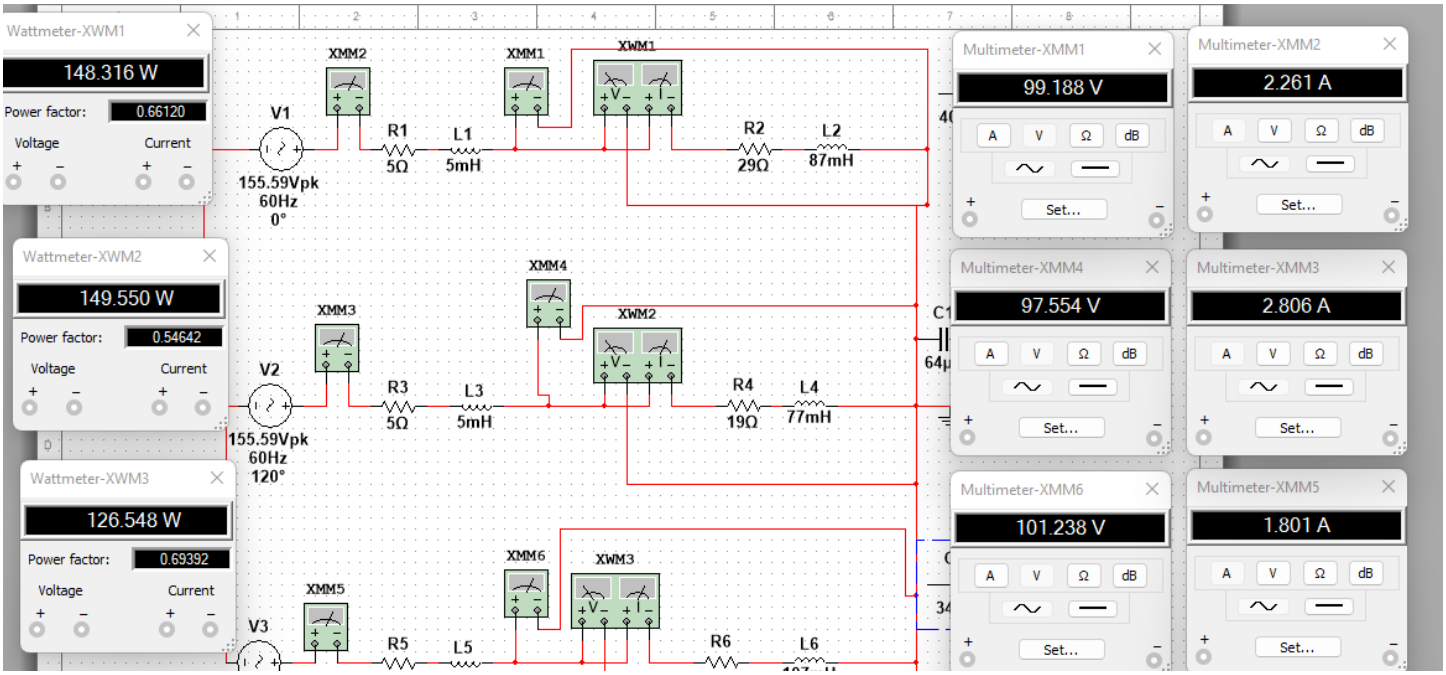


Figure 4 2. devre kompanzasyon öncesi ölçümler

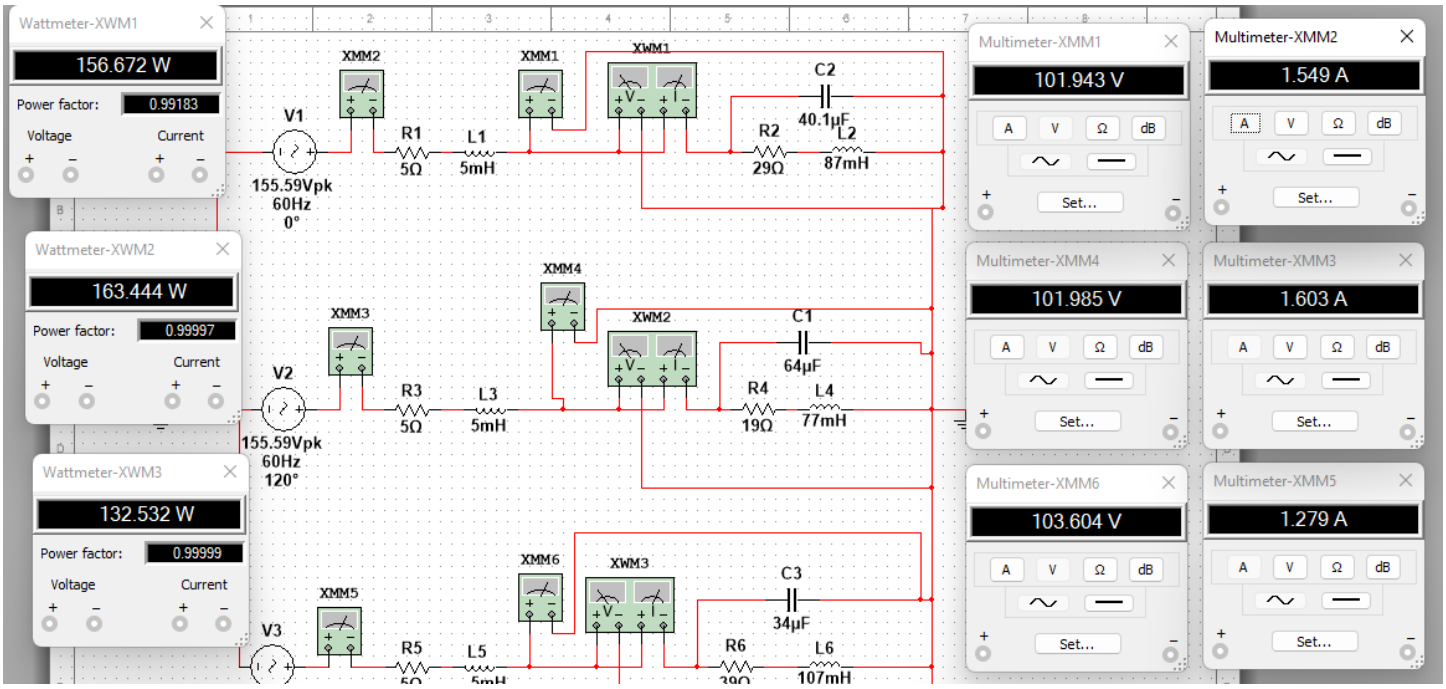


Figure 5 Devre 2 kompanzasyon sonrası ölçümler

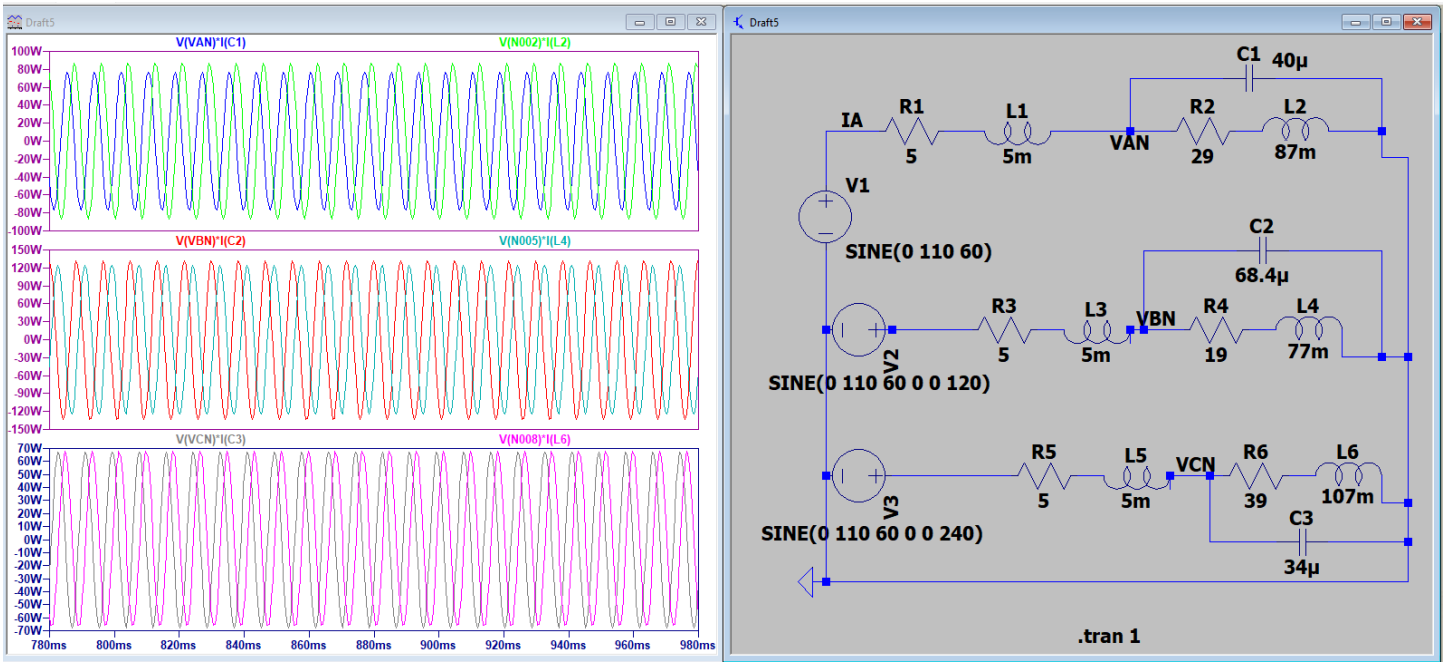


Figure 6 2. devre spice güç ölçümleri

hat		önce			kompanzasyon ile		
		VAN	AKIM	aktif güç	VAN	AKIM	aktif güç
A	hesap	99.16	2.26	148.75	99.18	2.261	148.31
	simülasyon	102.19	1.54	158.11	101.94	1.549	156.67
B	hesap	97.53	2.81	150.1	101.9	1.6	163
	simülasyon	97.554	2.8	149.55	101.985	1.603	163.44
c	hesap	101.2	1.8	126.89	103.85	1.2829	132.85
	simülasyon	101.238	1.801	126.548	103.6	1.279	132.532

Açıkca görülmektedir a hattı VAN ve aktif güç sonucu dışında %2’ yi geçen hata yoktur.

Hesaplamalar ve simülasyonlar birbirlerini sağlamaktadır.