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"Elektrijada 2012, oblast II, zadatak 2, maj 2012";
lista = {EE → 6, R → 10, L → 10, CC →  $\frac{6}{10}$ , a →  $\frac{1}{2}$ , uC[0] → uC0, iL[0] → iL0};
"Nezavisni pocetni uslovi";
Print["uC0 = ", uC0 =  $\frac{(2-a)*EE}{3-a}$  /. lista, " V."]
Print["iL0 = ", iL0 =  $\frac{a*EE}{R*(3-a)}$  /. lista, " A."]

uC0 =  $\frac{18}{5}$  V.
iL0 =  $\frac{3}{25}$  A.

"Oznake za struje za t>=0+:";
"Kroz generator ie od - ka +";
"Kroz induktivitet: iL, smer s leva na desno,";
"Kroz gornji otpornik 2R: ie - iL, s leva na desno";
"Kroz kondenzator CC*duC/dt, odozgo prema dole";
"Desni desni otpornik: ie-CC*duC/dt, odozgo prema dole";

"Jednacine za t>=0+, po konturama";
"Spoljasnja kontura:";
Print["K1: ", K1 = EE - (R*ie[t] + 2*R*(ie[t] - iL[t]) + R*(ie[t] - CC*∂t uC[t])), "=0"]
"Kontura E,R,L,CC:";
Print["K2: ", K2 = EE - (uC[t] + L*∂t iL[t] + R*ie[t]), "=0"]
"Srednji cvor:";
Print["C1: ", C1 = iL[t] - a*ie[t] - CC*∂t uC[t], "=0"]

K1: EE - Rie[t] - 2R (ie[t] - iL[t]) - R (ie[t] - CC uC'[t]) = 0
K2: EE - Rie[t] - uC[t] - L iL'[t] = 0
C1: -a ie[t] + iL[t] - CC uC'[t] = 0

smena = {LaplaceTransform[ie[t], t, s] → IE, LaplaceTransform[iL[t], t, s] → IL,
  LaplaceTransform[uC[t], t, s] → UC};
Print["L1 = ", L1 = LaplaceTransform[K1, t, s] /. smena, " = 0,"]
Print["L2 = ", L2 = LaplaceTransform[K2, t, s] /. smena, " = 0,"]
Print["L3 = ", L3 = LaplaceTransform[C1, t, s] /. smena, " = 0."]

L1 = -4 IER + 2 ILR +  $\frac{EE}{s}$  + CCR (s UC - uC[0]) = 0,
L2 = -IER +  $\frac{EE}{s}$  - UC - L (IL s - iL[0]) = 0,
L3 = -a IE + IL - CC (s UC - uC[0]) = 0.

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"Iz C1 racunamo IE:";
Print["IE = ", IE =  $\frac{IL - CC (s UC - uC[0])}{a}$  ]

IE =  $\frac{IL - CC (s UC - uC[0])}{a}$ 

"Zamenjujemo ie u L1 i L2";
Print["L1: ", L1 = FullSimplify[L1], "=0"]
Print["L2: ", L2 = FullSimplify[L2], "=0"]

L1:  $\frac{EE}{s} + \frac{R (2 (-2 + a) IL + (4 + a) CC (s UC - uC[0]))}{a} = 0$ 
L2:  $\frac{EE}{s} - IL L s - UC + L iL[0] - \frac{R (IL + CC (-s UC + uC[0]))}{a} = 0$ 

"Iz L1 racunamo IL i to zamenjujemo u L2";
Print["IL = ", IL =  $\frac{a * EE + R (4 + a) CC s (s UC - uC[0])}{2 * R * s * (2 - a)}$ , "."]

IL =  $\frac{a EE + (4 + a) CCR s (s UC - uC[0])}{2 (2 - a) R s}$ .

Print["L2: ", L2 = FullSimplify[L2], "=0"]

L2:  $\frac{EE ((-3 + 2 a) R + a L s) + R s ((4 - 2 a + 3 CCR s + (4 + a) CCL s^2) UC + 2 (-2 + a) L iL[0] - CC (3 R + (4 + a) L s) uC[0])}{2 (-2 + a) R s} = 0$ 

"Iz L2=0 racunamo UC";
RezUC = Flatten[Solve[Numerator[L2] == 0, UC]];
Print["UC = ", UC = Simplify[UC /. RezUC], "."]

UC = -  $\frac{EE ((-3 + 2 a) R + a L s) + R s (2 (-2 + a) L iL[0] - CC (3 R + (4 + a) L s) uC[0])}{R s (4 - 2 a + 3 CCR s + (4 + a) CCL s^2)}$ .

"Konacno resenje:";
Print["UC = ", UC = Simplify[UC /. lista], "."]

UC =  $\frac{20 + 109 s + 162 s^2}{5 s (1 + 3 s)^2}$ .

Print["uC(t) = ", uC[t] = Expand[InverseLaplaceTransform[UC, s, t]], " V."]

uC(t) =  $4 - \frac{2 e^{-t/3}}{5} - \frac{1}{9} e^{-t/3} t V.$ 

"Provera"
Print["iL(t) = ", iL[t] = Expand[FullSimplify[ $\frac{a EE + (4 + a) * CC * R * \partial_t uC[t]}{2 * R * (2 - a)}$ ] /. lista], " A."]

Provera

iL(t) =  $\frac{1}{10} + \frac{e^{-t/3}}{50} + \frac{1}{30} e^{-t/3} t A.$ 

Print["uCpoc = ", uCpoc = Simplify[uC[t] /. t -> 0], " V."]
Print["iLpoc = ", iLpoc = Simplify[iL[t] /. t -> 0], " A."]

uCpoc =  $\frac{18}{5} V.$ 

iLpoc =  $\frac{3}{25} A.$ 

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