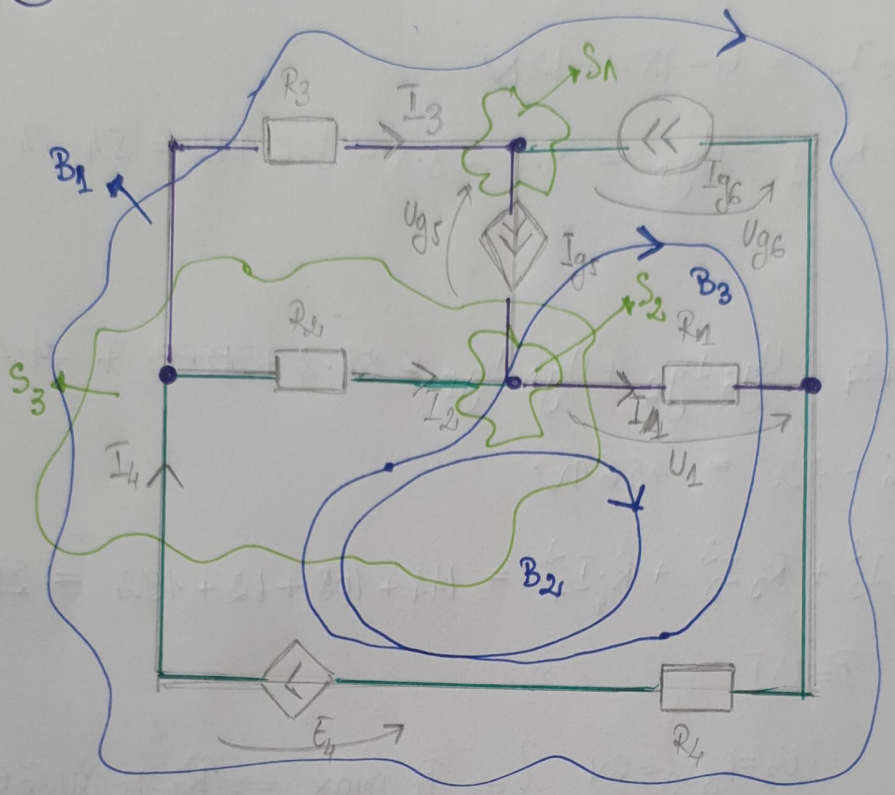
TEMĂ SEMINAR 2

1. $R_1 = 1\,\Omega$, $R_2 = 3\,\Omega$, $R_3 = 3\,\Omega$, $R_4 = 3\,\Omega$, $E_4 = 9 I_2$, $I_{g_5} = 0{,}5\, U_1$, $I_{g_6} = 4\,A$.



$N = 4$, $L = 6$

$N - 1 \Rightarrow$ 3 ramuri

$L - N + 1 \Rightarrow$ 3 laturi

$A = \{2, 4, 6\}$

$C = \{1, 5, 3\}$

(S_1): $-I_3 - I_{g_6} + I_{g_5} = 0 \Rightarrow I_{g_5} = 4 + I_3$

(S_2): $-I_2 + I_1 - I_{g_5} = 0$

(S_3): $-I_4 + I_1 + I_3 - I_{g_5} = 0$

$\overset{(-)}{\Rightarrow} -I_2 + I_4 - I_3 = 0$

$-I_{g_6} - I_4 + I_1 = 0 \Rightarrow \underline{I_4 = I_1 - 4}$

(B_1): $U_{g_6} + R_4 I_4 - E_4 + R_3 I_3 = 0 \quad (1)$

(B_2): $R_2 I_2 + U_1 + R_4 I_4 - E_4 = 0$

(B_3): $U_{g_6} + R_4 I_4 - E_4 + R_2 I_2 + U_{g_5} = 0 \quad (2)$

(1)-(2)

$\Rightarrow R_3 I_3 - R_2 I_2 - U_{g_5} = 0 \Rightarrow U_{g_5} = R_3 I_3 - R_2 I_2$

~~$I_1 + I_1$~~ $I_{g_5} = 0{,}5\, U_1 = 0{,}5\, I_1 R_1 \Rightarrow \underline{I_{g_5} = 0{,}5 \cdot I_1}$

$\underline{I_3 = I_{g_5} - 4 = 0{,}5\, I_1 - 4}$

$I_2 = I_1 - 0,5 I_1 = 0,5 I_1$

$R_2 I_2 + U_1 + R_4 I_4 - E_4 = 0 \Rightarrow 3 \cdot 0,5 I_1 + I_1 + 3(I_1 - 4) - 9 \cdot 0,5 I_1 = 0 \Rightarrow$

$\Rightarrow 1,5 I_1 + I_1 + 3 I_1 - 12 - 4,5 I_1 = 0 \Rightarrow I_1 = 12\,A$

$I_2 = 0,5 \cdot 12 = 6A$, $I_3 = 6 - 4 = 2A$, $I_4 = 12 - 4 = 8A$, $I_{g5} = 6A$

$U_{g5} = R_3 I_3 - R_2 I_2 = 6 - 18 = -12\,V$

$U_{g6} = E_4 - R_4 I_4 - R_2 I_2 - U_{g5} = 9 \cdot 6 - 3 \cdot 8 - 3 \cdot 6 + 12 = 54 - 24 - 18 + 12 =$

$= 24\,V$

$P_g = E_4 I_4 + U_{g6} I_{g6} + U_{g5} I_{g5} = 54 \cdot 8 + 24 \cdot 4 + 6 \cdot (-12)$

$= 432 + 96 - 72 = 456\,W$

$P_C = R_1 I_1^2 + R_2 I_2^2 + R_3 I_3^2 + R_4 I_4^2 = 144 + 108 + 12 + 192 = 456\,W$

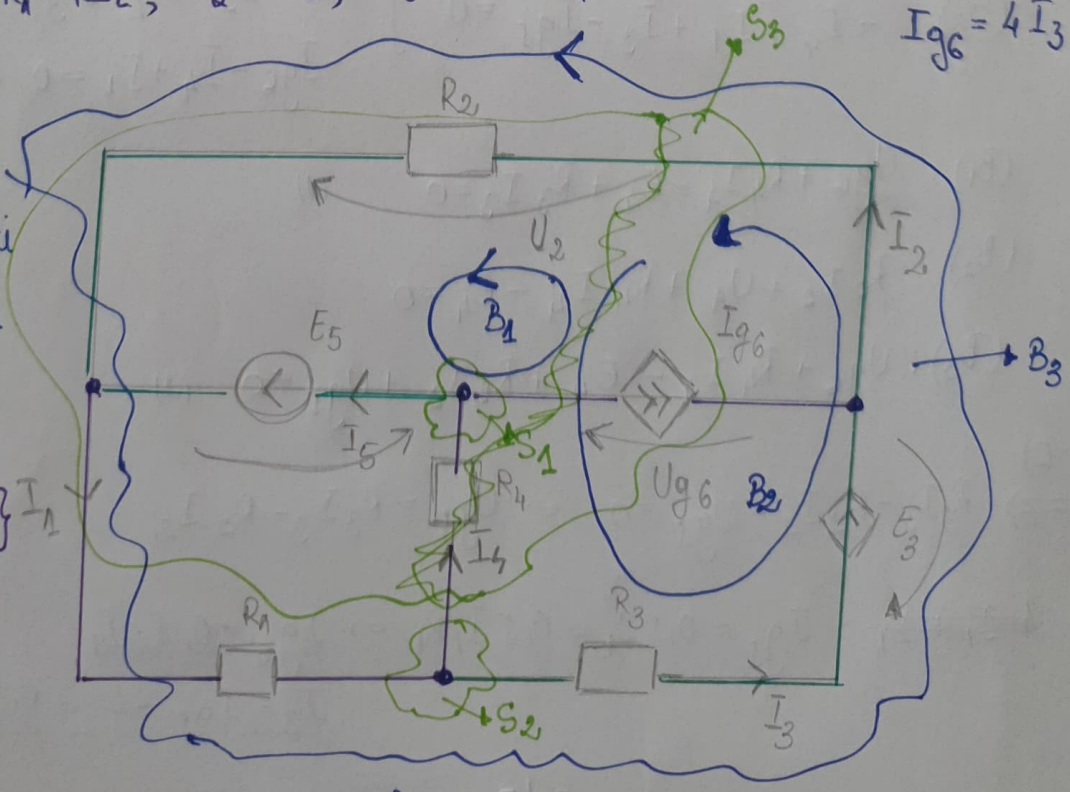
$P_g = P_C$ $\qquad P = U \cdot I$

$U_1 = R_1 \cdot I_1 = 12V$ $\qquad U_3 = R_3 I_3 = 6V$

$U_2 = R_2 I_2 = 18V$ $\qquad U_4 = R_4 I_4 = 24$

$\Rightarrow P_4$ max $\Rightarrow R_4$ se încălzește cel mai mult.

② $R_1 = 1\Omega$, $R_2 = 2\Omega$, $R_3 = 3\Omega$, $R_4 = 1\Omega$, $E_3 = 2U_2$, $E_5 = 26V$, $I_{g6} = 4 I_3$.



$N = 4$, $L = 6$

$N - 1 \Rightarrow$ 3 noduri

$L - N + 1 \Rightarrow$ 3 ochiuri

$A = \{3, 2, 5\}$

$C = \{1, 4, 6\}$

(B_1) : $U_2 + E_5 - U_{g6} = 0$

(B_2) : $U_2 + E_5 - I_4 R_4 + R_3 I_3 - E_3 = 0 \Rightarrow E_5 - R_4 I_4 + R_3 I_3 - U_2 = 0$

(B_3) : $R_1 I_1 + R_3 I_3 - E_3 + U_2 = 0 \Rightarrow R_1 I_1 + R_3 I_3 - U_2 = 0$ $(-)$

$E_5 - R_4 I_4 - R_1 I_1 = 0 \Rightarrow$

$\Rightarrow 26 - I_4 - I_1 = 0 \Rightarrow \boxed{I_4 = 26 - I_1}$

(S_1) : $I_5 + I_{g6} - I_4 = 0 \Rightarrow I_5 + 4I_3 - I_4 = 0$ $\Big\}$ $(+)$ $\Rightarrow I_5 + I_3 - I_1 = 0 \Rightarrow$

(S_2) : $I_4 - I_1 + I_3 = 0$

(S_3) : $-I_2 + I_1 - I_4 + I_{g6} = 0$ $\Big\}$ $(+)$ $\Rightarrow I_3 - I_2 + 4I_3 \Rightarrow \underline{I_2 = 5I_3}$

$I_5 + I_2 - I_1 = 0$ $\Rightarrow \boxed{I_2 = 10I_1 - 130}$

$26 - 2I_1 + I_3 = 0 \Rightarrow \boxed{I_3 = 2I_1 - 26}$

~~$I_5 = I_4 - I_{g6} = 26 - I_1 - 8I_1 + 96 = -9I_1 + 126$~~

$I_{g6} = 4I_3 = 8I_1 - 104$

$I_5 = I_4 - I_{g6} = 26 - I_1 - 8I_1 + 104 = -9I_1 + 130 \Rightarrow \boxed{I_5 = -9I_1 + 130}$

$I_1 + 3 \cdot (2I_1 - 26) - 2(10I_1 - 130) = 0 \Rightarrow I_1 + 6I_1 - 78 - 20I_1 + 260 = 0 \Rightarrow$

$\Rightarrow -13I_1 + 182 = 0 \Rightarrow I_1 = \frac{182}{13} = 14\,A$, $U_2 = 20\,V$

$\underline{I_1 = 14A}$, $\underline{I_2 = 140 - 130 = 10A}$, $\underline{I_3 = 28 - 26 = -2A}$, $\underline{I_4 = 26 - 14 = 12A}$,

$\underline{I_5 = -126 + 130 = 4A}$, $\underline{U_{g6} = U_2 + E_5 = 20 + 26 = 46\,V}$, $\underline{I_{g6} = -8A}$

$P_g = E_5 I_5 + U_2 I_2 + U_{g6} \cdot I_{g6} + E_3 I_3 = 26 \cdot 4 + 200 + 46 \cdot (+8) + 40 = 42$

$= 104 + 200 + 368 + 80 = +448 + 124 = +572\,W$

$P_e = R_1 I_1^2 + R_2 I_2^2 + R_3 I_3^2 + R_4 I_4^2 = 196 + 200 + 12 + 144 = 552\,W$

$\underline{P_c = P_g}$

$P = U \cdot I = R I^2$

$U_1 = R_1 I_1 = 14V$ $\quad U_3 = R_3 I_3 = -6V$

$U_2 = R_2 I_2 = 20V$ $\quad U_4 = R_4 I_4 = 12V$

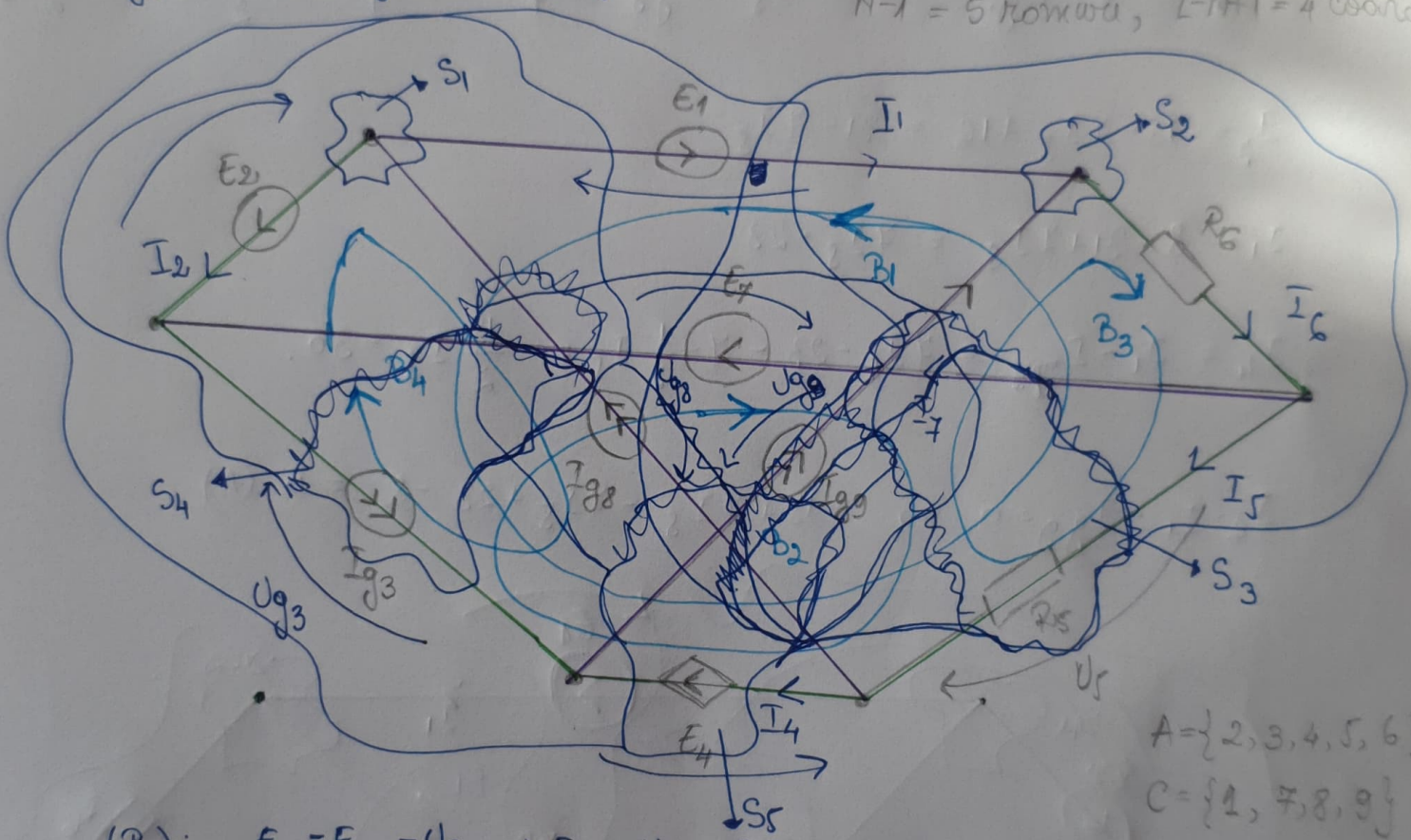
$\Rightarrow U_2$ max $\Rightarrow$ $\Rightarrow R_2$ se încălzește cel mai mult.

(3.) $R_5 = R_6 = 2\Omega$, $E_1 = 12V$, $E_2 = 42V$, $E_7 = 38V$, $E_4 = 7U_5$,

$I_{g3} = 14A$, $I_{g8} = 8A$, $I_{g8} = 8A$

$N = 6$, $L = 9$

$N-1 = 5$ noduri, $L-N+1 = 4$ ochiuri



$A = \{2, 3, 4, 5, 6\}$

$C = \{1, 7, 8, 9\}$

(B_1): $E_1 - E_2 - U_{g3} + E_4 - U_5 - R_6 I_6 = 0$

(B_2): $E_7 + U_5 - E_4 + U_{g3} = 0$

(B_3): $R_6 I_6 + U_5 - E_4 - U_{g9} = 0$

(B_4): $E_2 + U_{g8} - E_4 + U_{g3} = 0$

$\overset{+}{\Rightarrow} E_1 - E_2 - R_6 I_6 + E_7 = 0$

$\Rightarrow I_6 = \dfrac{E_1 - E_2 + E_7}{R_6} =$

$= \dfrac{12 - 42 + 17 I_5}{2} = -15 + 7 I_5$

(S_1): $I_1 + I_2 - I_{g8} = 0$ $(+)$ $\Rightarrow$ $I_2 - I_{g8} + I_6 - I_{gg} = 0 \Rightarrow I_2 = -I_6 + 16$

(S_2): $I_6 - I_1 - I_{gg} = 0$

(S_3): ~~$-I_7 - I_{gg} - I_5 = 0$~~ $-I_1 + I_5 - I_{g8} + I_7 = 0$ $\Rightarrow$

(S_4): ~~$-I_7 - I_{g8} + I_{g3} = 0$~~ $I_{g3} - I_{g8} - I_1 - I_7 = 0$

(S_5): ~~$I_4 - I_{g8} - I_{gg} = 0$~~ $-I_4 + I_1 + I_{gg} - I_7 - I_{g8} = 0$

$\Rightarrow I_5 + 2I_7 - I_{g3} = 0 \Rightarrow I_5 = I_{g3} - 2I_7 \Rightarrow I_7 = \frac{14 - I_5}{2} = 7 - \frac{1}{2} I_5$

$I_2 = 15 - 7I_5 + 16 = 31 - 7I_5$

$I_1 = 8 - 31 + 7I_5 = 7I_5 - 23$

$I_4 = I_1 - I_{g8} = 7I_5 - 23 - 7 + \frac{1}{2} I_5 = \frac{15}{2} I_5 - 30.$

$I_6 - I_1 - I_{gg} = 0 \Rightarrow -15 + 7I_5 - 7I_5 + 23 - 8 = 0$ (A)