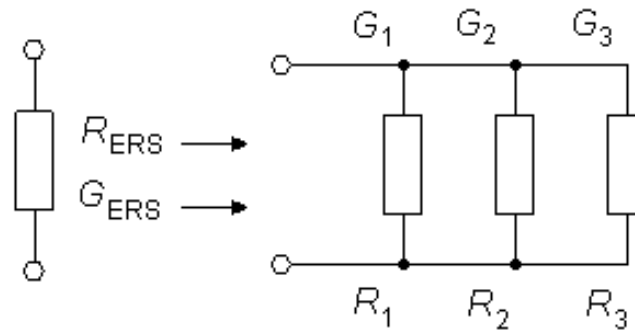
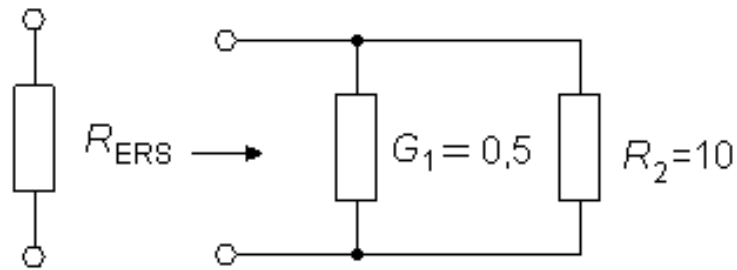


Blanda R och G



$$G_{ERS} = G_1 + G_2 + G_3$$
$$\updownarrow \quad \updownarrow \quad \updownarrow \quad \updownarrow$$
$$\frac{1}{R_{ERS}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

Exempel, blanda R och G

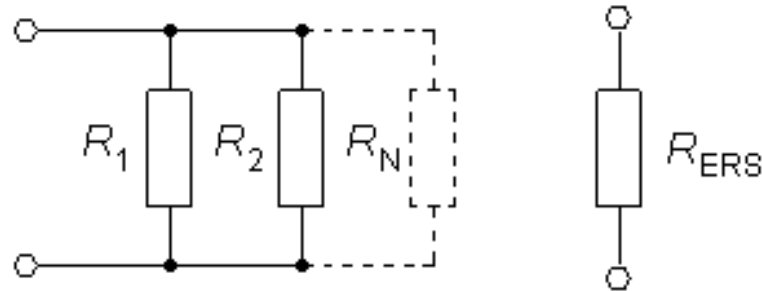


$$\frac{1}{R_{ERS}} = G_1 + \frac{1}{R_2} = 0,5 + 1/10 = 0,6$$

$$\frac{1}{R_{ERS}} = 0,6 \text{ MHO} \Rightarrow R_{ERS} = \frac{1}{0,6} = 1,67 \Omega$$

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N st *samma värde* parallellkopplade



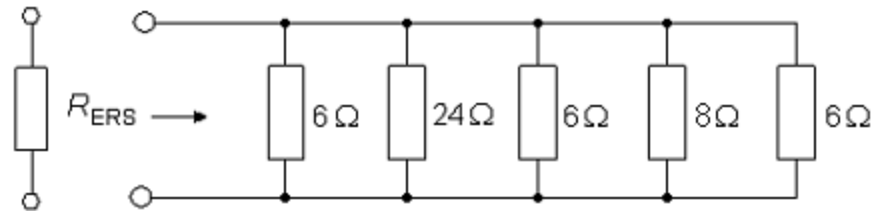
$$R_1 = R_2 = \dots = R_N = R$$

$$\frac{1}{R_{ERS}} = \frac{1}{R} + \frac{1}{R} + \dots = \frac{N}{R}$$

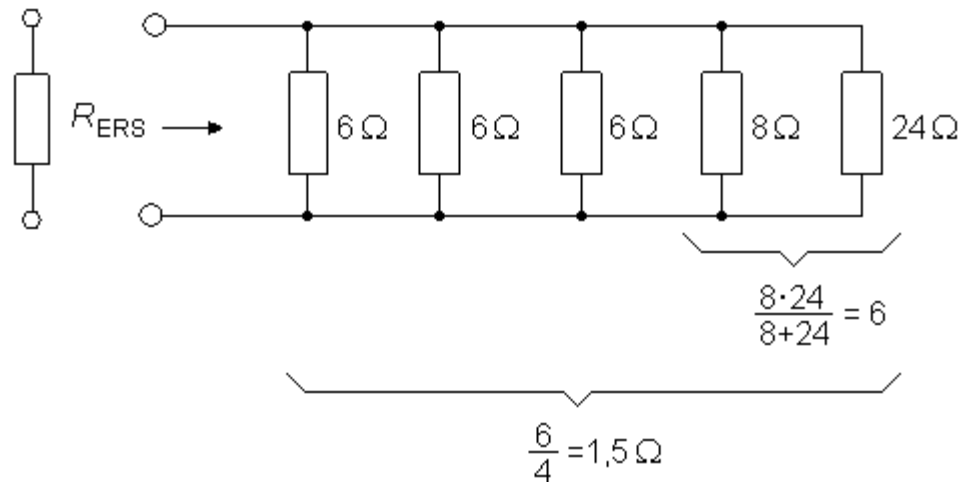
$$R_{ERS}(N) = \frac{R}{N}$$

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OK att flytta ...



Omritat:



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Ersättningsresistans (1.6)

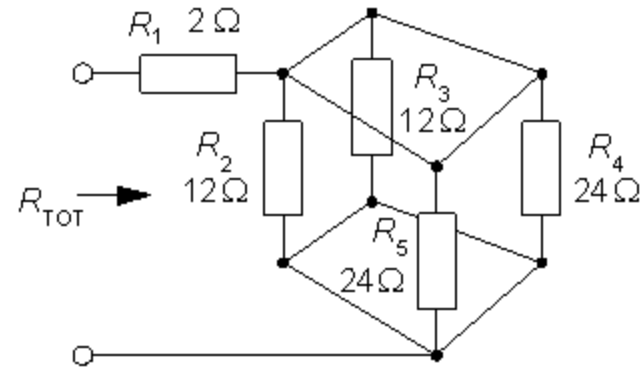
$$R_{TOT} = 2 + (12 // 12) // (24 // 24)$$

// betyder parallellkoppling

$$12 // 12 = 6 \quad 24 // 24 = 12$$

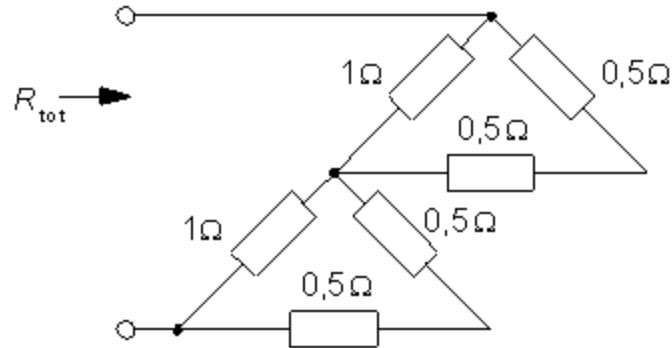
$$(12 // 12) // (24 // 24) = \frac{6 \cdot 12}{6 + 12} = 4$$

$$R_{TOT} = 2 + 4 = 6 \Omega$$



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Ersättningsresistans (1.1)



$$R_{TOT} = 1/(0,5+0,5) + 1/(0,5+0,5) = 1/1 + 1/1 = 0,5 + 0,5 = 1$$

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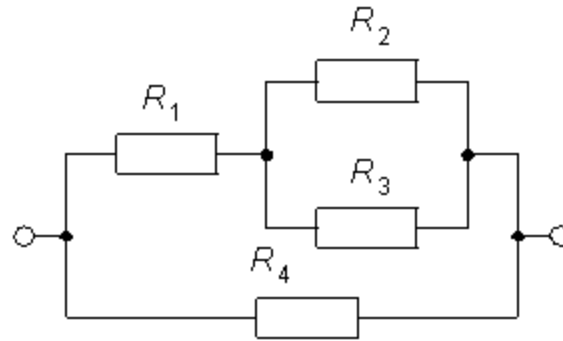
Ersättningsresistans (1.2)

$$R_1 = 1 \Omega$$

$$R_2 = 21 \Omega$$

$$R_3 = 42 \Omega$$

$$R_4 = 30 \Omega$$



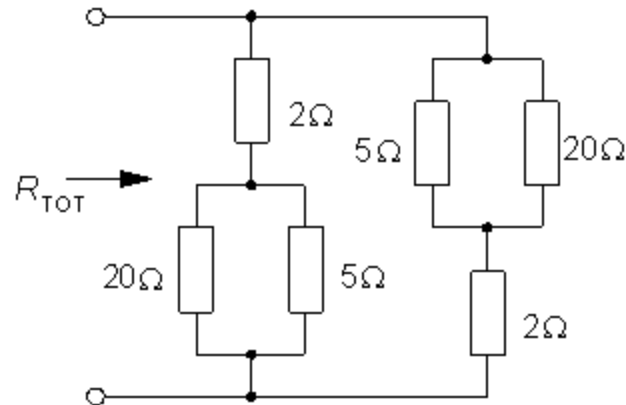
$$R_{ERS} = 30 // (1 + 21 // 42)$$

$$21 // 42 = \frac{21 \cdot 42}{21 + 42} = 14 \Rightarrow (1 + 21 // 42) = 15$$

$$30 // 15 = \frac{30 \cdot 15}{30 + 15} = 10 \Rightarrow R_{ERS} = 10 \Omega$$

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Ersättningsresistans (1.8)



$$R_{TOT} = (2 + 20 // 5) // (20 // 5 + 2)$$

$$(2 + 20 // 5) = 2 + \frac{20 \cdot 5}{20 + 5} = 2 + 4 = 6 \quad 6 // 6 = 3$$

$$R_{TOT} = 3 \Omega$$

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Serie – parallell kretsar (3.3)

Beräkna strömmen $I = ?$ och spänningen $U = ?$ för figurens serie-parallellkrets.

Beräkna en ersättningsresistans:

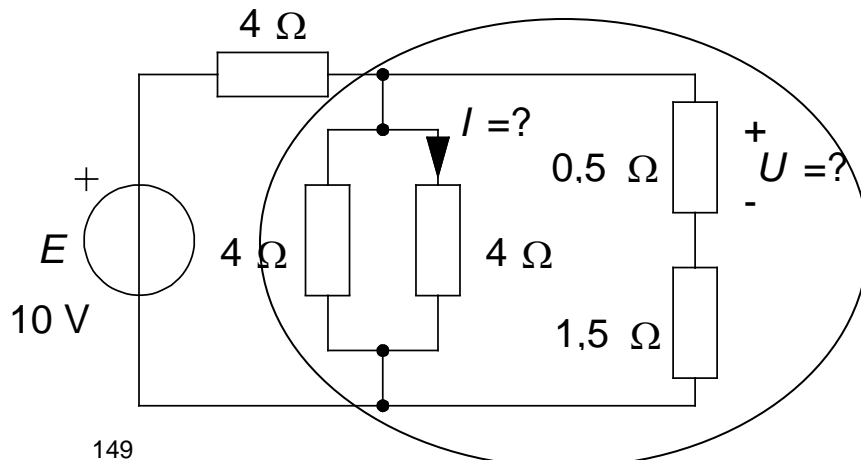
$$R_{ERS} = 2 // (4 // 4) = 2 // 2 = 1 \Omega$$

Beräkna spänningen över ersättningsresistansen U_{RERS}

$$U_{RERS} = 10 \frac{1}{4+1} = 2$$

Strömmen $I = U_{RERS} / 4 = 2 / 4 = 0,5 \text{ A}$

Spänningen $U = 2 \frac{0,5}{1,5+0,5} = 0,5 \text{ V}$

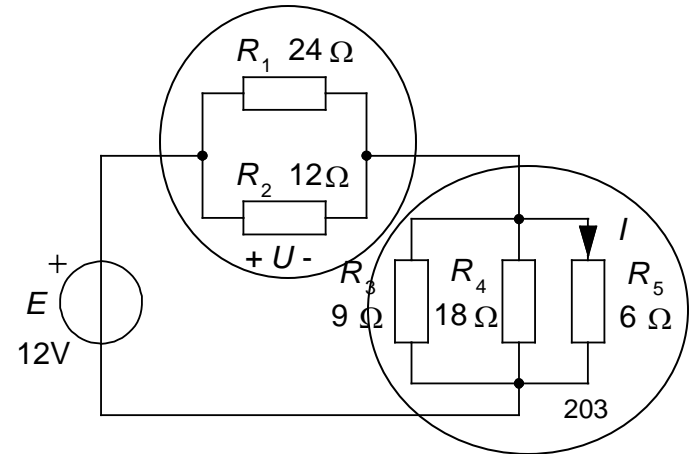


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Serie – parallell kretsar (3.2)

Beräkna strömmen I och spänningen U för figurens serie-parallellkrets.

Vi startar med att beräkna två ersättningsresistanser:



$$R_{1//2} = \frac{24 \cdot 12}{24 + 12} = 8 \quad \frac{1}{R_{3//4//5}} = \frac{1}{9} + \frac{1}{18} + \frac{1}{6} = \frac{2+1+3}{18} = \frac{6}{18} \Rightarrow R_{3//4//5} = \frac{18}{6} = 3$$

Spänningsdelning:

$$U = 12 \frac{8}{8+3} = 8,73 \Rightarrow U_{3//4//5} = E - U \Rightarrow I = \frac{U_{3//4//5}}{R_5} = \frac{12 - 8,73}{6} = 0,55 \text{ A}$$

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Serie – parallell kretsar (3.4)

Beräkna strömmen I och spänningen U för figurens serie-parallellkrets

Vi beräknar en ersättningsresistans:

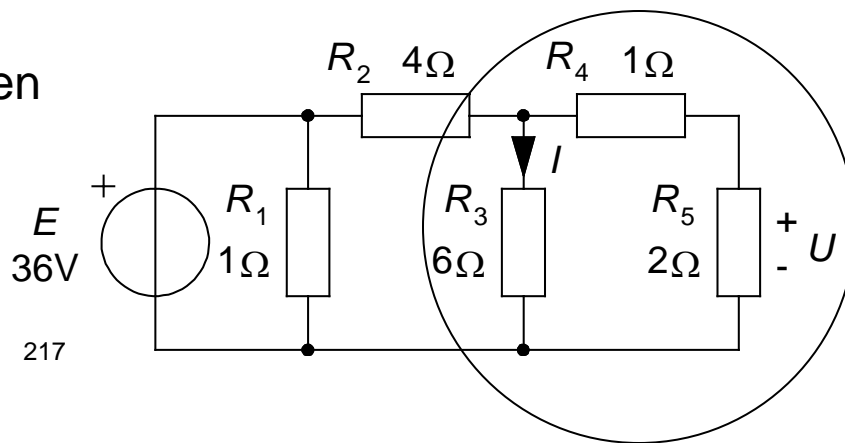
$$R_{3//4,5} = \frac{6 \cdot (1 + 2)}{6 + 1 + 2} = 2$$

$U_{R1} = 36 \text{ V}$. $U_{R3} = U_{R3//4,5}$ kan beräknas med spänningsdelningsformeln:

$$U_{R3} = E \frac{R_{3//4,5}}{R_{3//4,5} + R_2} = 36 \frac{2}{2 + 4} = 12 \Rightarrow I = \frac{U_{R3}}{R_3} = \frac{12}{6} = 2 \text{ A}$$

U kan nu beräknas med spänningsdelningformeln:

$$U = U_{R3//4,5} \frac{R_5}{R_4 + R_5} = 12 \frac{2}{1 + 2} = 8 \text{ V}$$

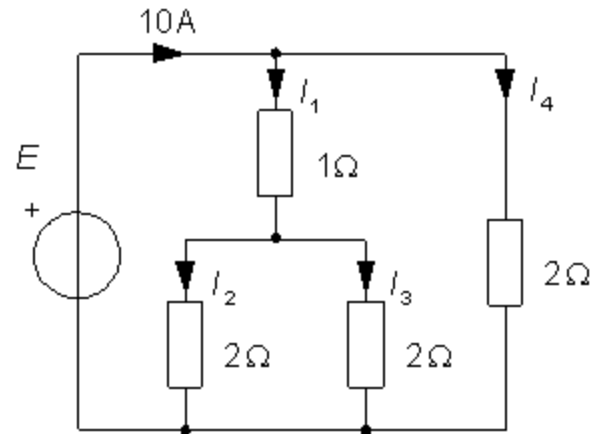


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Kirchoffs strömlag (6.1)

Kan Du gissa strömmarna?

$$\begin{aligned}I_1 &= 5 \text{ A} \\I_2 &= 2,5 \text{ A} \\I_3 &= 2,5 \text{ A} \\I_4 &= 5 \text{ A}\end{aligned}$$



$$I_1 + I_4 = 10$$

$$I_1 = I_2 + I_3 \quad I_2 = I_3$$

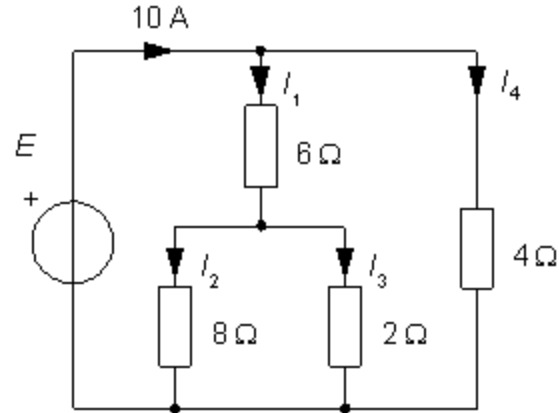
Parallellkrets, OHM's lag: $I_4 \cdot 2 = I_1 \cdot (1 + 2//2) \Rightarrow I_4 = I_1 = 10/2 = 5$

$$I_1 = I_2 + I_3 \Rightarrow I_2 = I_3 = 5/2 = 2,5$$

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Kirchoffs strömlag (6.2)

Nu måste man räkna!



$$R_{ERS} = \frac{\left(6 + \frac{8 \cdot 2}{8 + 2}\right) \cdot 4}{\left(6 + \frac{8 \cdot 2}{8 + 2}\right) + 4} = 2.62\ \Omega \quad E = R_{ERS} \cdot I = 2.62 \cdot 10 = 26.2\ \text{V}$$

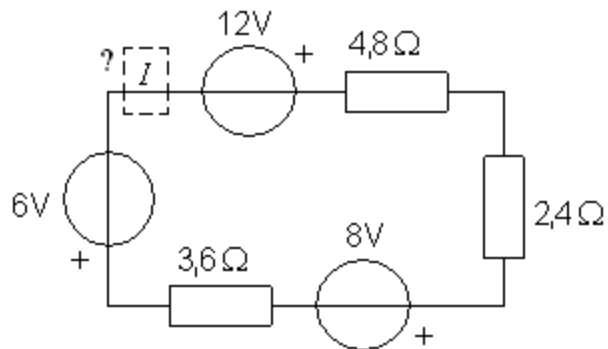
$$I_4 = \frac{E}{4} = \frac{26.2}{4} = 6.55\ \text{A} \quad I_1 = I - I_4 = 10 - 6.55 = 3.45\ \text{A}$$

$$I_2 = \frac{E - 6 \cdot I_1}{8} = \frac{26.2 - 3.45 \cdot 6}{8} = \frac{5.5}{8} = 0.69\ \text{A} \quad I_3 = \frac{5.5}{2} = 2.75\ \text{A}$$

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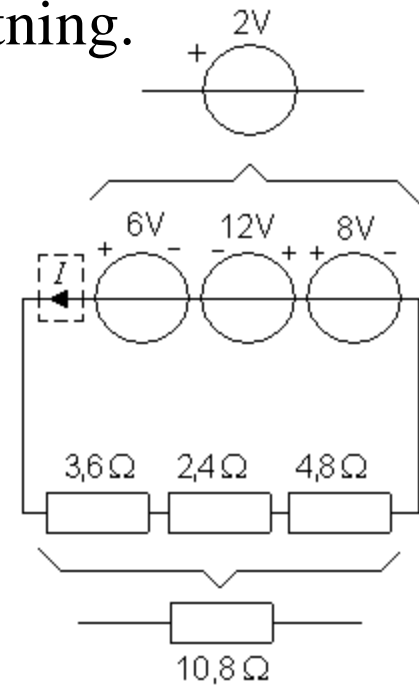
Seriekrets

Bestäm strömmen I till storlek och riktning.



$$8 + 6 - 12 = 2 \quad 3,6 + 2,4 + 4,8 = 10,8$$

$$I = \frac{2}{10,8} = 0,19 \text{ A}$$



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