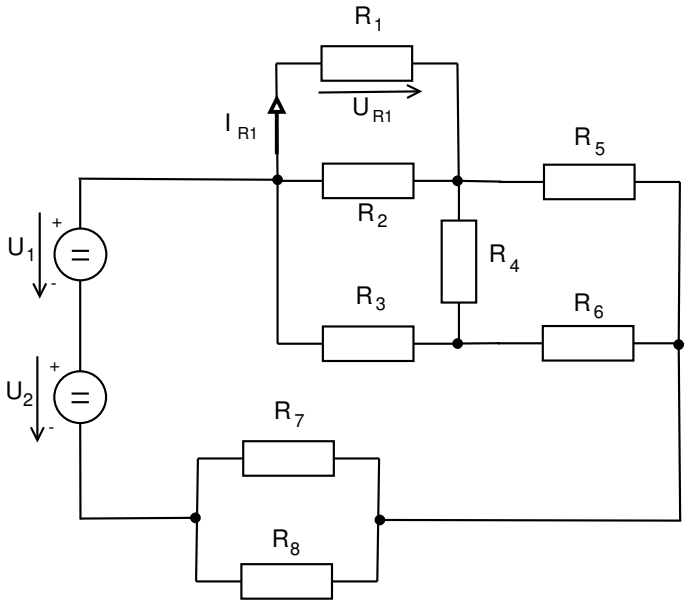
Final project IELe 2017/18

The aim of the project is to practise the solving of electric circuits. Solve given tasks, write the process of solving and right results. Calculations write in general formulas, given values put into formulas and get results. Make your computations on four valid decimal places. Be careful with transformation of radians to degrees.

Please send the signed resumé to Dr. Šátek via e-mail (satek@fit.vutbr.cz) in PDF file format until 5th January 2018.

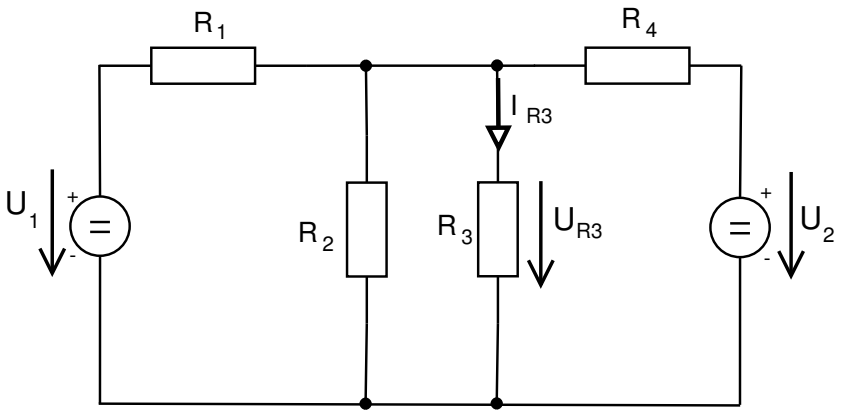
1 (**2 points**)
Calculate the voltage U_{R1} and the current I_{R1}. Use the method of the circuit simplifying.

sk.	U_1 [V]	U_2 [V]	R_1 [Ω]	R_2 [Ω]	R_3 [Ω]	R_4 [Ω]	R_5 [Ω]	R_6 [Ω]	R_7 [Ω]	R_8 [Ω]
A	80	120	350	650	410	130	360	750	310	190
B	95	115	650	730	340	330	410	830	340	220
C	100	80	450	810	190	220	220	720	260	180
D	105	85	420	980	330	280	310	710	240	200
E	115	55	485	660	100	340	575	815	255	225
F	125	65	510	500	550	250	300	800	330	250
G	130	60	380	420	330	440	450	650	410	275
H	135	80	680	600	260	310	575	870	355	265



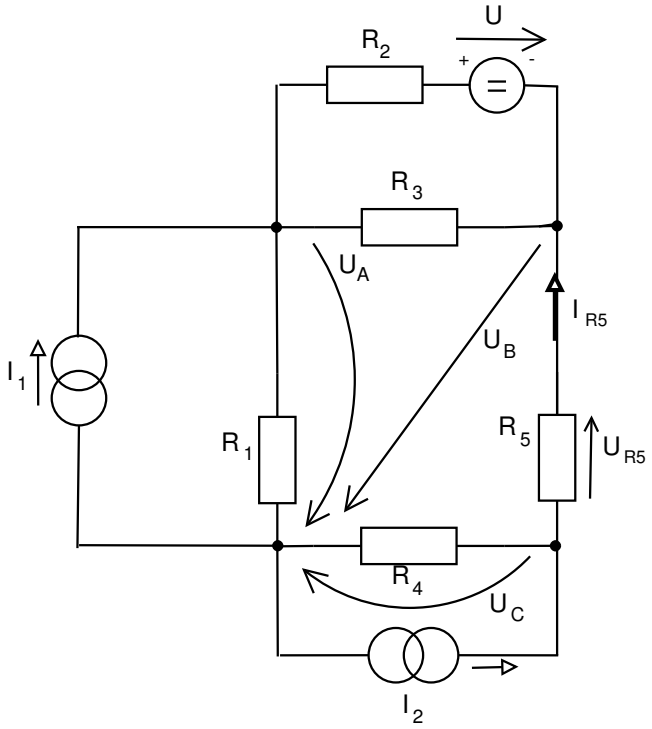
2 (**2 point**)
Calculate the voltage U_{R3} and the current I_{R3}. Use the Thevenin's theorem.

sk.	U_1 [V]	U_2 [V]	R_1 [Ω]	R_2 [Ω]	R_3 [Ω]	R_4 [Ω]
A	50	100	525	620	210	530
B	100	50	310	610	220	570
C	200	70	220	630	240	450
D	150	200	200	660	200	550
E	250	150	335	625	245	600
F	130	180	350	600	195	650
G	180	250	315	615	180	460
H	220	190	360	580	205	560



3 (**2 points**)
Calculate the voltage U_{R5} and the current I_{R5}. Use the Kirchhoff's node rule (U_A, U_B, U_C).

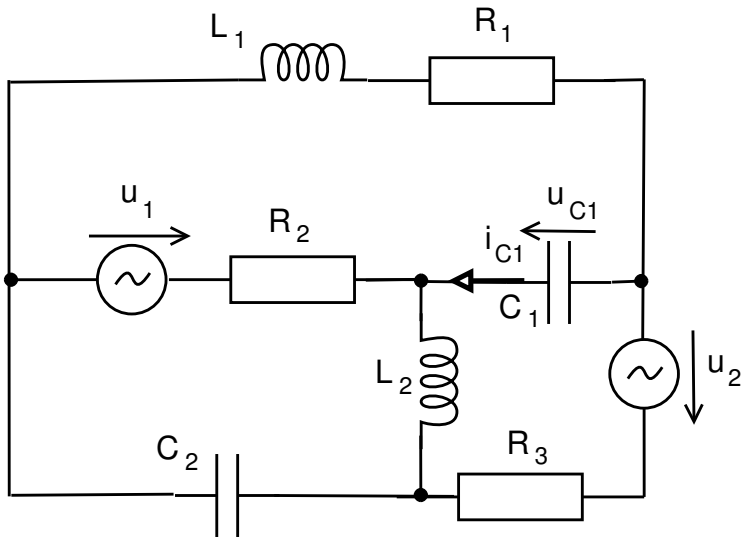
sk.	U [V]	I_1 [A]	I_2 [A]	R_1 [Ω]	R_2 [Ω]	R_3 [Ω]	R_4 [Ω]	R_5 [Ω]
A	120	0.9	0.7	53	49	65	39	32
B	150	0.7	0.8	49	45	61	34	34
C	110	0.85	0.75	44	31	56	20	30
D	115	0.6	0.9	50	38	48	37	28
E	135	0.55	0.65	52	42	52	42	21
F	145	0.75	0.85	48	44	53	36	25
G	160	0.65	0.45	46	41	53	33	29
H	130	0.95	0.50	47	39	58	28	25



4 (**3 points**)
The power voltage is given by $u_1 = U_1 \cdot \sin(2\pi ft)$, $u_2 = U_2 \cdot \sin(2\pi ft)$. According to the voltage on capacitor C_1: $u_{C_1} = U_{C_1} \cdot \sin(2\pi ft + \varphi_{C_1})$ solve parts $|U_{C_1}|$ and φ_{C_1}. Use the Kirchhoff's loop rule.

Hint: "Direction of the arrow of the power voltage is set for particular time ($t = \frac{\pi}{2\omega}$)."

sk.	U_1 [V]	U_2 [V]	R_1 [Ω]	R_2 [Ω]	R_3 [Ω]	L_1 [mH]	L_2 [mH]	C_1 [μF]	C_2 [μF]	f [Hz]
A	35	55	12	14	10	120	100	200	105	70
B	25	40	11	15	12	100	85	220	95	80
C	35	45	10	13	11	220	70	230	85	75
D	45	50	13	15	13	180	90	210	75	85
E	50	30	14	13	14	130	60	100	65	90
F	20	35	12	10	15	170	80	150	90	65
G	55	50	13	12	11	140	60	160	80	60
H	65	60	10	10	12	160	75	155	70	95



5 (**3 points**)
Write the general differential equation describing the circuit on the picture and replace the known values. Find the analytical solution for $u_C = f(t)$. Check the result by replacing them into the differential equation.

sk.	U [V]	C [F]	R [Ω]	$u_C(0)$ [V]
A	20	50	10	9
B	40	10	20	8
C	60	5	30	7
D	50	5	25	6
E	80	30	40	5
F	45	30	15	4
G	75	50	25	3
H	5	50	40	2