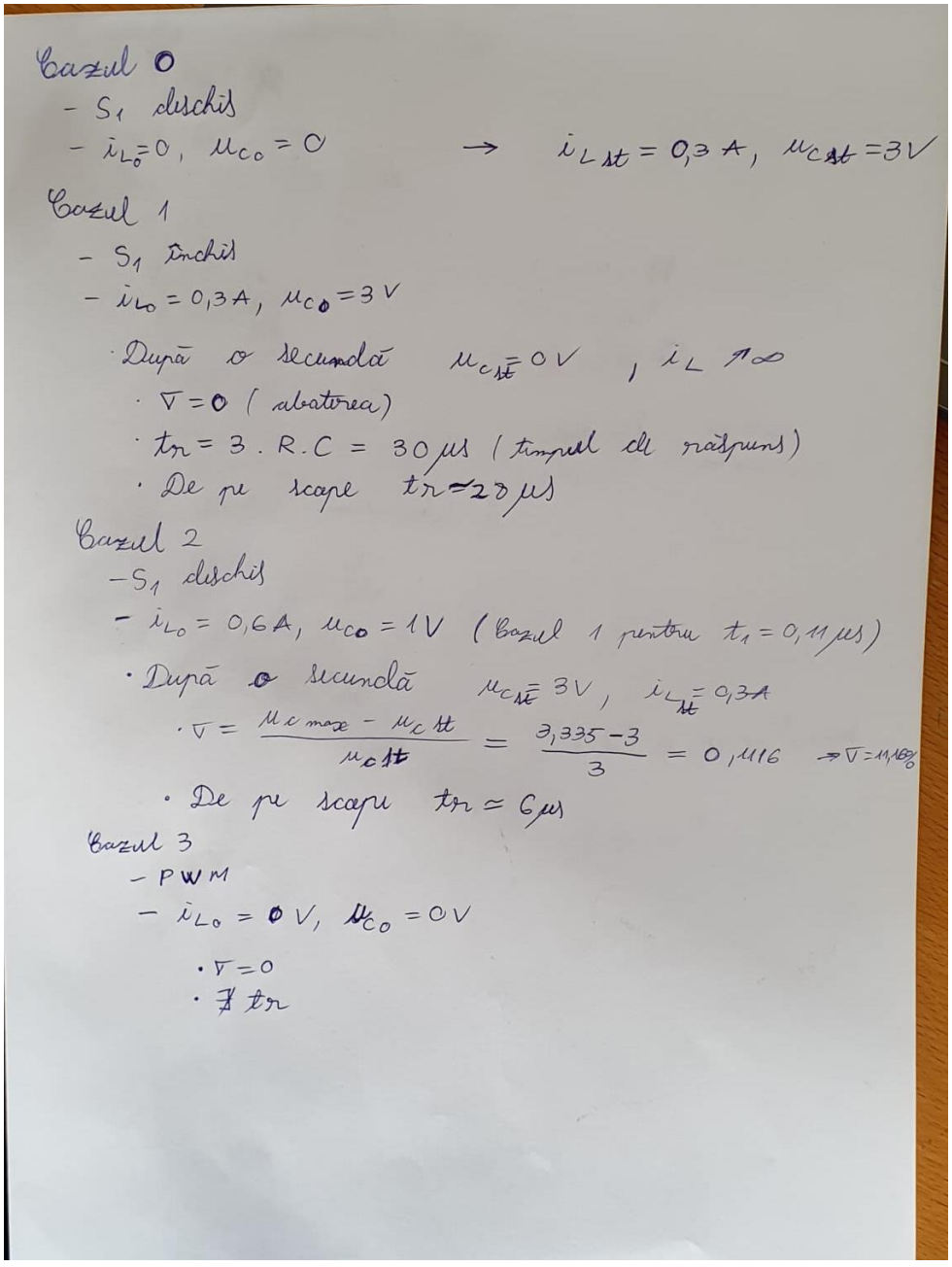
Project PREH



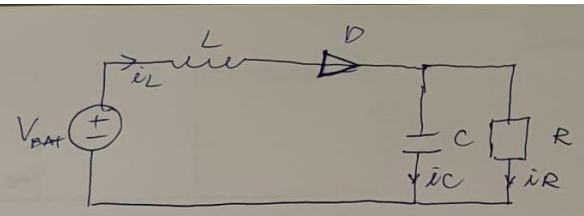
Cazul 0
- S_1 deschis
- $i_{L_0} = 0$, $u_{C_0} = 0$ → $i_{L\,st} = 0{,}3\,A$, $u_{C\,st} = 3V$

Cazul 1
- S_1 închis
- $i_{L_0} = 0{,}3A$, $u_{C_0} = 3V$
  - După o secundă $u_{C\,st} = 0V$, $i_L \nearrow \infty$
  - $\nabla = 0$ (abaterea)
  - $t_r = 3 \cdot R \cdot C = 30\,\mu s$ (timpul de răspuns)
  - De pe scară $t_r = 20\,\mu s$

Cazul 2
- S_1 deschis
- $i_{L_0} = 0{,}6A$, $u_{C_0} = 1V$ (Cazul 1 pentru $t_1 = 0{,}11\,\mu s$)
  - După o secundă $u_{C\,st} = 3V$, $i_{L\,st} = 0{,}3A$
  - $\nabla = \frac{u_{C\,max} - u_{C\,st}}{u_{C\,st}} = \frac{3{,}335 - 3}{3} = 0{,}1116 \rightarrow \nabla = 11{,}16\%$
  - De pe scară $t_r \simeq 6\,\mu s$

Cazul 3
- PWM
- $i_{L_0} = 0\,V$, $u_{C_0} = 0V$
  - $\nabla = 0$
  - $\nexists\, t_r$

S_1 open



$$i_C = C \cdot \frac{du_C}{dt}$$

$$u_L = L \cdot \frac{di_L}{dt}$$

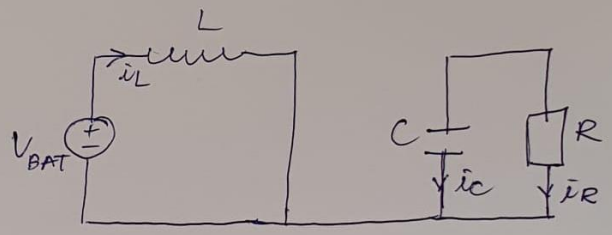
$$i_L = i_C + i_R$$

$$i_L = i_D$$

$$U_D = 0$$

$$V_{BAT} = V_L + V_D + V_C$$

S_2 closed

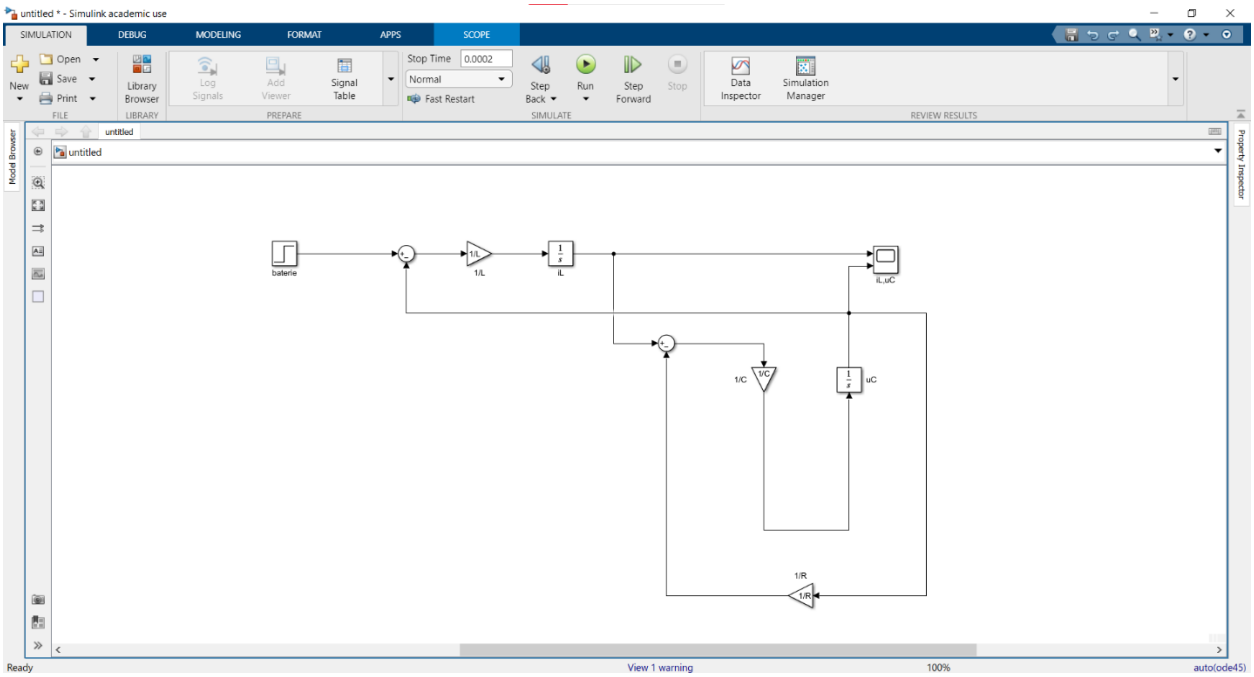


$$V_{BAT} = L \cdot \frac{di}{dt}$$

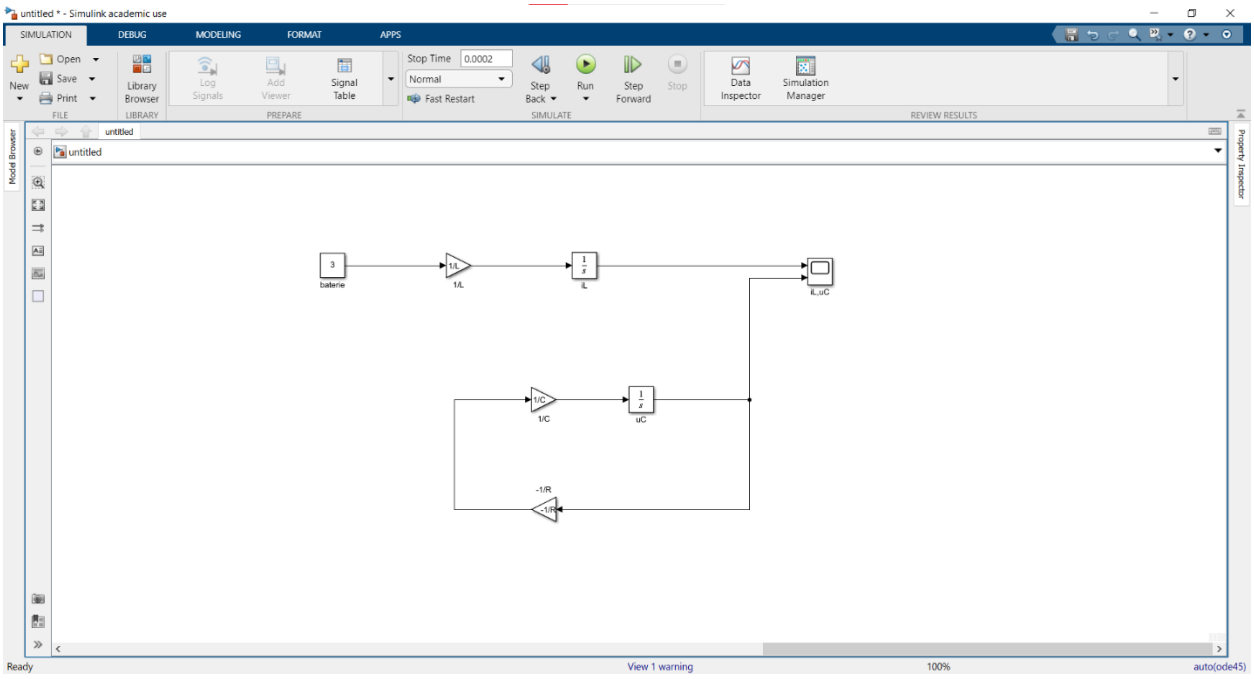
$$i_D = 0$$

$$i_C = -i_R$$

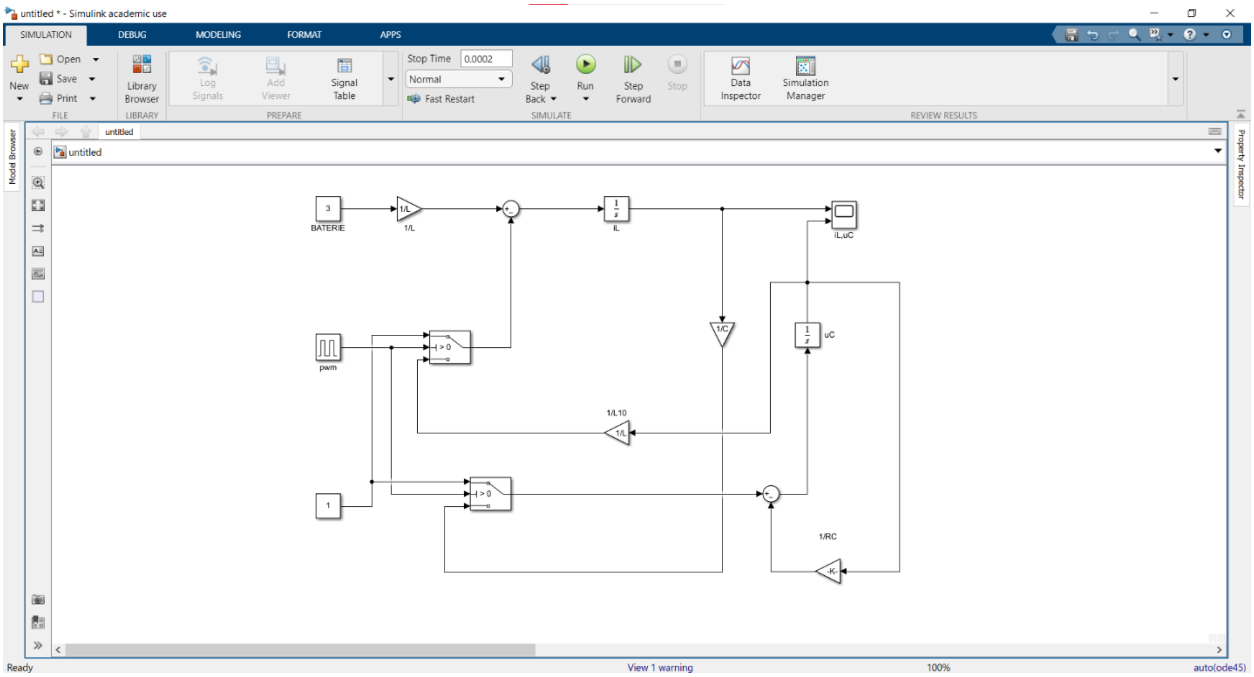
Simulink diagram for S1 open.



Simulink diagram for S1 closed.

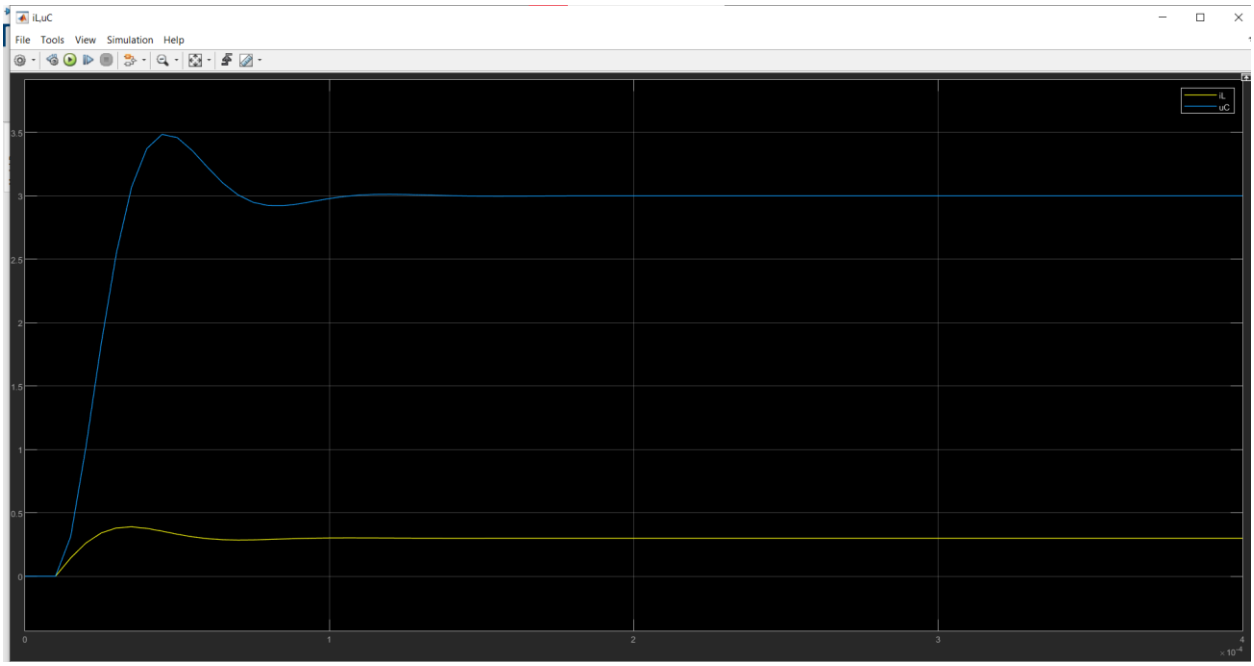


Simulink diagram for PWM.



2.2.2.0)

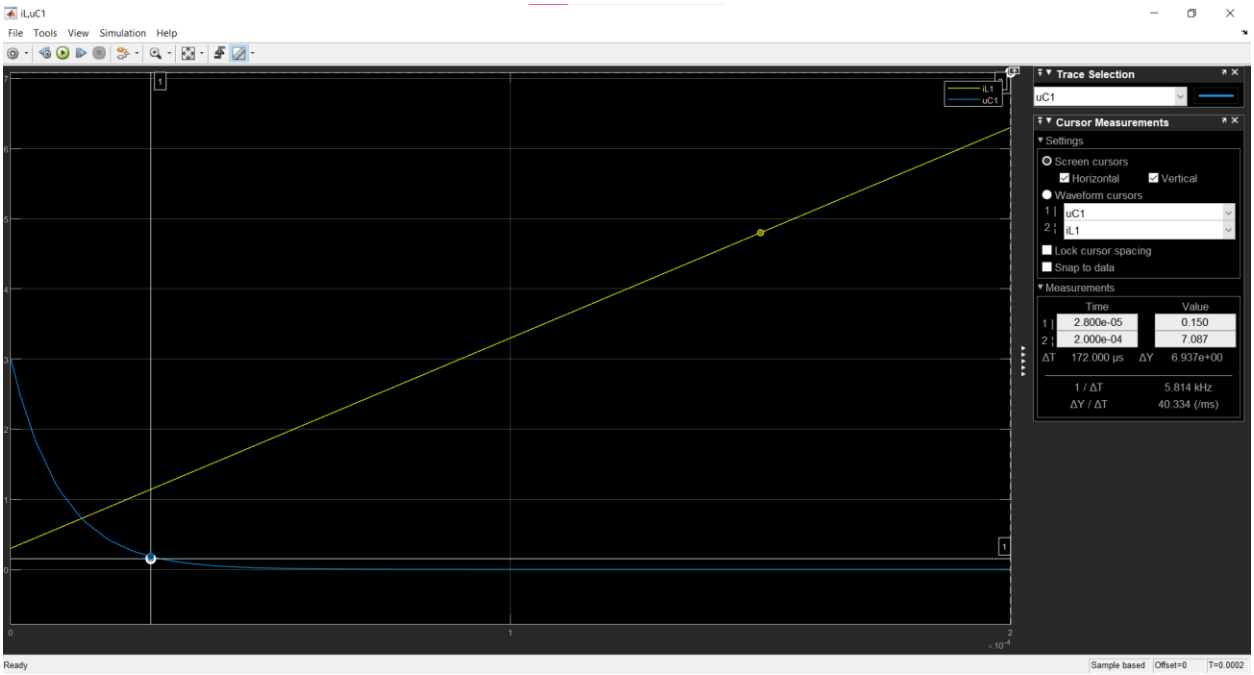
Before we start with point 2.2.2.1, we need to have set initial conditions for differential ecuations for inductor and capacitor. I suppose the switch S1 is open in first place and I let 1 second for iL and uC to stabilize.



So the initial values for first exercise are iL0=0.3[A] and uC0=3[V].

2.2.2.1)

S1 changes its state from open to closed.

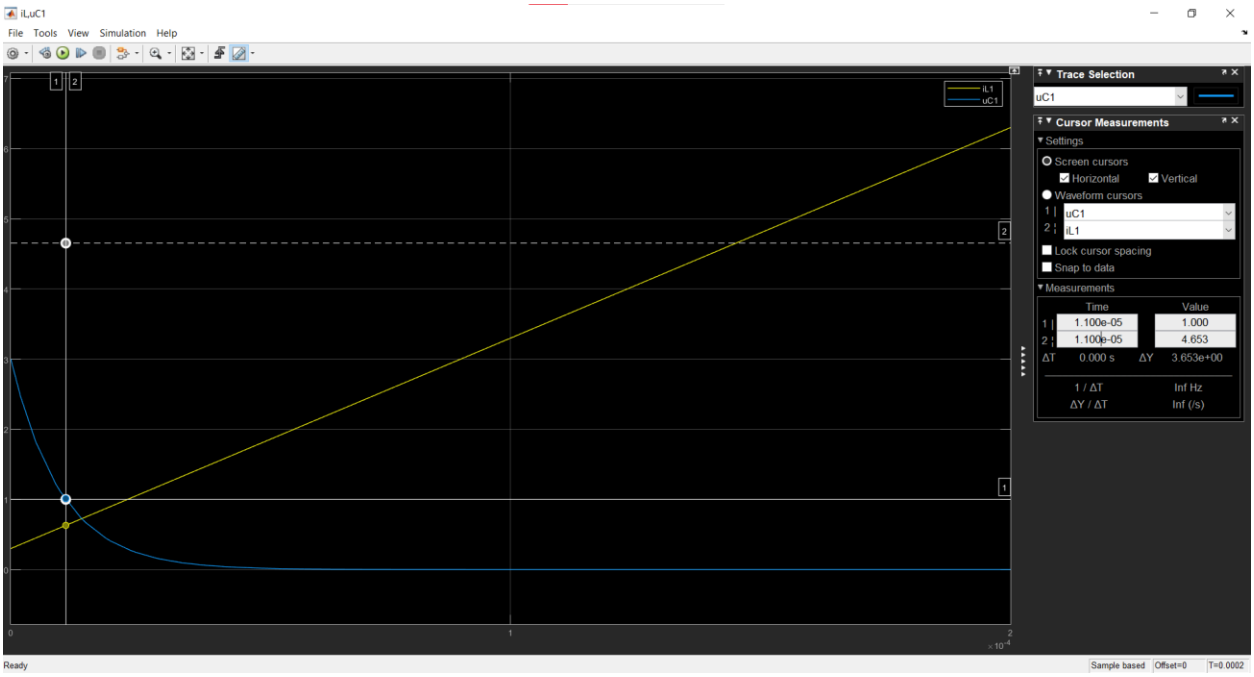


In case of uC, the system is stable and the steady-state value is 0[V], because capacitor discharges. After 2 ms the value of Uc is 0[V], that means after 1s will be the same. The overshoot is also 0 and transient time(respose time) is 28us.

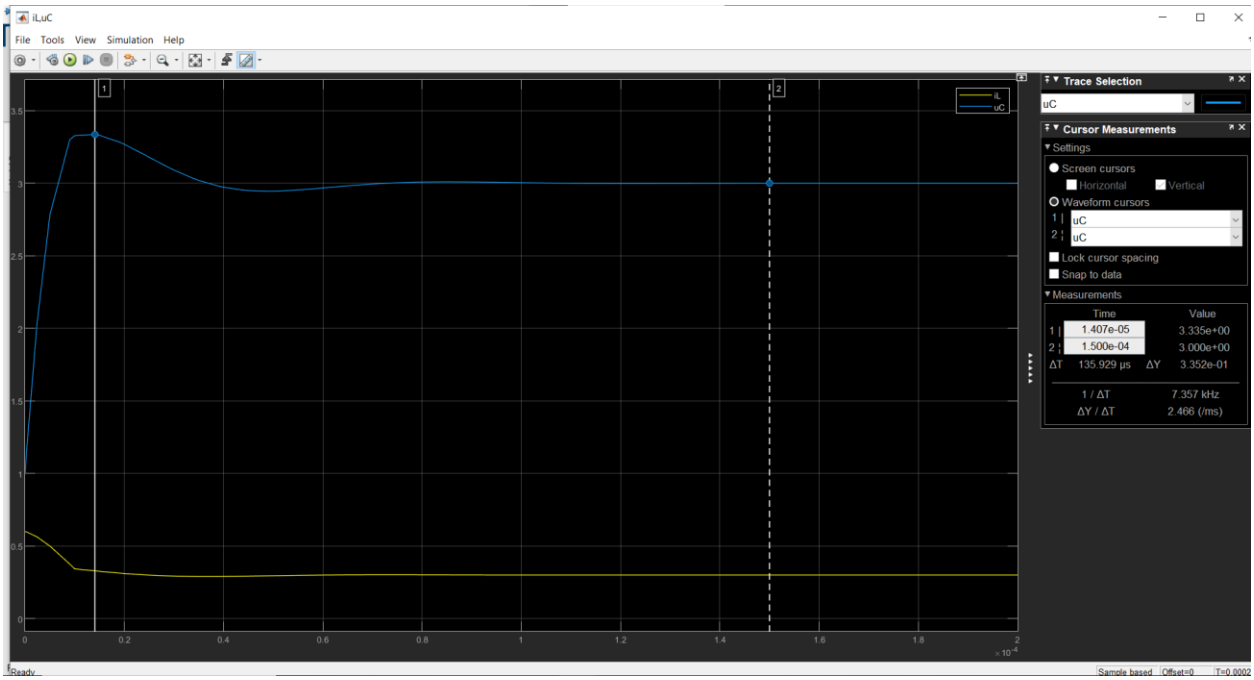
2.2.2.2)

S1 changes its state from closed to open.

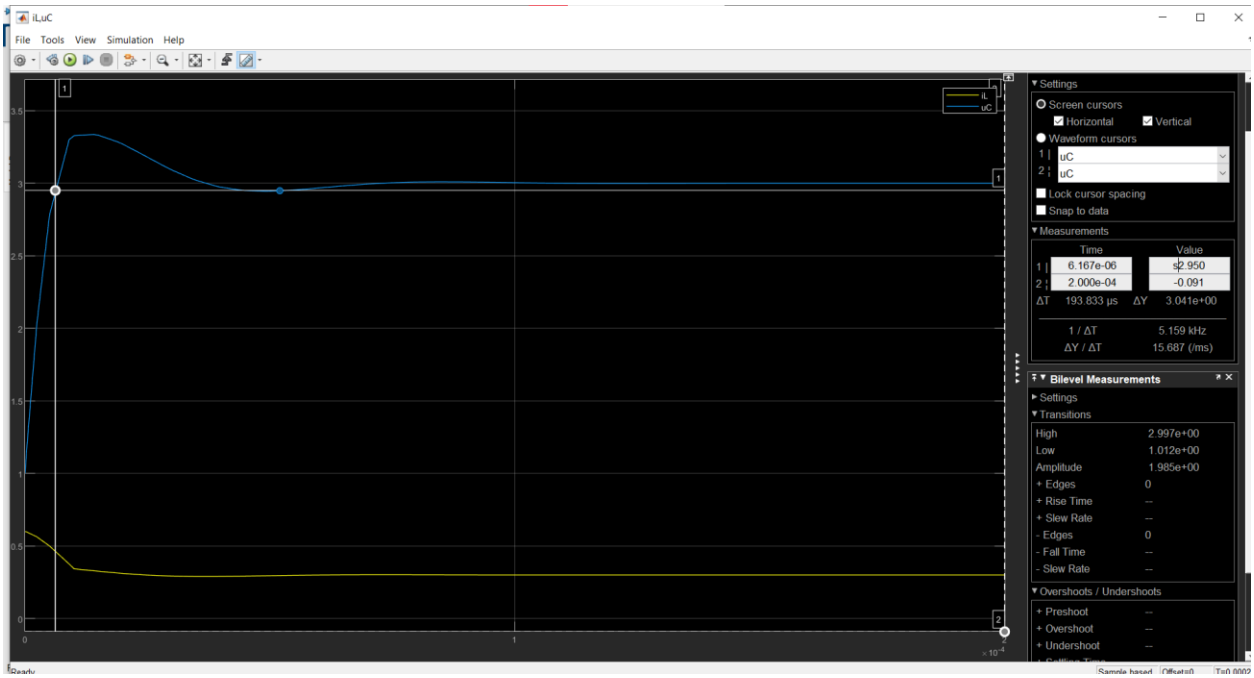
Again, we do not have initial values so I choose iL0 and uC0 after letting S1 closed for 11us. We have iL0=0.6[A] and uC0=1[V].



Here I choose the peak value:

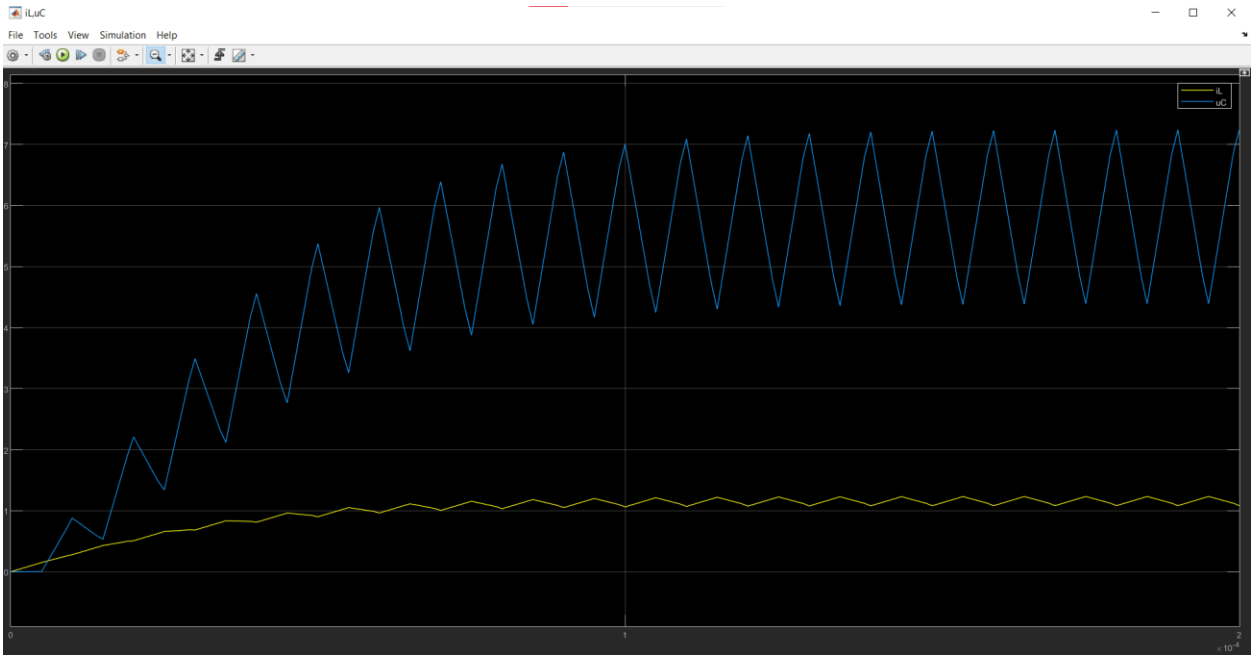


The system is stable again, because steady-state value of uC is 3[V]. Value of uC after 1s is also 3[V]. The overshoot is going to be 11,16% and the transient time will be 6us.



2.2.2.3)

S1 is controlled by a PWM signal.



The system is marginaly stable. Value of uC is oscillating and the mean is 6[V] after 1s. Overshoot value and transient time value do not exist.