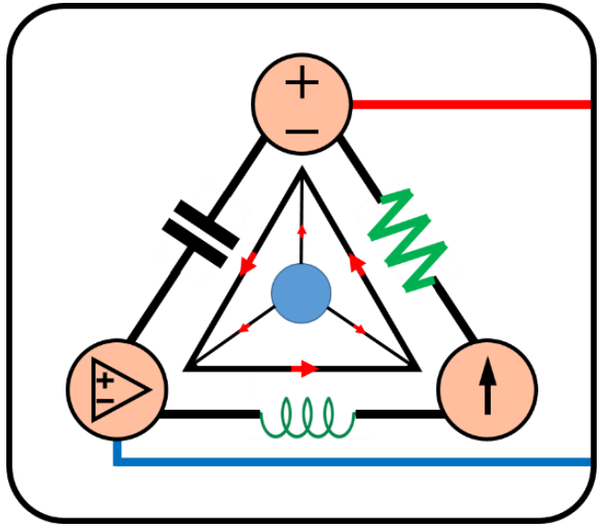
2-Mavzu: Elektr zanjiriga oid asosiy qonunlar.

(Lecture-2: Basic Laws)

2-Mavzuning 3-qismi

(Part 3 of the Lecture-2)



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2-Mavzu: Elektr zanjiriga oid asosiy qonunlar.

(Lecture-2: Basic Laws)

O‘quv rejasi:

2.1. Om qonuni.

2.2. Tugun, shaxobcha va kontur.

2.3. Kirxgof qonunlari.

2.4. Ketma-ket ulangan qarshiliklar va kuchlanishni bo‘linish qoidasi.

2.5. Parallel ulangan qarshiliklar va tok kuchini bo‘linish qoidasi.

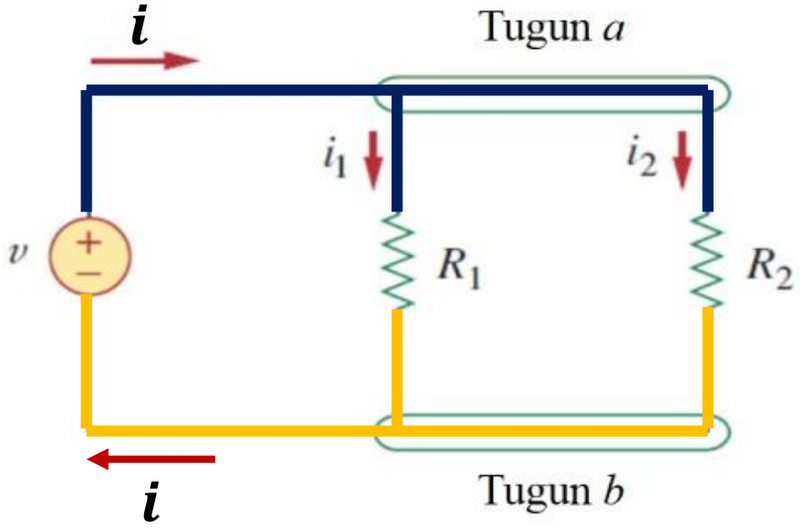
2.6. Qarshiliklar yulduzini qarshiliklar uchburchagiga (Wye-Delta) o‘zgartirish.

2.7. Qo‘llanilishi.

2.5. Parallel ulangan qarshiliklar va tok kuchini bo‘linishi.

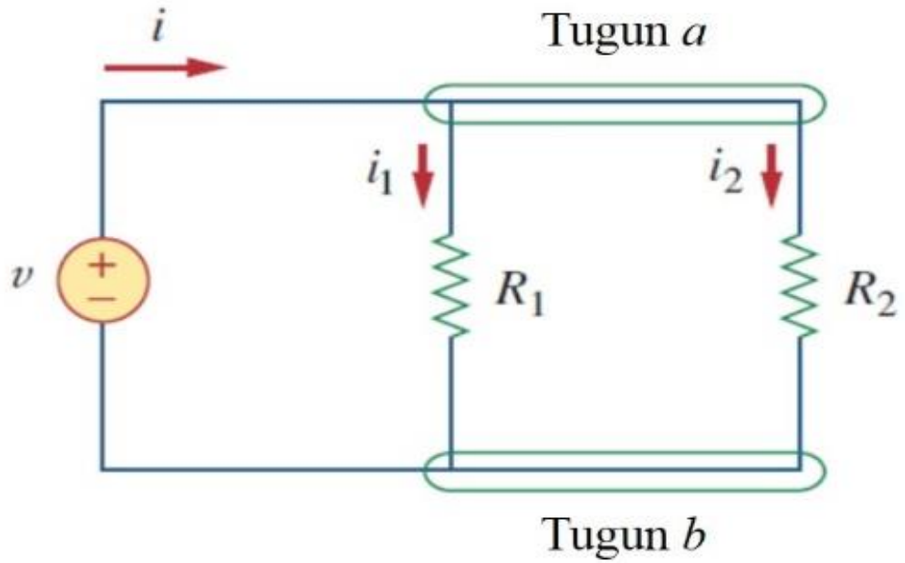
Elektr zanjirlarida qarshiliklar ketma-ket ulangan bo‘lsa, ulardan o‘tayotgan tok kuchlari bir xil bo‘lar edi. Rezistorlardagi kuchlanishlarning yig‘indisi umumiy manba hosil qilib berayotgan kuchlanishga teng bo‘lar edi. Endi qarshiliklar, elektr iste’molchilari zanjirda parallel ulangan bo‘lsa, zanjirning to‘la qarshiligi qanday topiladi? Umuman mana shu holat uchun Om qonunini qanday tadbiq qilamiz?

Aslida elektr tokini real holatda elektronlarning harakati hosil qiladi. Bu yerda biz elektr tokining yo‘nalishi sifatida musbat “+” zarrachalarning harakat yo‘nalishini olishga kelishgan edik.



2.22-rasm. Ikkita rezistorni parallel ulanishi.

Bu yerda ikkita rezistor parallel ravishda ulangan va ular bir xil kuchlanishga ega.



Om qonunidan ma’lumki,

$$\boldsymbol{u = i_1 R_1 = i_2 R_2}$$

yoki,

$$\boldsymbol{i_1 = \frac{u}{R_1}, \quad i_2 = \frac{u}{R_2}} \qquad (2.33)$$

KCL bo‘yicha *a* tugunda umumiy tok kuchi *i* quyidagicha yoziladi:

$$\boldsymbol{i = i_1 + i_2} \qquad (2.34)$$

(2.33) tenglamani (2.34) tenglamaga almashtirsak, $\boldsymbol{\frac{1}{R_{um}} = \frac{1}{R_1} + \frac{1}{R_2}}$ yoki, quyidagiga ega bo‘lamiz.

$$\boldsymbol{i = \frac{u}{R_1} + \frac{u}{R_2} = u\left(\frac{1}{R_1} + \frac{1}{R_2}\right) = \frac{u}{R_{um}}} \qquad (2.35)$$

$$\boldsymbol{\frac{1}{R_{um}} = \frac{R_1 + R_2}{R_1 R_2}} \qquad (2.36)$$

bu yerda: R_{um} - parallel rezistorlarning ekvivalent qarshiligi.

$$\boldsymbol{R_{um} = \frac{R_1 R_2}{R_1 + R_2}} \qquad (2.37)$$

Demak, ikkita parallel ulangan rezistorlarning ekvivalent qarshiligi ularning qarshiliklari yig‘indisiga bo‘lingan qiymatga teng.

Shuni ta’kidlash kerakki, bu faqat parallel ravishda ikkita rezistorga tegishli.

$$\boldsymbol{R_{um} = \frac{R_1 R_2}{R_1 + R_2}} \qquad (2.37)$$

agar $R_1 = R_2$, u holda $\boldsymbol{R_{eq} = \frac{R_1}{2}}$.

(2.36) tenglamadagi natijani N ta rezistorlar parallel bo‘lgan zanjirning umumiy holatiga kengaytira olamiz. Ekvivalent qarshilik,

$$\boldsymbol{\frac{1}{R_{um}} = \frac{1}{R_1} + \frac{1}{R_2} + \cdots + \frac{1}{R_N}} \qquad (2.38)$$

R_{um} har doim parallel kombinatsiyadagi eng kichik qarshilik qiymatidan kichikroq ekanligini unutmaslik kerak. Agar $R_1 = R_2 = \cdots = R_N = R$ bo‘lsa,

$$\boldsymbol{R_{um} = \frac{R}{N}} \qquad (2.39)$$

$$\frac{1}{R_{um}} = \frac{1}{100} + \frac{1}{100} + \frac{1}{100} + \frac{1}{100} = \frac{4}{100} \qquad R_{um} = \frac{100}{4} = 25\ \Omega$$

Ko‘pincha rezistorlar bilan parallel ravishda ishlashda qarshilikdan ko‘ra o‘tkazuvchanlikni ishlatish qulayroqdir.

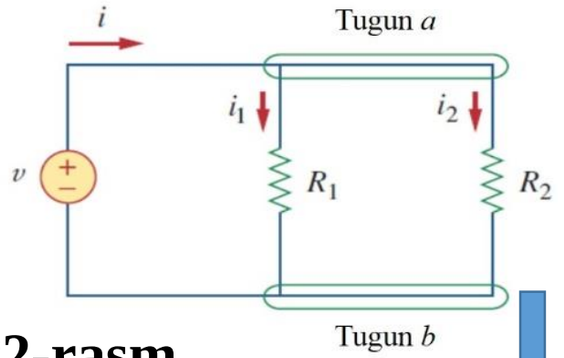
Parallel o‘tkazgichlar qiymati individual o‘tkazuvchanliklarning yig‘indisiga teng bo‘lgan yagona o‘tkazuvchanlik sifatida ishlaydi.

(2.38) tenglamadan parallel ravishda *N* ta rezistorlar uchun ekvivalent o‘tkazuvchanlik quyidagicha yoziladi.

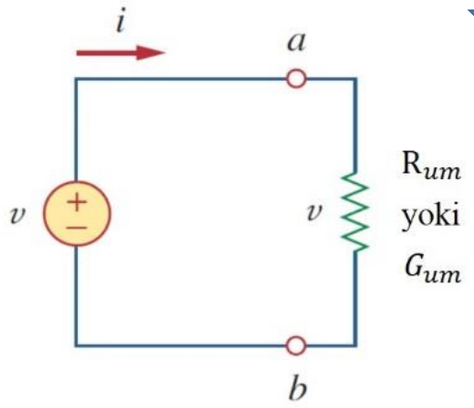
$$G_{um} = G_1 + G_2 + \cdots + G_N \qquad (2.40)$$

bu yerda: $G_{um} = \frac{1}{R_{um}}, G_1 = \frac{1}{R_1}, G_2 = \frac{1}{R_2}, \ldots, G_N = \frac{1}{R_N}$.

Demak, parallel ulangan rezistorlarning ekvivalent o‘tkazuvchanligi ularning individual o‘tkazuvchanliklarining yig‘indisidir.

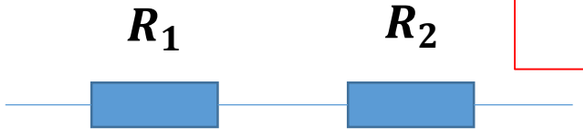


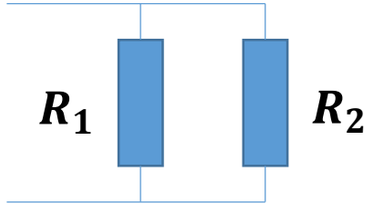
2.22-rasm.



2.23-rasm. 2.22-rasmning ekvivalent zanjiri.

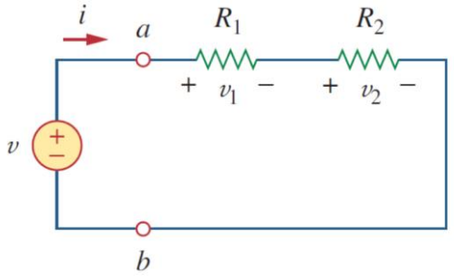
Ekvivalentlarning o‘xshashligi





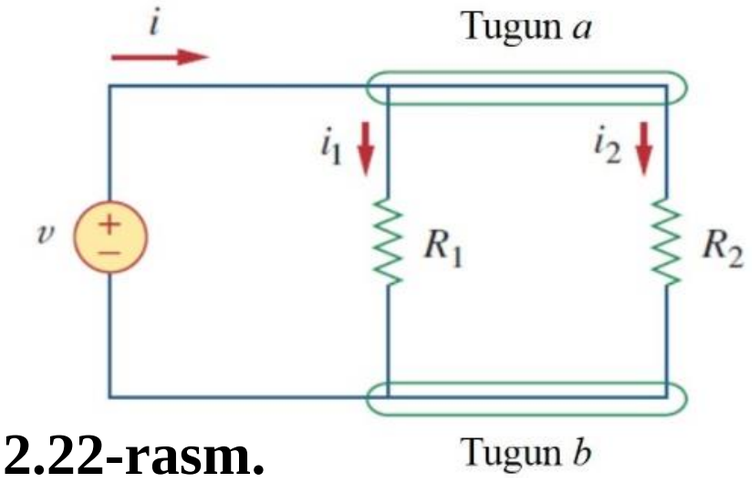
$$R_{um} = R_1 + R_2 + \cdots + R_N \quad (2.30)$$

$$G_{um} = G_1 + G_2 + \cdots + G_N \quad (2.40)$$



Shunday qilib ketma-ket N rezistorlarning ekvivalent o‘tkazuvchanligi G_{um} ni quyidagicha yozishimiz mumkin.

$$\frac{1}{G_{um}} = \frac{1}{G_1} + \frac{1}{G_2} + \cdots + \frac{1}{G_N} \quad (2.41)$$



2.22-rasm.

2.22-rasmdagi a tuguniga kiradigan umumiy tok kuchi i ni hisobga olsak, biz i_1 va i_2 tok kuchini qanday olamiz?

Biz ekvivalent qarshilik bir xil kuchlanishga ega ekanligini bilamiz, yoki

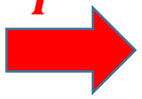
$$\frac{1}{R_{um}} = \frac{1}{R_1} + \frac{1}{R_2} \rightarrow R_{um} = \frac{R_1 R_2}{R_1 + R_2} \rightarrow u = iR_{um} = i\frac{R_1 R_2}{R_1 + R_2} \qquad (2.42)$$

$$i_1 = \frac{u}{R_1} \rightarrow i_1 = i\frac{R_1 R_2}{(R_1 + R_2)R_1} \rightarrow i_1 = \frac{R_2}{R_1 + R_2} i$$

$$i_2 = \frac{u}{R_2} \rightarrow i_2 = i\frac{R_1 R_2}{(R_1 + R_2)R_2} \rightarrow i_2 = \frac{R_1}{R_1 + R_2} i \qquad (2.43)$$

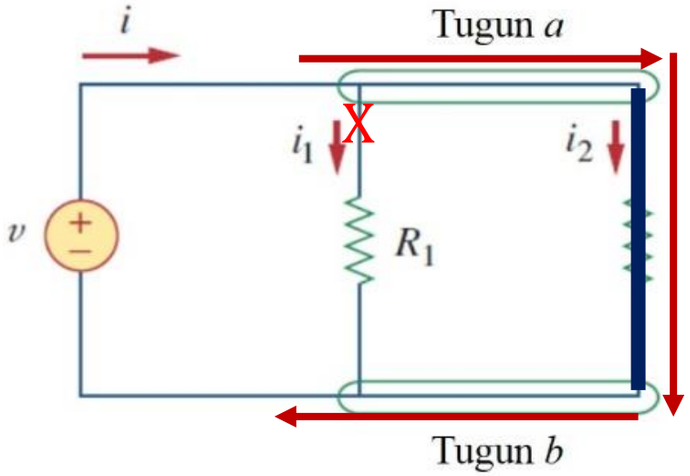
Bu umumiy tok kuchi rezistorlar tomonidan ularning **qarshiliklariga teskari mutanosib** ravishda taqsimlanganligini ko‘rsatadi.

Bu ***tok kuchi bo‘linish prinsipi*** (*principle of current division*) sifatida tanilgan va 2.22-rasmdagi zanjir ***tok kuchini bo‘linuvchisi*** (*current divider*) sifatida tanilgan.

E’tibor bersak, kattaroq tok kuchi 

kichikroq qarshilik 

orqali o‘tadi.



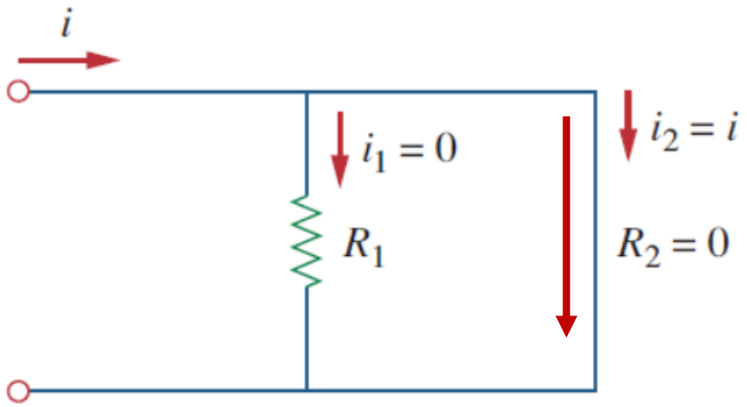
$$R_2 = 0$$

$$i_1 = \frac{R_2}{R_1 + R_2} i$$

$$i_2 = \frac{R_1}{R_1 + R_2} i$$

$$= 0$$

Chunki, bu yo‘nalish eng kam qarshilikka ega bo‘lgan shaxobcha hisoblanadi.



a)

2.24-rasm.

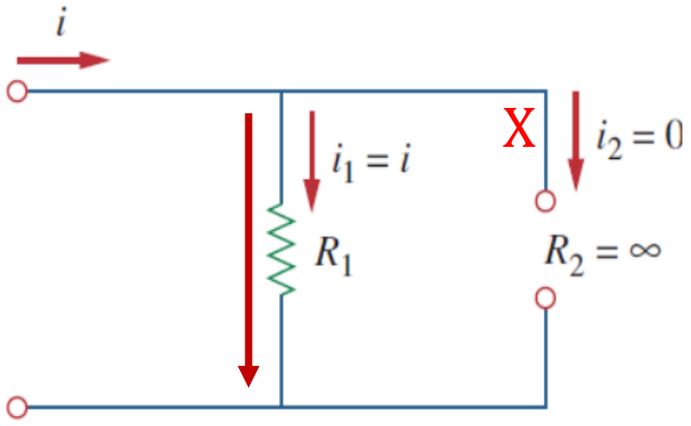
a) qisqa tutashgan zanjir;

Shunday qilib, 2.24-rasm, *a* da ko‘rsatilganidek, zanjir qisqa tutashganda, ikkita narsani yodda tutish kerak:

1. Ekvivalnet qarshilik

$$\boldsymbol{R_2 = 0} \Longrightarrow \boldsymbol{R_{um} = \frac{R_1 R_2}{R_1 + R_2} = 0}$$

2. Barcha tok kuchlari zanjirdagi qisqa tutashuv orqali o‘tadi.



b)

2.24-rasm.

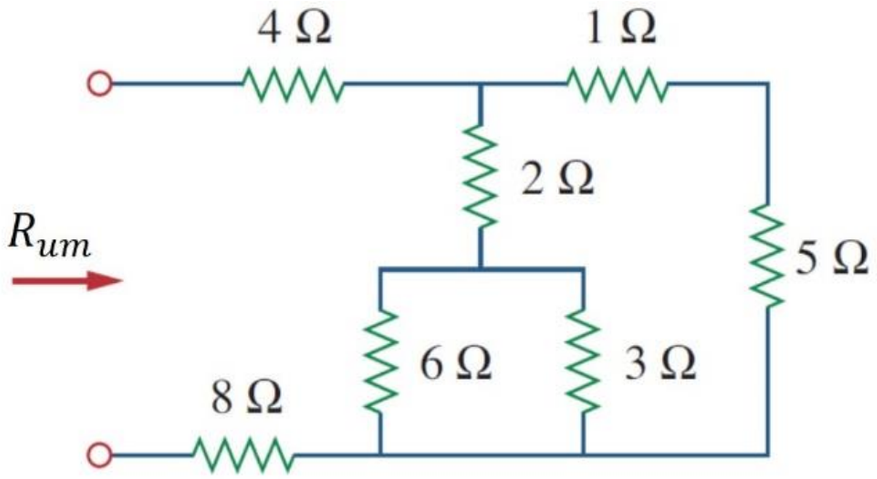
b) ochiq zanjir.

$R_2 = \infty \Longrightarrow$ **ochiq zanjir**

Tok kuchi hali ham eng kam qarshilik R_1 yo‘lidan o‘tadi.

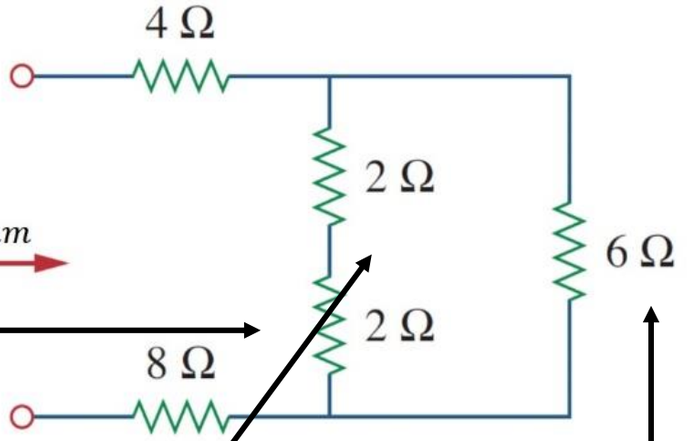
$$R_2 \to \infty \Longrightarrow R_{um} = \frac{R_1 R_2}{R_1 + R_2} = R_1$$

2.5.1-masala. 2.25-rasmdagi zanjir uchun R_{um} ni toping.



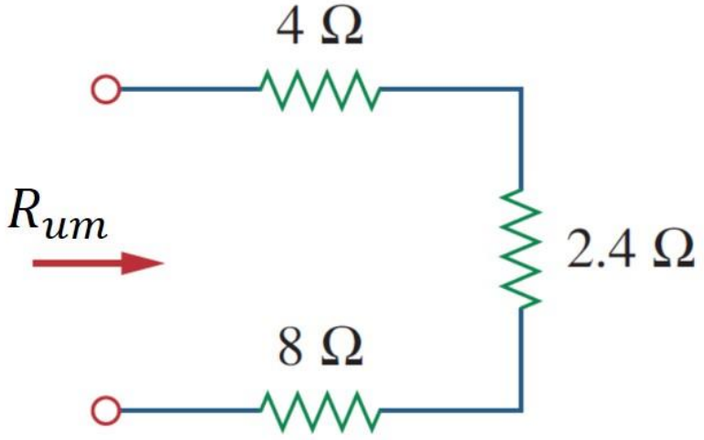
2.25-rasm.

Yechish:



$$6\ \Omega||3\ \Omega = \frac{6 \cdot 3}{6+3} = 2\ \Omega$$

$$2\ \Omega + 2\ \Omega = 4\ \Omega \qquad 1\ \Omega + 5\ \Omega = 6\ \Omega$$

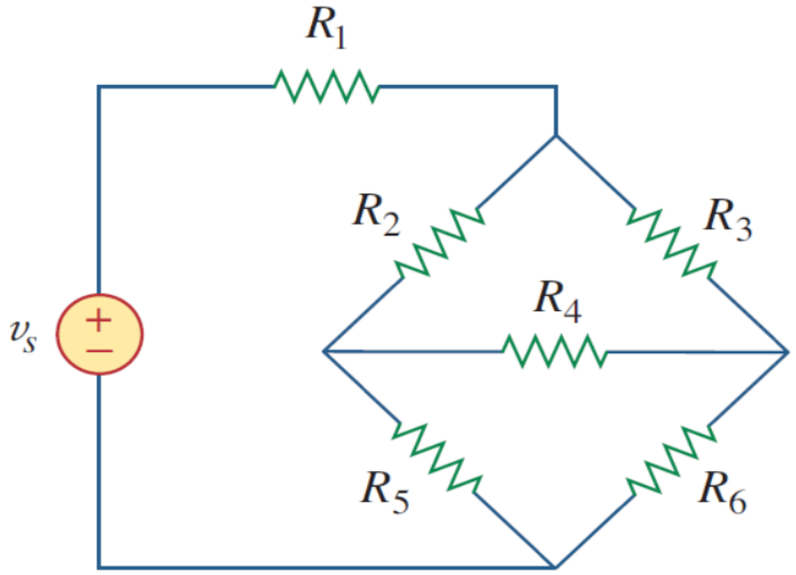


$$4\ \Omega||6\ \Omega = \frac{4 \cdot 6}{4+6} = 2{,}4\ \Omega$$

$$R_{um} = 4\ \Omega + 2{,}4\ \Omega + 8\ \Omega = 14{,}4\ \Omega$$

2.6. Qarshiliklar yulduzini qarshiliklar uchburchagiga (Wye-Delta) o‘zgartirish.

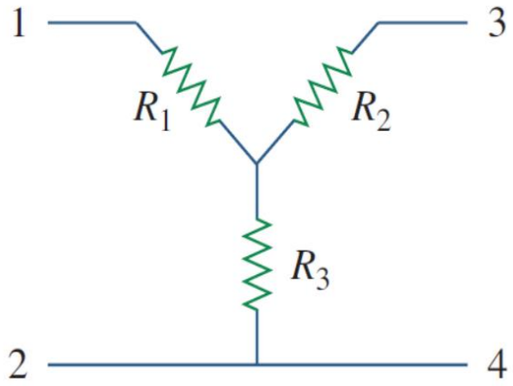
Ko‘pincha rezistorlar parallel yoki ketma-ket bo‘lmaganda, zanjirni tahlil qilishda noqulay vaziyatlar yuzaga keladi.



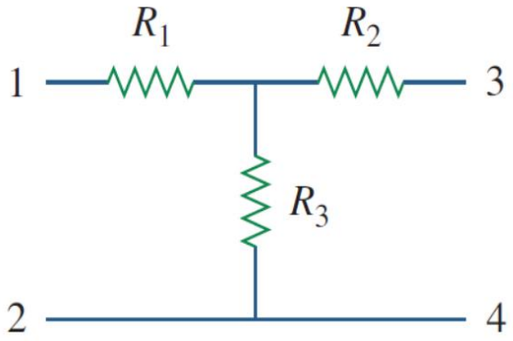
2.27-rasm. Ko‘prik tarmoqli zanjir.

Rezistorlar ketma-ket yoki parallel bo‘lmasa, R_1 dan R_6 gacha bo‘lgan rezistorlarni qanday birlashtiramiz?

2.27-rasmda ko‘rsatilgan ko‘plab zanjirlar uch terminalli ekvivalent tarmoqlardan foydalangan holda soddalashtirilishi mumkin.



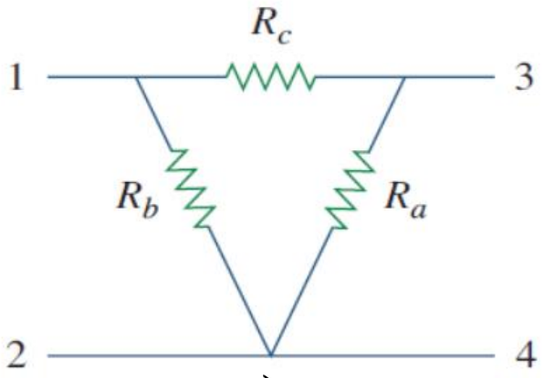
a)



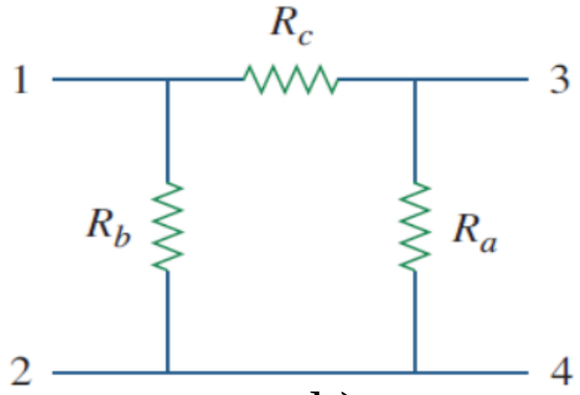
b)

2.28-rasm. Xuddi shu tarmoqning ikkita shakli:

a) Y; b) T.



a)



b)

2.28-rasm. Xuddi shu tarmoqning ikkita shakli:

a) Δ; b) Π.

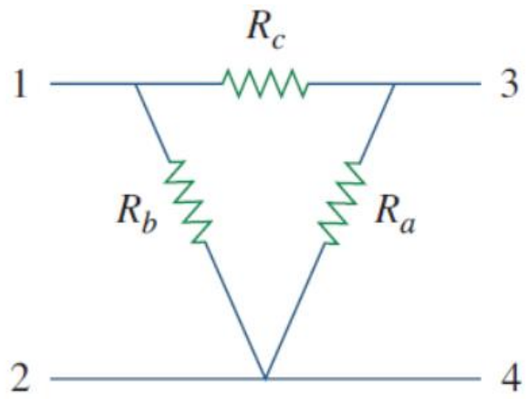
Bular 2.28-rasmda ko‘rsatilgan wye (Y) “yulduz” yoki tee (T) tarmog‘i va 2.29-rasmda ko‘rsatilgan delta (Δ) “uchburchak” yoki pi (Π) tarmog‘idir. Ushbu tarmoqlar o‘z-o‘zidan yoki kattaroq tarmoqning bir qismi sifatida paydo bo‘ladi.

Ular uch fazali tarmoqlarda, elektr filtrlarida va mos keladigan tarmoqlarda qo‘llaniladi.

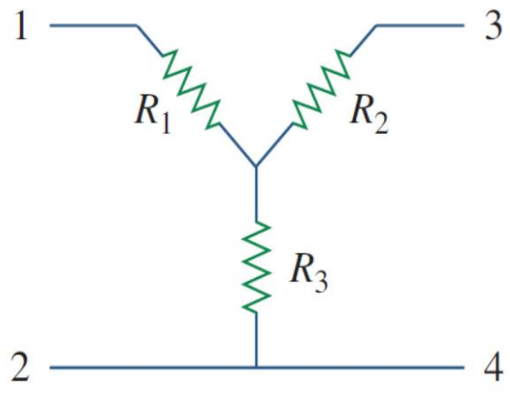
Bizning asosiy e’tiborimiz, ushbu tarmoqni tahlil qilishda wye-delta transformatsiyasini qanday qo‘llashdir.

2.6.1. Qarshiliklar uchburchagini qarshiliklar yulduziga (Delta to Wye) ekvivalent o‘zgartirish.

Δ



Y



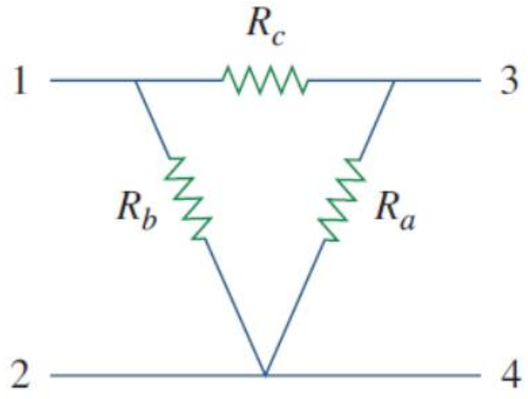
Zanjirda uchburchak konfiguratsiya mavjud bo‘lgan joyda wye tarmog‘i bilan ishlash qulayroqdir.

Biz mavjud delta tarmog‘iga wye tarmog‘ini qo‘shamiz va wye tarmog‘idagi ekvivalent qarshiliklarni topamiz.

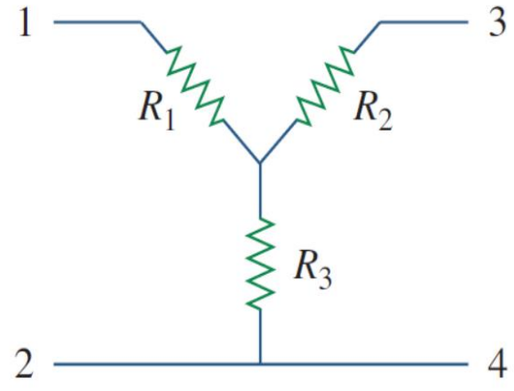
Wye tarmog‘idagi ekvivalent qarshiliklarni olish uchun biz ikkita tarmoqni solishtiramiz va Δ (yoki Π) tarmoqdagi har bir juft tugun orasidagi qarshilik Y (yoki T) tarmog‘idagi bir xil juft tugunlar orasidagi qarshilik bilan bir xil ekanligiga ishonch hosil qilamiz. Masalan, 2.28 va 2.29-rasmlardagi 1 va 2 terminallar uchun,

$$\boldsymbol{R_{12}(Y) = R_1 + R_3} \qquad \textbf{(2.46)}$$

$$\boldsymbol{R_{12}(\Delta) = R_b || (R_a + R_c)}$$



2.28-rasm.



2.29-rasm.

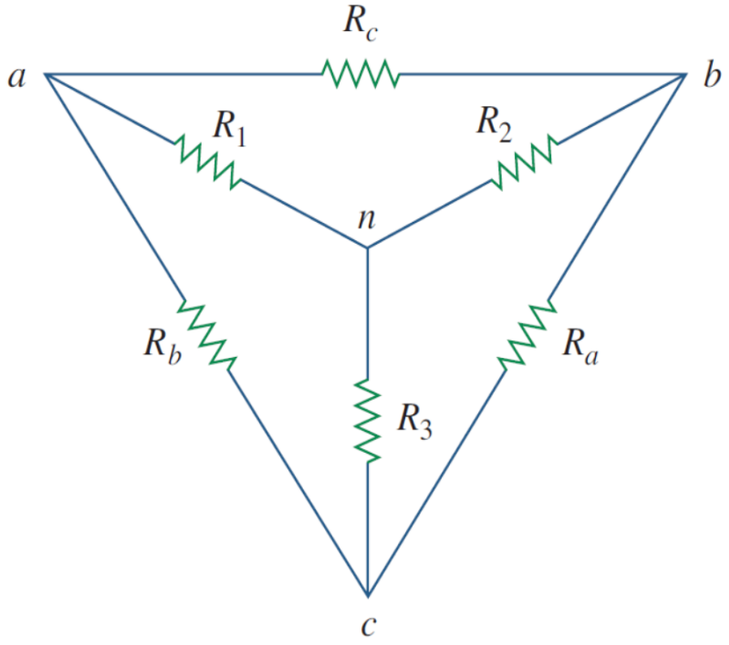
$R_{12}(Y) = R_{12}(\Delta)$ sozlama quyidagini beradi.

$$\boldsymbol{R_{12} = R_1 + R_3 = \frac{R_b\,(R_a+R_c)}{R_a+R_b+R_c}} \qquad (2.47a)$$

$$\boldsymbol{R_{13} = R_1 + R_2 = \frac{R_c\,(R_a+R_b)}{R_a+R_b+R_c}} \qquad (2.47b)$$

$$\boldsymbol{R_{34} = R_2 + R_3 = \frac{R_a\,(R_b+R_c)}{R_a+R_b+R_c}} \qquad (2.47c)$$

Y zanjiridagi har bir rezistor ikkita qo‘shni Δ shaxobchadagi rezistorlarning mahsuloti bo‘lib, uchta Δ rezistorlar yig‘indisiga bo‘linadi.



2.30-rasm. Y va Δ tarmoqlarining superpozitsiyasi birini ikkinchisiga aylantirishda sifatidagi kombinatsiyasi.

(2.47a) tenglamadan (2.47c) tenglamani ayirsak, quyidagi hosil bo‘ladi.

$$\boldsymbol{R_1 - R_2 = \frac{R_c\,(R_b - R_a)}{R_a + R_b + R_c}} \qquad (2.48)$$

(2.47b) va (2.48) tenglamalarni qo‘shsak, quyidagi hosil bo‘ladi.

$$\boldsymbol{R_1 = \frac{R_b R_c}{R_a + R_b + R_c}} \qquad (2.49)$$

(2.47b) tenglamadan (2.48) tenglamani ayirish natijasida quyidagi hosil bo‘ladi.

$$\boldsymbol{R_2 = \frac{R_c R_a}{R_a + R_b + R_c}} \qquad (2.50)$$

(2.47a) tenglamadan (2.49) tenglamani ayirib, quyidagini hosil qilamiz.

$$\boldsymbol{R_3 = \frac{R_a R_b}{R_a + R_b + R_c}} \qquad (2.51)$$

2.6.2. Qarshiliklar yulduzini qarshiliklar uchburchagiga (Wye to Delta) ekvivalent o‘zgartirish.

Wye tarmog‘ini ekvivalent delta tarmog‘iga aylantirish uchun konvertatsiya formulalarini olish uchun (2.49) dan (2.51) tenglamalarga e’tibor qaratamiz.

$$R_1R_2 + R_2R_3 + R_3R_1 = \frac{R_aR_bR_c(R_a+R_b+R_c)}{(R_a+R_b+R_c)^2} = \frac{R_aR_bR_c}{R_a+R_b+R_c} \qquad (2.52)$$

(2.52) tenglamani (2.49) dan (2.51) har biriga bo‘lish quyidagi tenglamalarga olib keladi:

$$R_a = \frac{R_1R_2+R_2R_3+R_3R_1}{R_1} \qquad (2.53)$$

$$R_b = \frac{R_1R_2+R_2R_3+R_3R_1}{R_2} \qquad (2.54)$$

$$R_c = \frac{R_1R_2+R_2R_3+R_3R_1}{R_3} \qquad (2.55)$$

Tenglamalardan (2.53), (2.55) va 2.29-rasm, Y ni Δ ga aylantirish qoidasi quyidagicha:

Δ tarmog‘idagi har bir qarshilik bir vaqtning o‘zida ikkitadan olingan Y rezistorlarining barcha mumkin bo‘lgan qiymatlari yig‘indisi bo‘lib, qarama-qarshi Y rezistorga bo‘linadi.

Y va Δ tarmoqlari qachon muvozanatlashgan deb aytiladi? Qachonki,

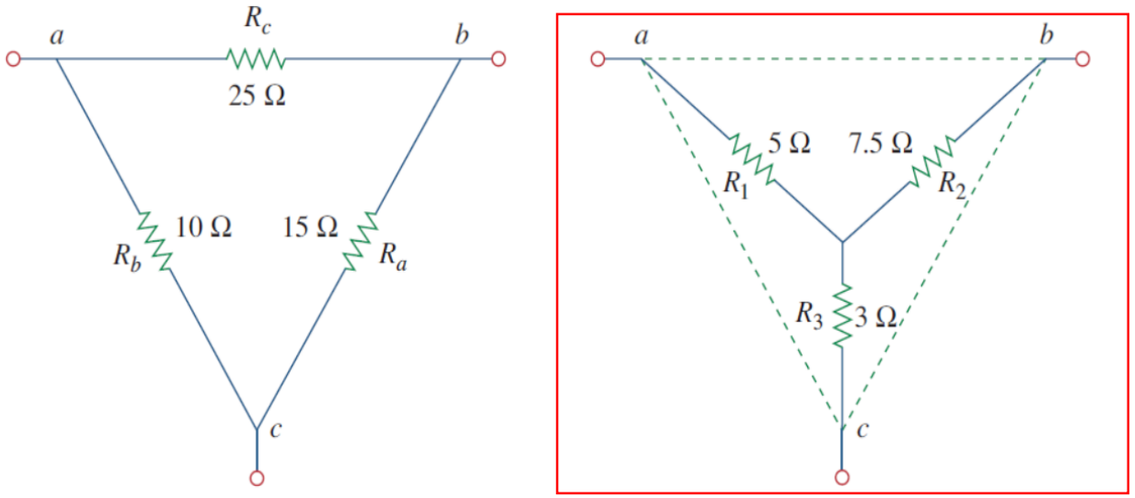
$$\boldsymbol{R_1 = R_2 = R_3 = R_Y,} \qquad \boldsymbol{R_a = R_b = R_c = R_\Delta} \tag{2.56}$$

Bunday sharoitlarda o‘zgartirish formulalari quyidagicha bo‘ladi.

$$R_Y = \frac{R_\Delta}{3}, \qquad R_\Delta = 3R_Y \tag{2.57}$$

Nima uchun R_Y R_Δ dan kamroq ekanligi haqida savol tug‘ilishi mumkin. Demak, biz **Y** - ulanishning “**ketma-ket**” ulanishga o‘xshashligini, **Δ** - ulanish esa “**parallel**” ulanishga o‘xshashligini bilamiz.

2.6.1-masala. 2.31-rasm, *a* dagi Δ tarmog‘ini ekvivalent Y tarmog‘iga aylantiring.



a) b)

2.31-rasm.
a) asl Δ tarmoq;
b) Y ekvivalent tarmog‘i.

Y tarmog‘ining ekvivalent zanjiri 2.31-rasm, *b* da ko‘rsatilgan.

Yechish: (2.49) va (2.50) tenglamalardan foydalanib, quyidagilarni aniqlaymiz.

$$R_1 = \frac{R_b R_c}{R_a + R_b + R_c} = \frac{10 \cdot 25}{15 + 10 + 25} = \frac{250}{50} = 5\ \Omega$$

$$R_2 = \frac{R_c R_a}{R_a + R_b + R_c} = \frac{25 \cdot 15}{15 + 10 + 25} = \frac{375}{50} = 7{,}5\ \Omega$$

$$R_3 = \frac{R_a R_b}{R_a + R_b + R_c} = \frac{15 \cdot 10}{15 + 10 + 25} = \frac{150}{50} = 3\ \Omega$$

2.7. Qo‘llanilishi.

Rezistorlar ko‘pincha elektr energiyasini issiqlikka yoki boshqa energiya turlariga aylantiradigan qurilmalarni modellashtirish uchun ishlatiladi.

o‘tkazgich simlari

Photo source: [38] - https://blog.igus.de/wp-content/uploads/2021/05/Kupferlitzen-kleiner-1024x682.jpeg

lampochkalar

Photo source: [39] - https://d1whtlypfis84e.cloudfront.net/guides/wp-content/uploads/2019/09/17130103/bulb.jpg

elektr isitgichlar

Photo source: [40] - https://ae01.alicdn.com/kf/U0e366f575f24401ca947a4e9681ba8b9U/KUMTEL-Electric-Mini-Fireplace-Stove-2200w-KS2760SS.jpeg

ovoz kuchaytirgichlar

Photo source: [43] - https://www.jblsynthesis.com/on/demandware.static/-/Sites-masterCatalog_Harman/default/dwafc0181b/JBLSynthesis_SCL1_Hero_Angle_Black_web.png

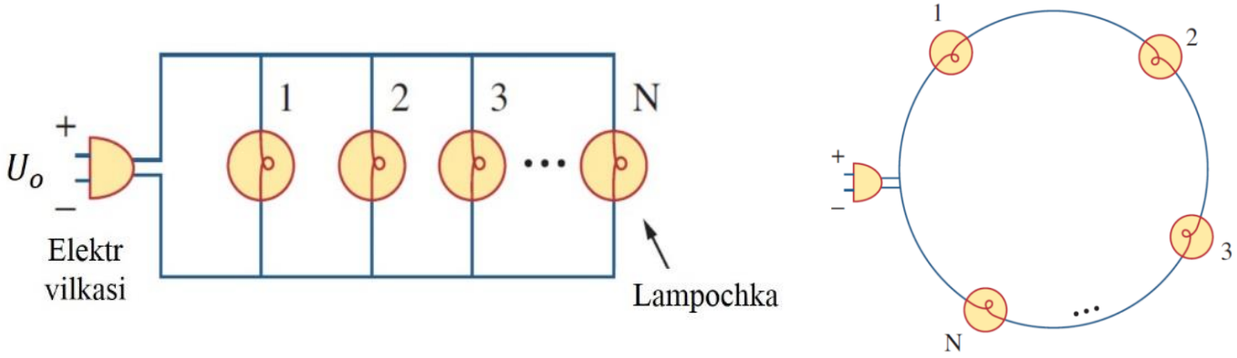
pechkalar

Photo source: [41] - https://contentgrid.thdstatic.com/hdus/en_US/DTCCOMNEW/fetch/NexGen/ContentPage/RangeFinish5vv.jpg

pechlar

Photo source: [42] - https://static.wixstatic.com/media/fd9026_2278803b508a4a38b4b8dc730540d246~mv2.jpg/v1/fit/w_1000%2Ch_1000%2Cal_c%2Cq_80,enc_auto/file.jpg

Yoritish tizimlari. Uydagi yoki ko‘ngil ochar joylarida daraxtlarni yoki biron-bir ob’yektlarni kabi yoritish tizimlari ko‘pincha 2.32-rasmda ko‘rsatilganidek, parallel yoki ketma-ket ulangan N ta lampalardan iborat bo‘ladi.



a) b)

2.32-rasm.

a) Lampochkalarni parallel ulash;
b) lampochkalarni ketma-ket ulash.

Har bir chiroq rezistor sifatida modellashtirilgan.

Barcha lampalar bir xil va U_0 elektr tarmog‘idagi kuchlanish deb faraz qilsak, har bir chiroqning kuchlanishi parallel ulanish uchun U_0 va ketma-ket ulanish uchun U_0/N dir.

Photo source: [44] - Fundamentals of Electric Circuits, Charles K. Alexander and Matthew N. O. Sadiku / 5th edition, the McGraw-Hill Companies, Inc., -2013. – p 59.

Hozirgacha biz birlashtiruvchi simlarni mukammal o‘tkazgichlar (ya’ni, nol qarshilik o‘tkazgichlari) deb hisobladik. Haqiqiy fizik tizimlarda esa, ulanish simining qarshiligi sezilarli darajada katta bo‘lishi mumkin va tizimni modellashtirish ushbu qarshilikni o‘z ichiga olishi kerak.

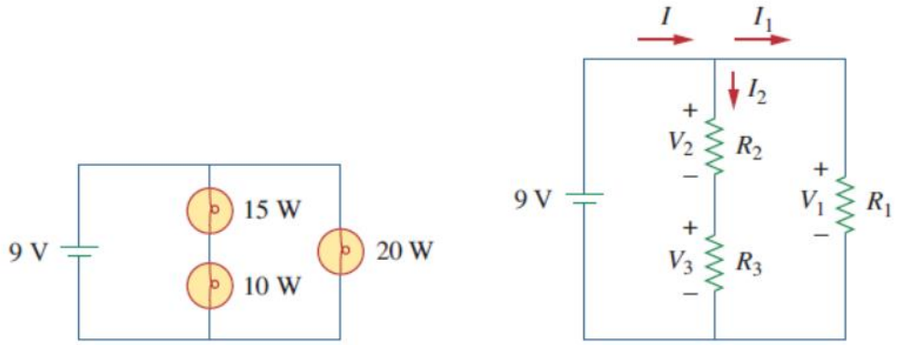
Ketma-ket ulanishni ishlab chiqarish oson, lekin kamida ikkita sababga ko‘ra amalda kamdan-kam qo‘llaniladi.

Birinchidan, u kamroq ishonchli; chiroq ishlamay qolganda, barcha lampalar o‘chadi.

Ikkinchidan, uni saqlash qiyinroq; chiroq yomon bo‘lsa, nosozlikni aniqlash uchun barcha lampalarni birma-bir tekshirib chiqish kerak.

2.7.1-masala. 2.33-rasm, *a* da ko‘rsatilganidek, 9 V batareyaga uchta lampochka ulangan.

Quyidagilarni hisoblang: a) akkumulyator tomonidan ta’minlangan umumiy tok, b) har bir lampochkadan o‘tadigan tok kuchi, c) har bir lampochkaning qarshiligi.



a) b)

2.33-rasm.
a) uchta lampochkali yoritish tizimi;
b) qarshilik zanjirlarining ekvivalent modeli.

Yechish: a) $p = 15 + 10 + 20 = 45\ W$ $\boxed{p = UI}$ $I = \frac{p}{U} = \frac{45}{9} = 5\ A$

b) $U_1 = U_2 + U_3 = 9\ V$

R_1 qarshiligi orqali o‘tadigan tok kuchi,

$$I_1 = \frac{p_1}{U_1} = \frac{20}{9} = 2{,}222\ A$$

KCL bo‘yicha, R_2 va R_3 larning ketma-ket birikmasi oqali o‘tuvchi tok kuchi,

$$I_2 = I - I_1 = 5 - 2{,}222 = 2{,}778\ A$$

c) $p = I^2R$ ekanligidan foydalanib,

$$R_1 = \frac{p_1}{I_1^2} = \frac{20}{2{,}222^2} = 4{,}05\ \Omega \qquad R_2 = \frac{p_2}{I_2^2} = \frac{15}{2{,}777^2} = 1{,}945\ \Omega \qquad R_3 = \frac{p_3}{I_3^2} = \frac{10}{2{,}777^2} = 1{,}297\ \Omega$$

TEKSHIRISH UCHUN SAVOLLAR!

2.1. Qarshilikning o‘zaro ta’siri bu:
A) kuchlanish. B) tok kuchi. C) o‘tkazgich. D) kulon.

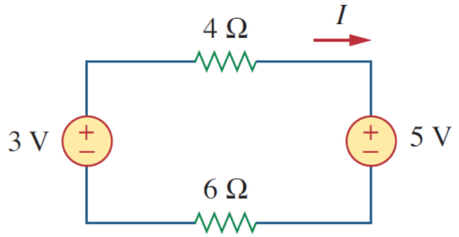
2.2. Elektr isitgich 120 V tarmoqdan 10 A tok kuchi iste’mol qiladi. Isitgichning qarshiligi bu:
A) 1200 Ω. B) 120 Ω. C) 12 Ω. D) 1,2 Ω.

2.3. 12 A tokni iste’mol qilganda 1,5 kVt tosterda kuchlanishning tushuvi bu:
A) 18 kV. B) 125 V. C) 120 V. D) 10,42 V.

2.4. 2 Vt, 80 kΩ rezistor xavfsiz o‘tkaza oladigan maksimal tok kuchi bu:
A) 160 kA. B) 40 kA. C) 5 mA. D) 25 μA.

2.5. Tarmoqda 12 ta tarmoq va 8 ta mustaqil halqa mavjud. Tarmoqda nechta tugun mavjud?
A) 19. B) 17. C) 5. D) 4.

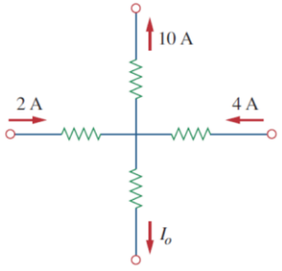
2.6. 2.34-rasmdagi zanjirda I tok kuchi aniqlang?



2.34-rasm.

A) -0,8 A.
B) -0,2 A.
C) 0,2 A.
D) 0,8 A.

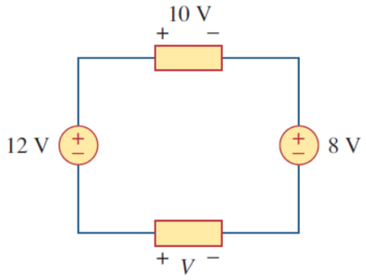
2.7. 2.35-rasmdagi zanjirda I_0 tok kuchini toping?



2.35-rasm.

A) -4 A.
B) -2 A.
C) 4 A.
D) 16 A.

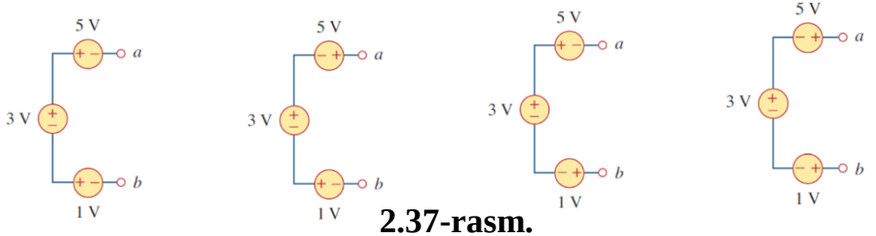
2.8. 2.36-rasmdagi zanjirda U kuchlanish qiymatini toping?



2.36-rasm.

A) 30 V.
B) 14 V.
C) 10 V.
D) 6 V.

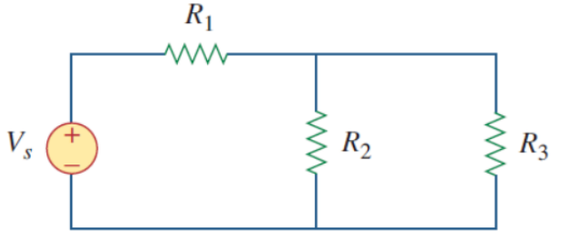
2.9. 2.37-rasmdagi zanjirlardan qaysi biri sizga $U_{ab} = 7\ V$ ni beradi?



2.37-rasm.

A) B) C) D)

2.10. 2.38-rasmdagi zanjirda R_3 ning pasayishi .....ning pasayishiga olib keladi. Nuqtalar o‘rniga tegishli bo‘lganlarning barchasini tanlang.



2.38-rasm.

A) R_3 dan o‘tuvchi tok kuchi.
B) R_3 dagi kuchlanish.
C) R_1 dagi kuchlanish.
D) R_2 dagi quvvat sarfi.

FOYDALANILGAN MANBALAR:

38. https://blog.igus.de/wp-content/uploads/2021/05/Kupferlitzen-kleiner-1024x682.jpeg
39. https://d1whtlypfis84e.cloudfront.net/guides/wp-content/uploads/2019/09/17130103/bulb.jpg
40. https://ae01.alicdn.com/kf/U0e366f575f24401ca947a4e9681ba8b9U/KUMTEL-Electric-Mini-Fireplace-Stove-2200w-KS2760SS.jpeg
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43. https://www.jblsynthesis.com/on/demandware.static/-/Sites-masterCatalog_Harman/default/dwafc0181b/JBLSynthesis_SCL1_Hero_Angle_Black_web.png
44. Fundamentals of Electric Circuits, Charles K. Alexander and Matthew N. O. Sadiku / 5th edition, the McGraw-Hill Companies, Inc., -2013. – p 59.

E'TIBORINGIZ UCHUN RAHMAT!!!