BIRZEIT UNIVERSITY

Faculty of Engineering & Technology
Department of Electrical & Computer Engineering
ENEE2103-Circuit And Electronics Laboratory
PreLab#3

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Date:
1/3/2024

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A- RC circuit:

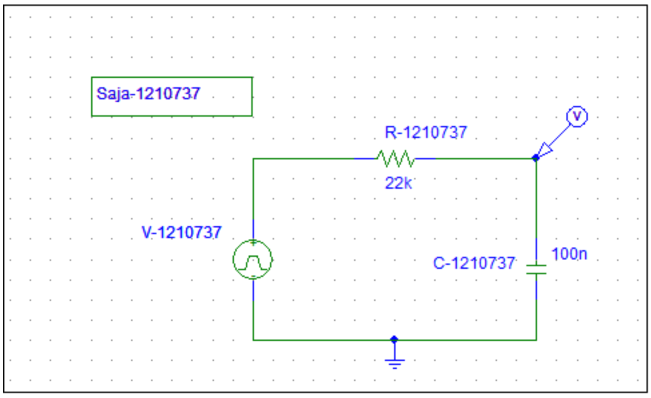

Figure1 : Rc Circuit

the cursor is pointed to measure the voltage at the capacitor

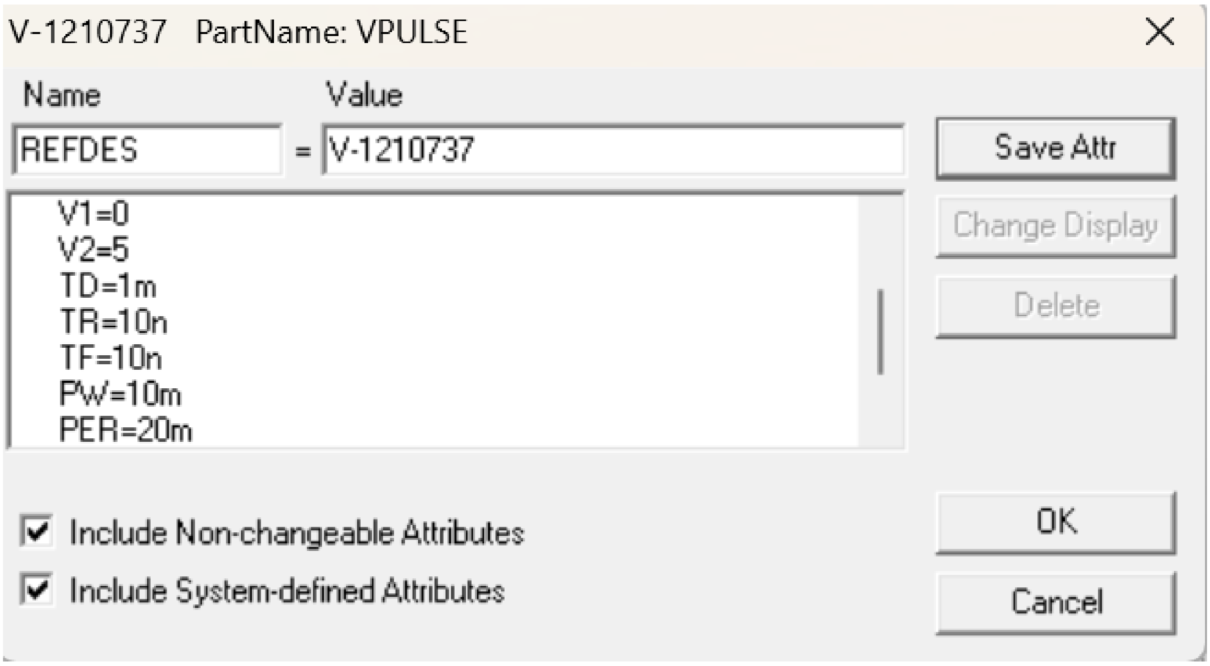

Figure 2:Vpulse in RC circuit

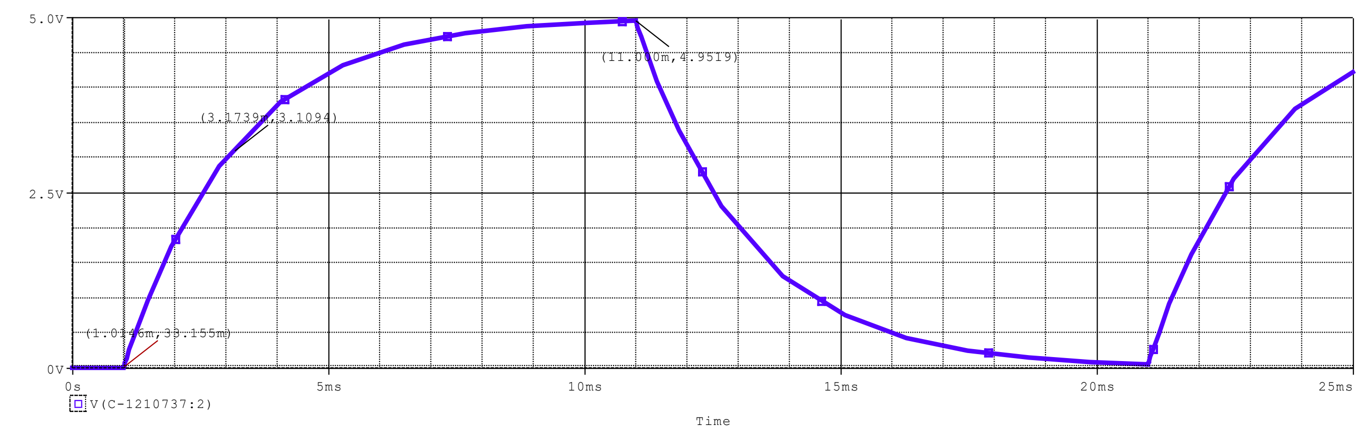

Figure 3: capacitor vpltage curve in Rc

The peak voltage equals 4.9519 so Vcharge=0.63 Vp=3.1196v
3.1239v is approximately at time 3.1739 ms
The beginning of rising is 1.0146ms
Time constant=3.1739-1.0146=2.1593ms (from graph)
Time constant=RC=22k*100n=2.2ms
C=time constant/R=2.1593ms/22k=98.15nF which is close to 100nF.

B- RL circuit:

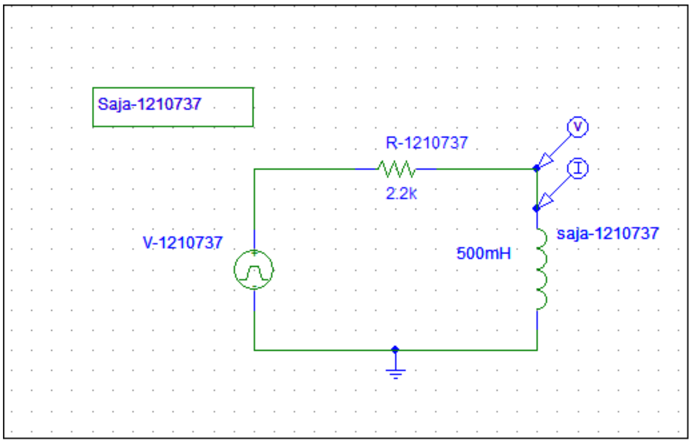

Figure 4: RL circuit

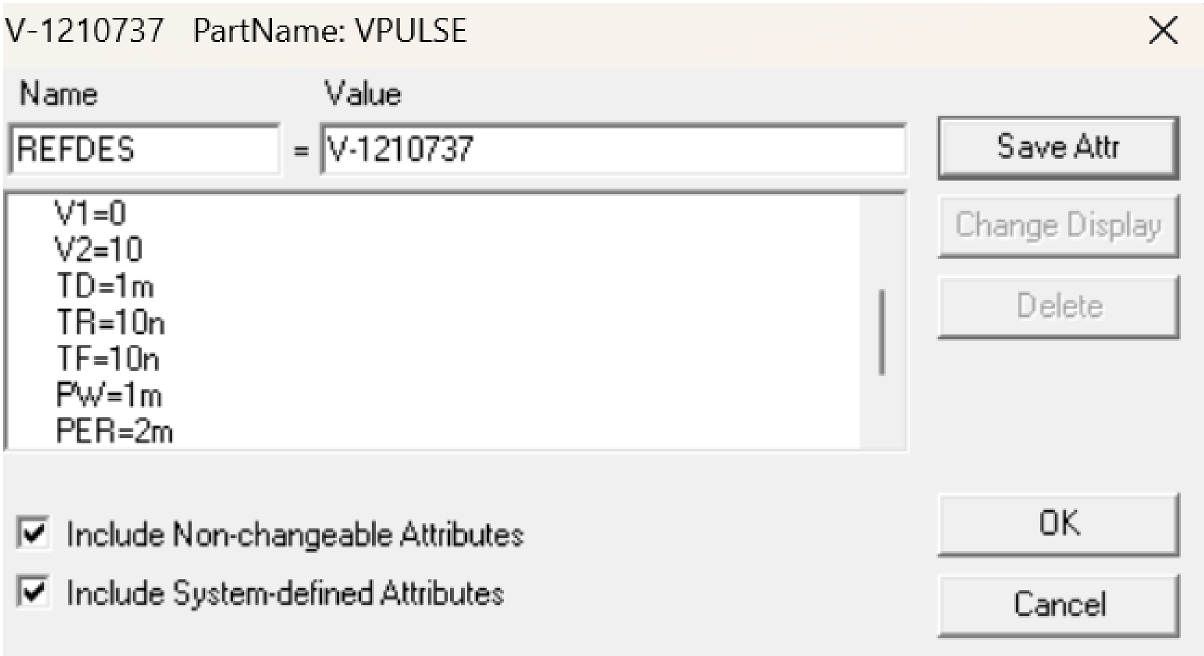

Figure 5: Vpulse in RL circuit

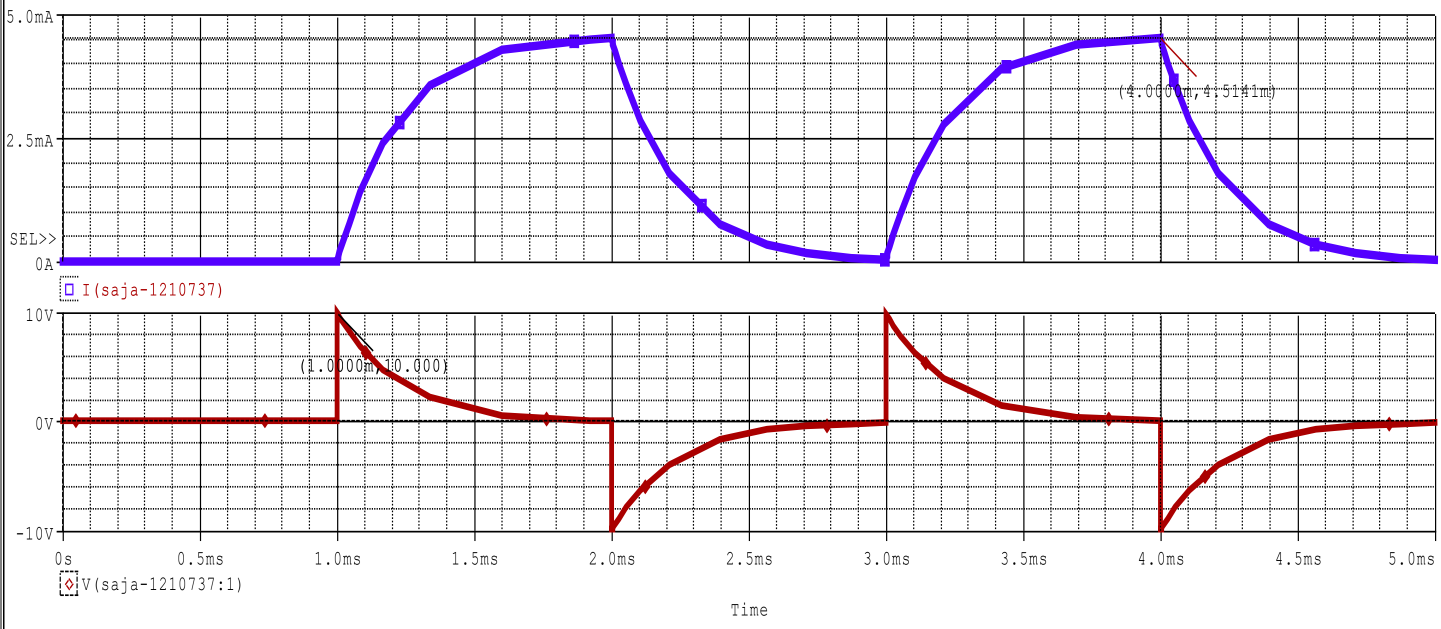

Figure6 : inductor voltage and current curve in RL circuit

As shown , the steady state voltage is equal to 10 volt so the Vdischarge=0.37*10=3.7volt.
3.7 volt is at time→ 1.2325ms
Start discharge at →1.0053ms
Time constant=1.2325ms-1.0053ms=227.2us

The steady state current is equal to →4.5141mA so the Ichargeing=0.63*4.5141=2.8439mA
2.8439mA is at time→1.2281ms
Starting charge at→1ms
Time constant=1.2281-1=228.1us

Time constant= L/R=500m/2.2k=227.3us which is close to two time constant from the graph.

Change the period of the periodic square wave to T=2τL and display the result:
time constant=2*L/R=2*500m/2.2k=454.545us

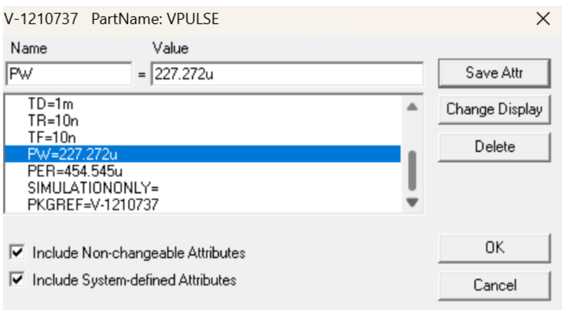

Figure8 : Vpulse for RL circuit when double the time constant

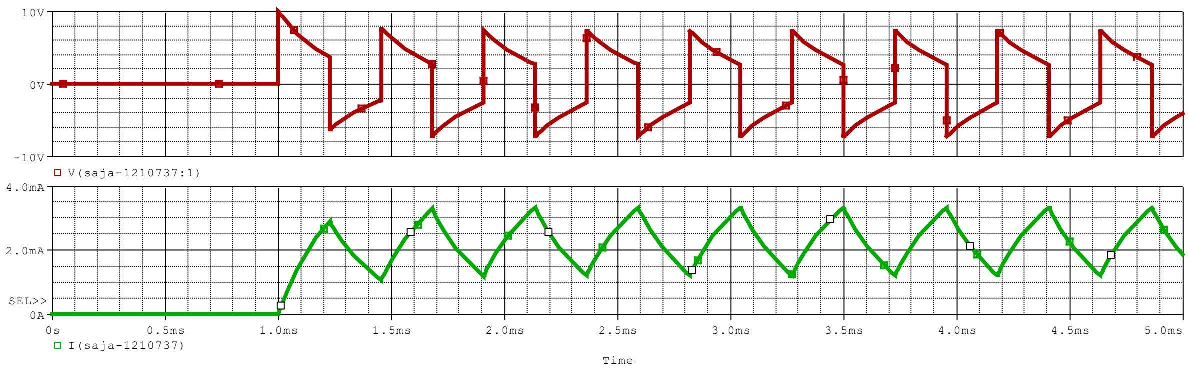

Figure 9: inductor current and voltage curve in RL circuit when double the time constant

the period is become too small and not enough for charging and discharging.

C. RLC circuit:

I. Response Type:

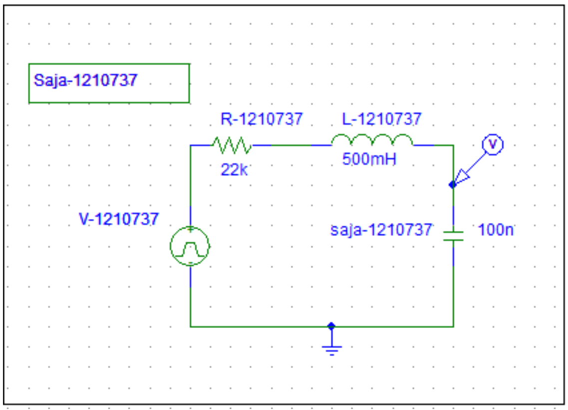

Figure10 : RLC circuit

a=R/2L=22k/(2*500m)=22000

W=1/√ (LC)=4472

a>w→Over damped

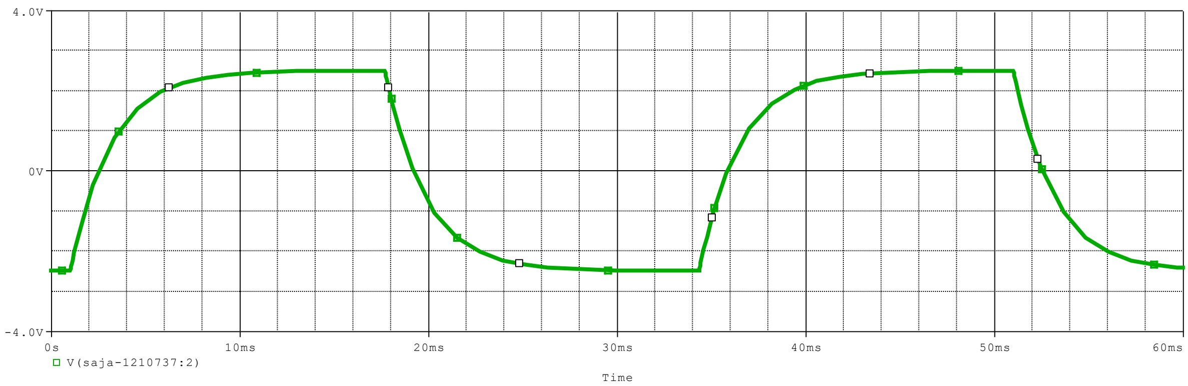

Figure 11: capactior voltage curve for RLC circuit

To be over damped→a>w
To be under damped→a<w
To be critical damped → a=w
a=w
R/2L=1/ √LC→R=2L/ √LC
So :
To be over damped→R>4.47k
To be under damped→R<4.47k
To be critical damped→R=4.47k

Under damped case:
Let R=1k

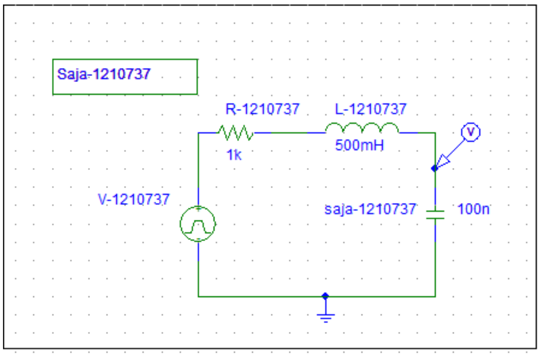

Figure 12: RLC circuit with R=1k

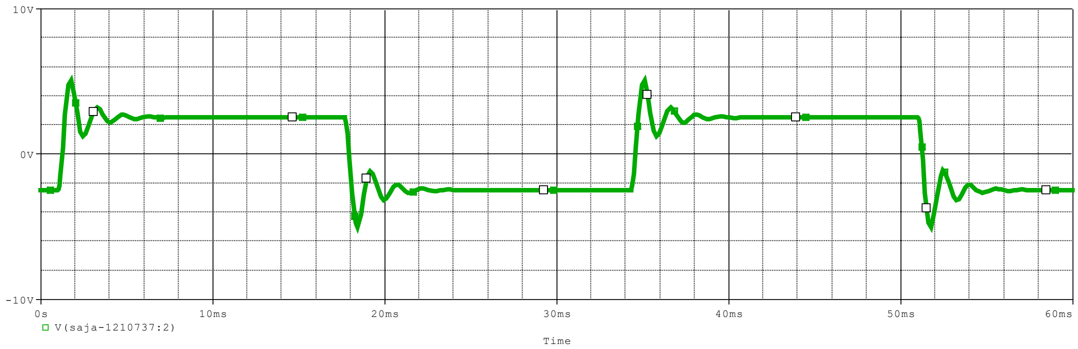

Figure 13: RLC underdamped

Critical damped case:
R=4.47k

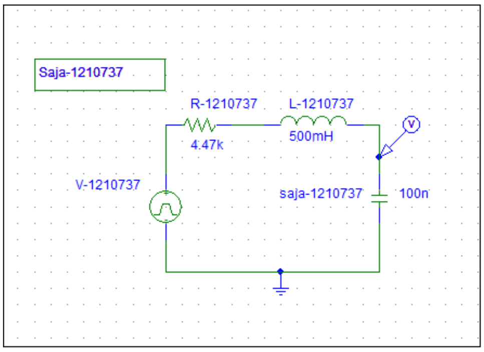

Figure 14: RLC circuit with R=4.47k

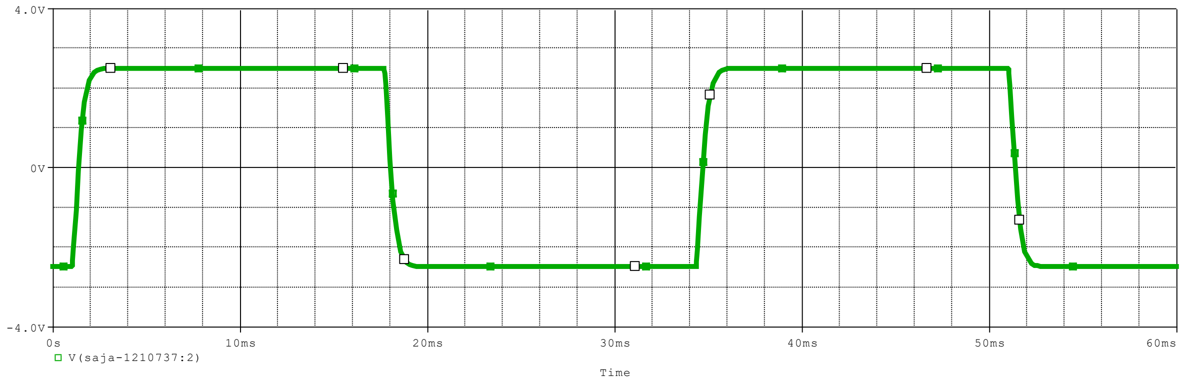

Figure 15: RLC critical damped

II- Response parameters:

We can chose any R<4.47k to be in under damped
Let R=1k like figure 12

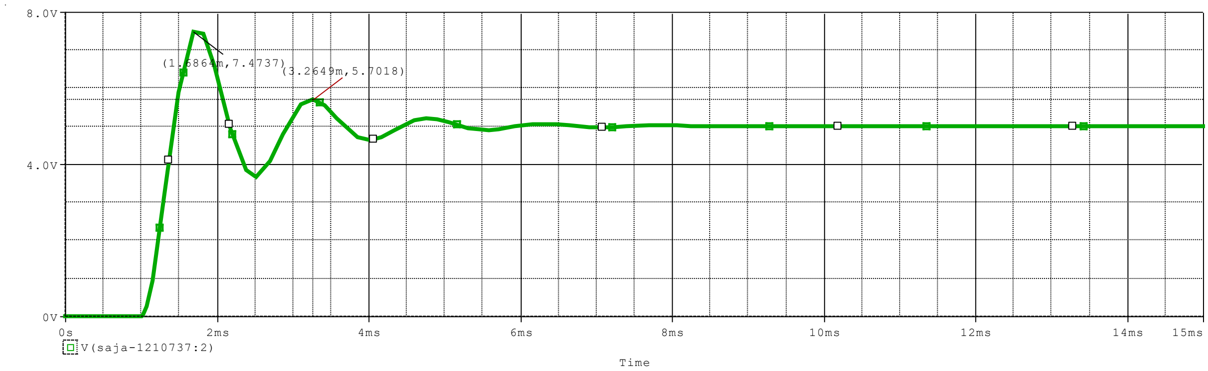

Figure 16:curve to find the response parameter when R=1k

(Va,Ta)→(7.4737,1.6864m)
(Vb,Tb)→(5.7018,3.2649m)
V∞=5volt

Decay time constant →τ =($tb-ta$) /[ln($Va-Vo(\infty)$ /$Vb-Vo(\infty)$)]=1253us
Damping Coefficient →α = 1 / τ→798 rad/sec
Damped radian frequency→ ωd = 2π/($tb-ta$)=3.98rad/sec

When we double the value of C→ c=200nF

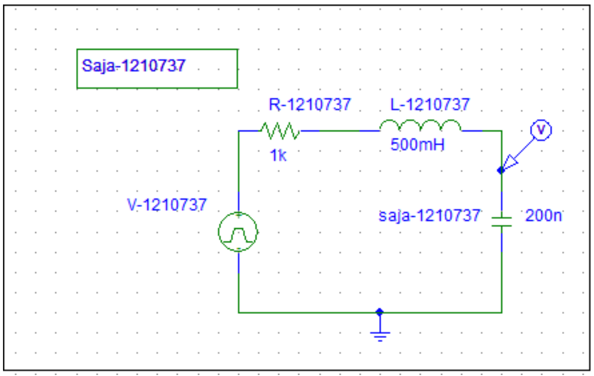

Figure 17: double the C in RLC circuit

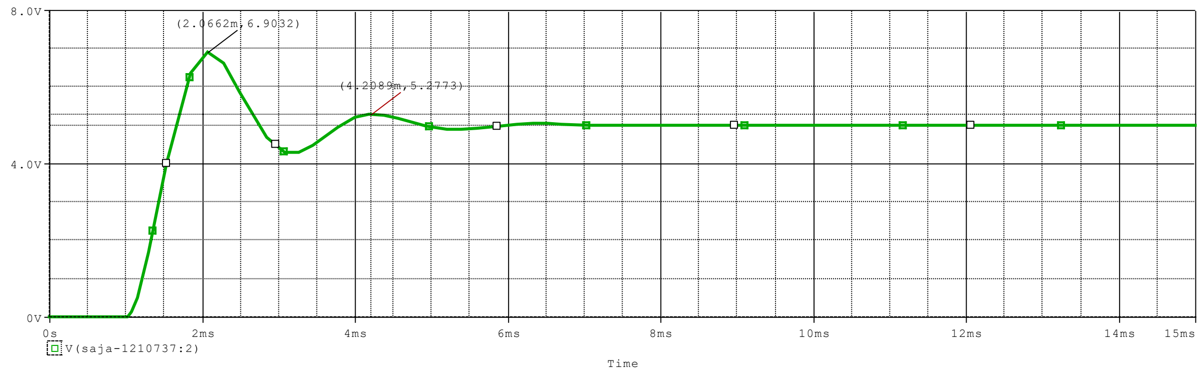

Figure 18:curve to find the response parameter when double C

(Va,Ta)→(6.9032,2.0662m)
(Vb,Tb)→(5.2773,4.2089m)
V∞=5volt
Decay time constant →τ =($tb-ta$) /[ln($Va-Vo(\infty)$ /$Vb-Vo(\infty)$)]=1112us
Damping Coefficient →α = 1 / τ→899 rad/sec
Damped radian frequency→ ωd = 2π/($tb-ta$)=2.93rad/sec

When reset the C to its initial value and reduce L to its half value:

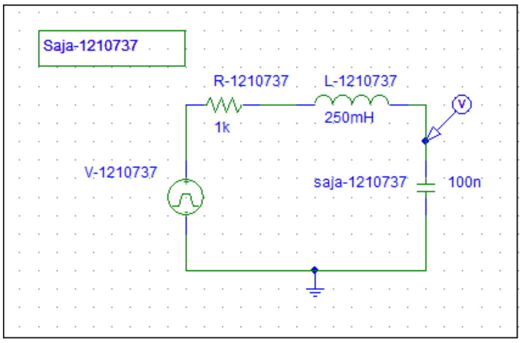

Figure 19: RLC circuit with reduce L to the half

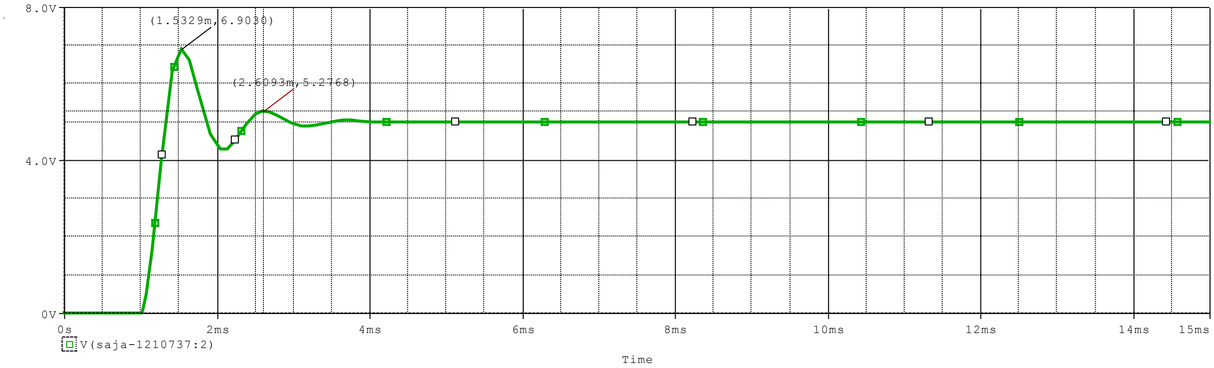

Figure 20: curve to find the response parameter when reduce L to the half

(Va,Ta)→(6.9030,1.5329m)

(Vb,Tb)→(5.2768,2.6093m)

V∞=5volt

Decay time constant →τ =($tb-ta$) /[ln($Va-Vo(\infty)$ /$Vb-Vo(\infty)$)]=558us

Damping Coefficient →α = 1 / τ→1791rad/sec

Damped radian frequency→ ωd = 2π/($tb-ta$)=5.84rad/sec