Faculty of Engineering & Technology
Electrical & Computer Engineering Department

ENEE2103

PreLab#2

First and Second Order Circuit

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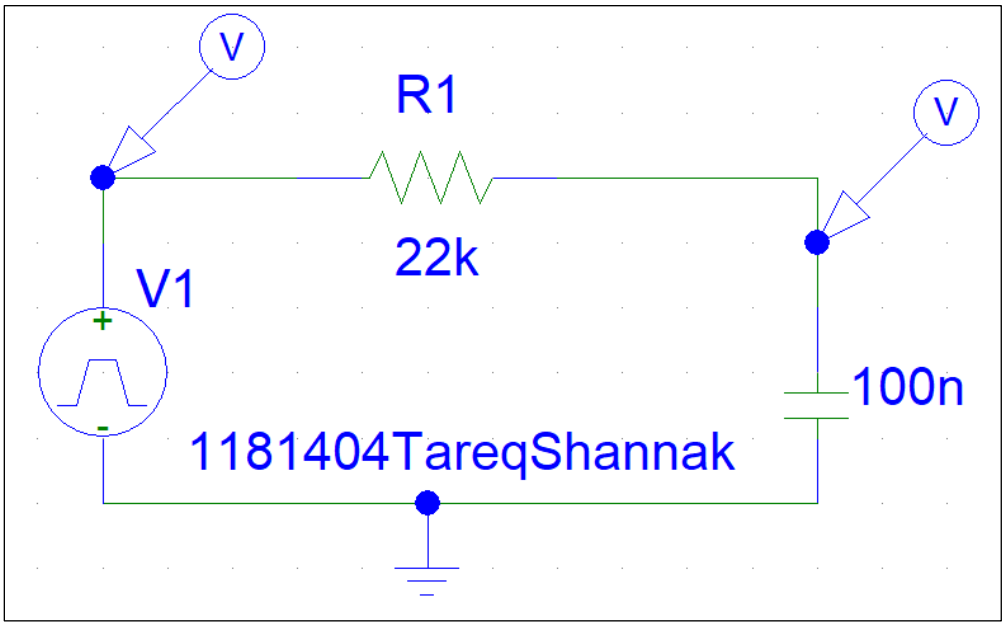
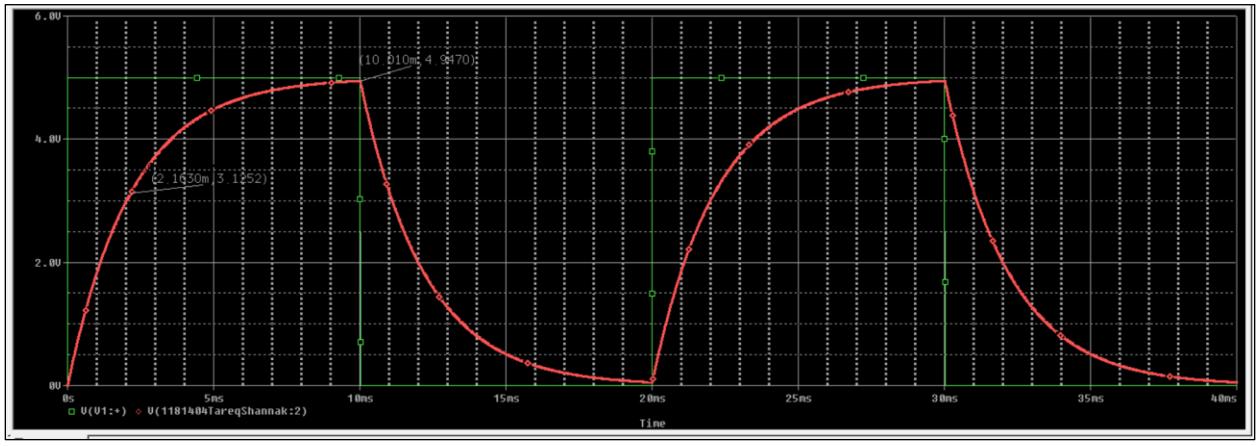
Section : 5

Date : 3/3/2021

Part A: RC Circuit





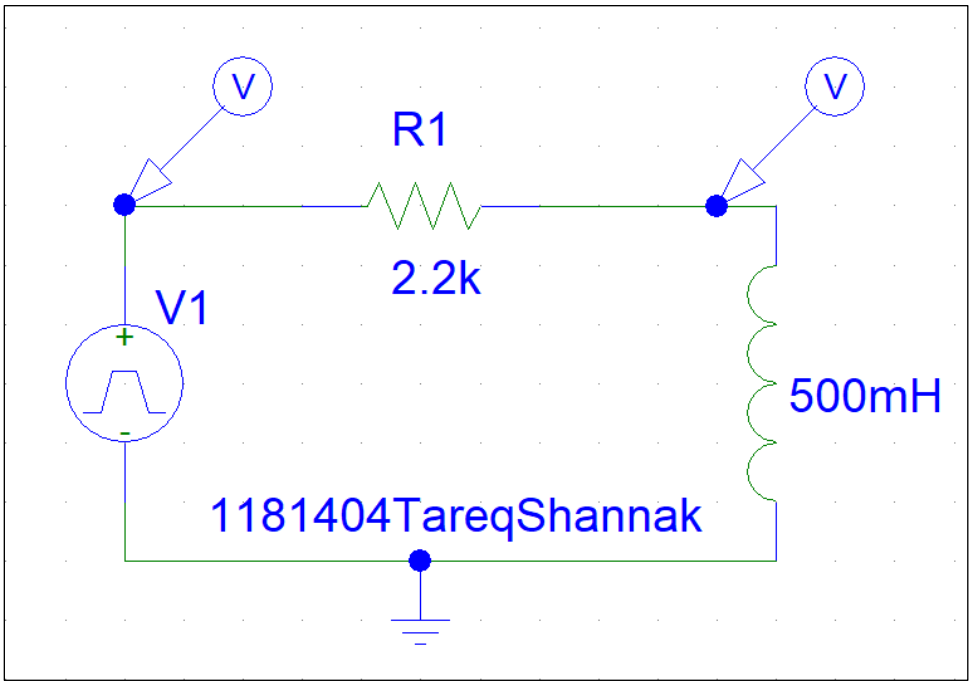
$V_{Charging}$ = 4.947 * 0.63 = 3.11661v

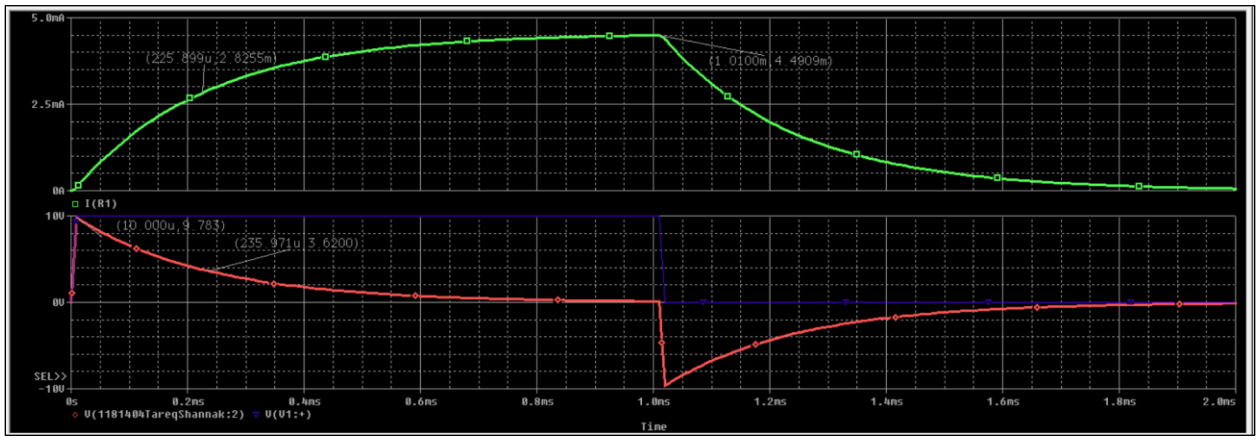
When V = 3.1252v, t = T = 2.163ms from graph

T = RC = 22k * 100nF = 2.2ms (theoritecal)

C = T/R = 2.163ms/22k = 98.3 nF (too close from 100nF)

Part B: RL Circuit





Since it's charging in the current response, $I_{Charging}$ = 0.63 * 4.4909mA = 2.829 m, t = T = 226us

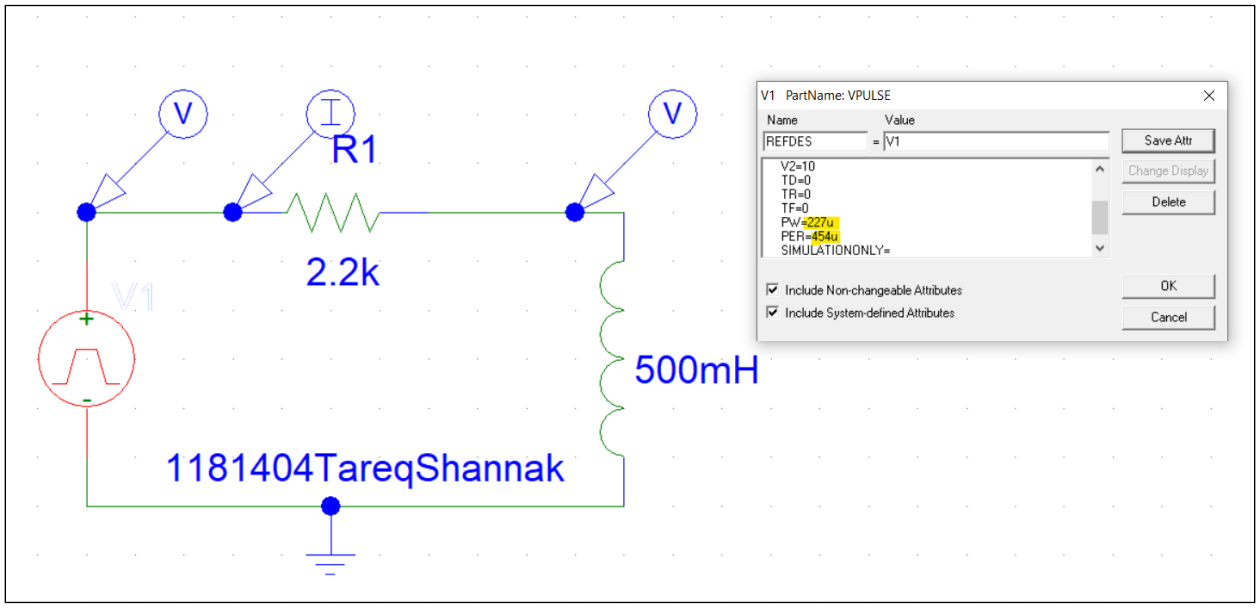
Since it's discharging in the voltage response, $V_{Discharging}$ = 0.37 * 9.783 = 3.62v, t = T = 236us

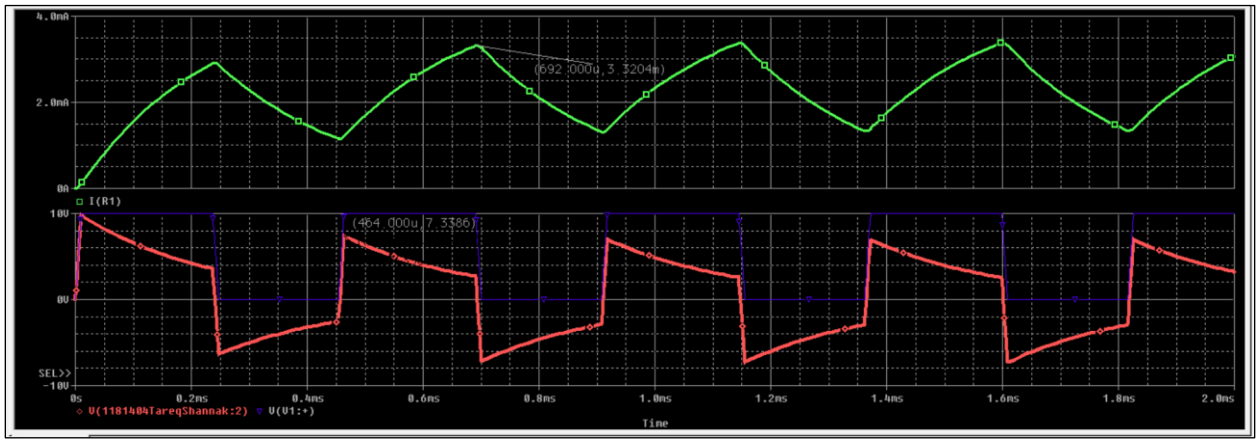
t = T = L/R = 500mH/2.2k = 227us (Theoretical)

The practical results are too close from the theoretical results.

$T=2\tau_L=2*L/R?$

T = 2*500m/2.2k = 454us = the period of the periodic square wave.





The period is too small and not enough to charging.

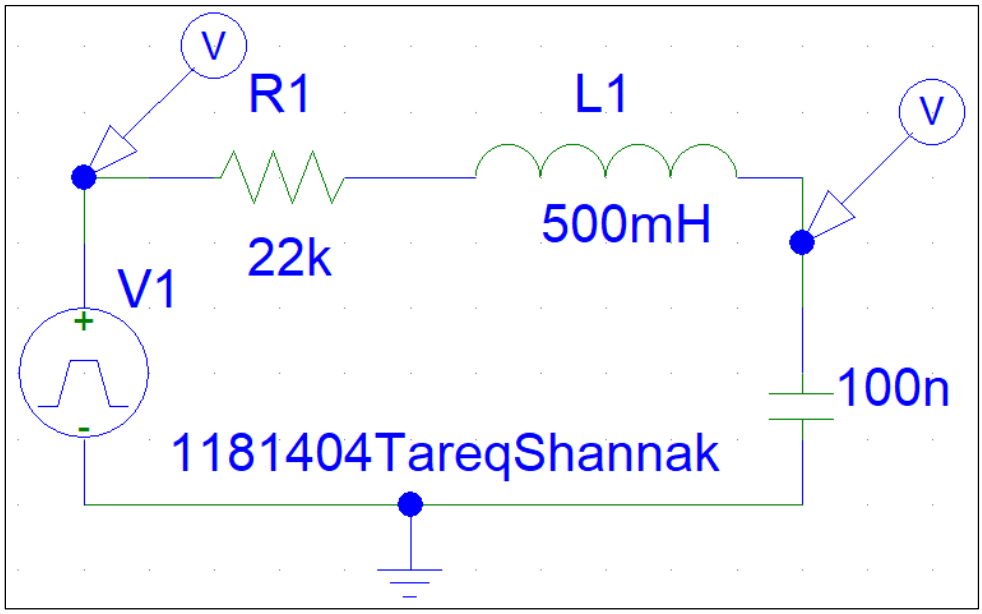
Part C: RLC Circuit

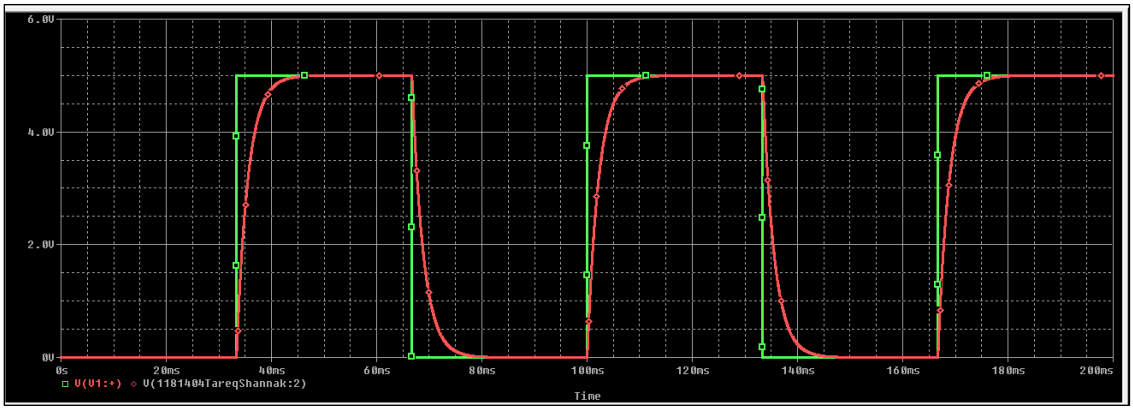
Response Type

a = R/2L = 22k/1H = 22000

w = 1/√(LC) = 4472

a>w? Overdamped



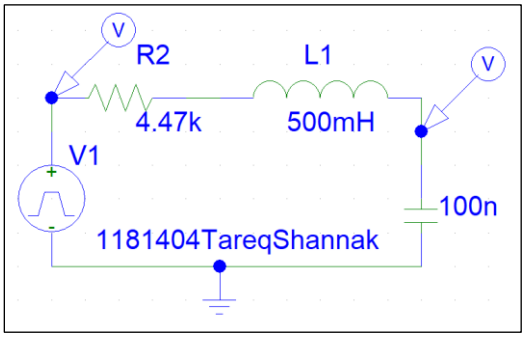


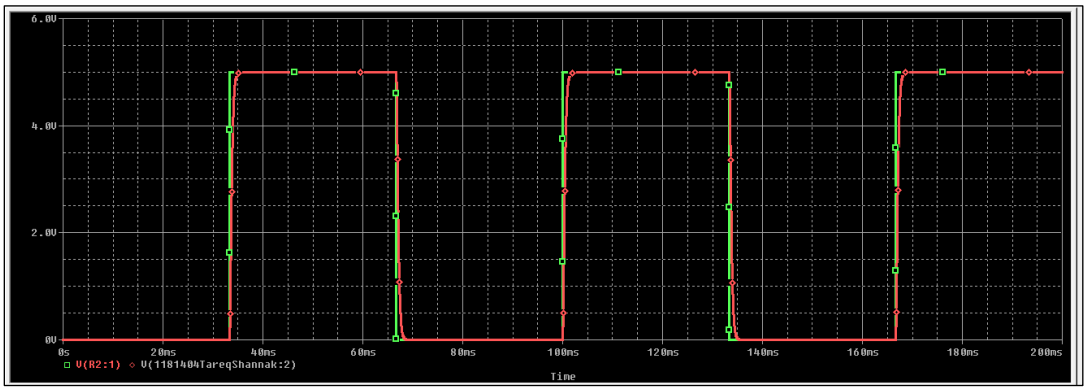
To be underdamped: a < w → R / 2L < 1 / √ (LC) → R < 2L / √ (LC) → R < 4.47 K ohm

To be overdamped: R > 4.47 K ohm

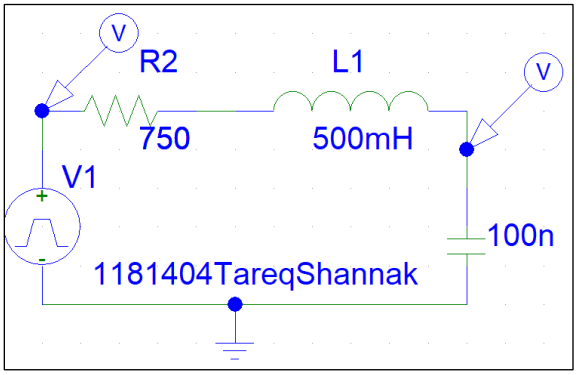
To be critical damped: R = 4.47 K ohm

Critical damping: R = 4.47 K

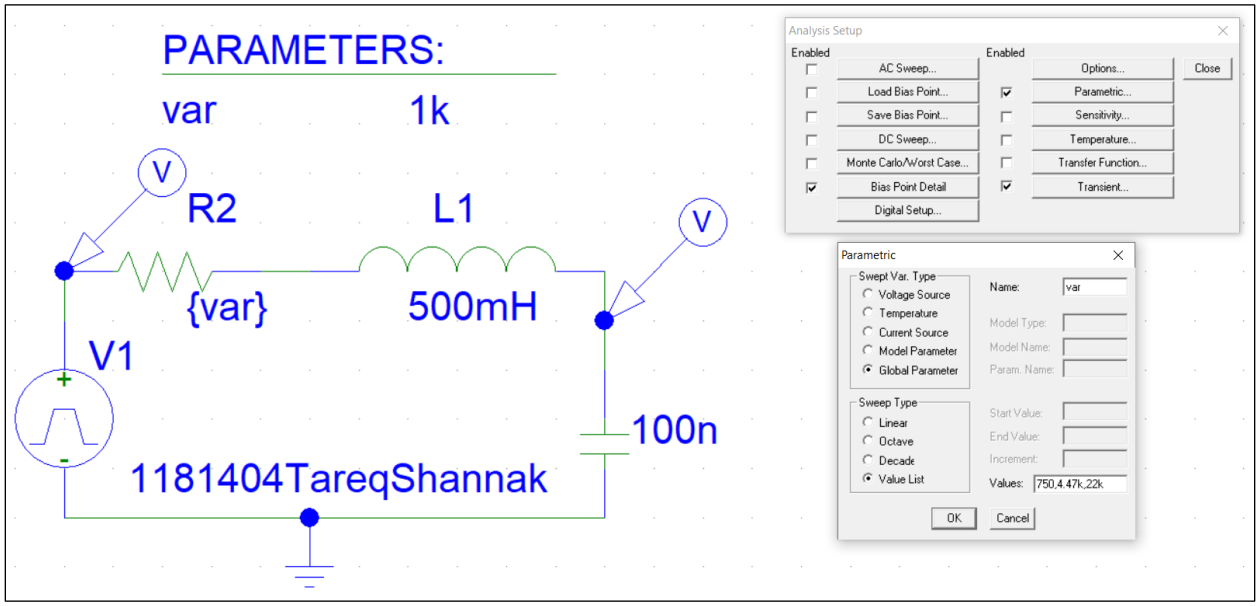


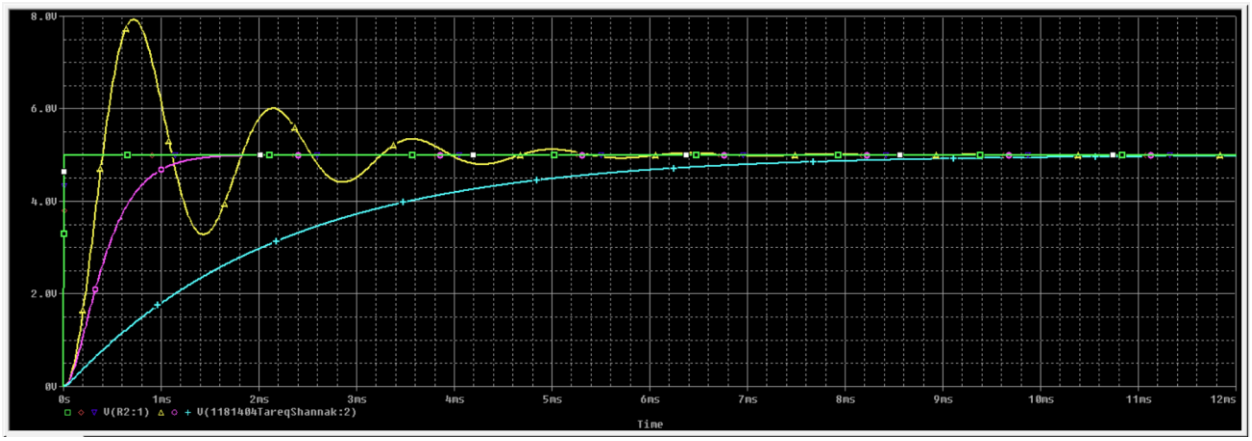


Underdamping: R =750



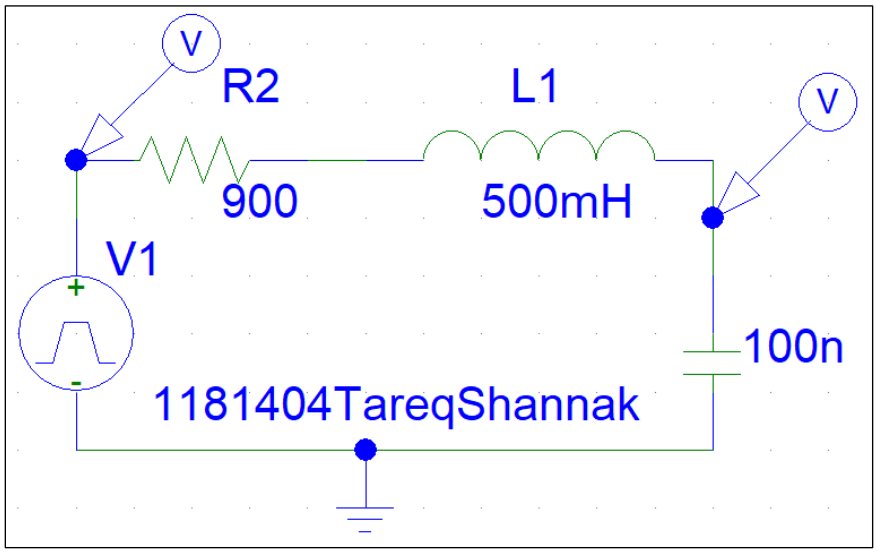
Using PARAM Element

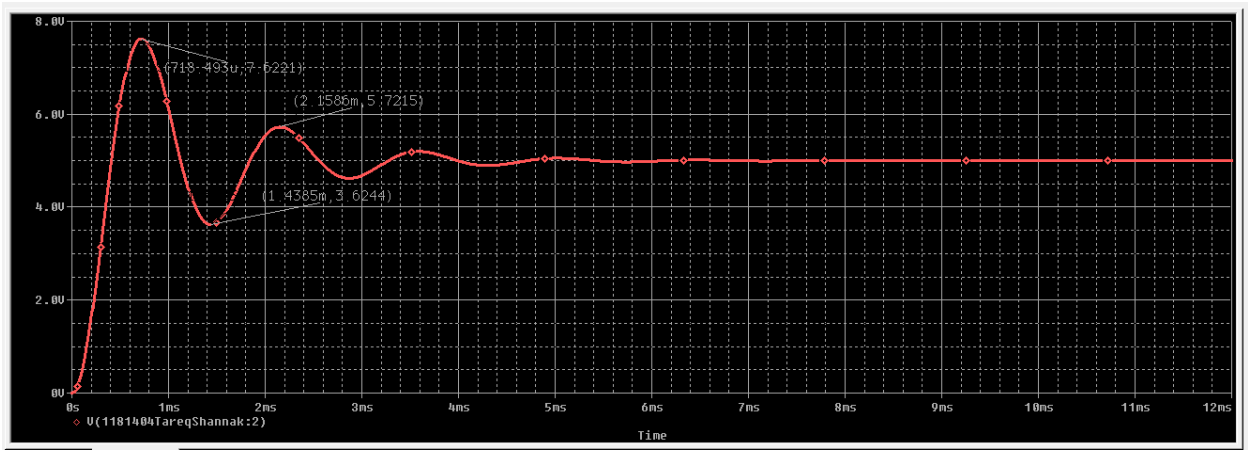




We can notice that when R=4.47k (Critical Damping – the pink curve), the output voltage is near from the input voltage (the green curve).

Response Parameters





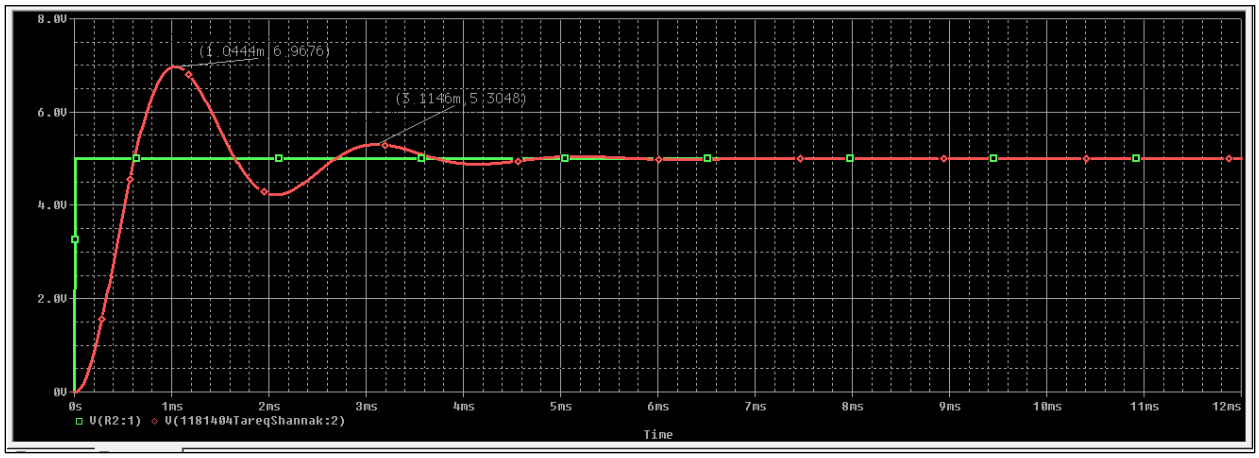
Va = 7.6221, Vb =5.7215, Ta = 718.493us, Tb = 2.1586ms, V_∞ = 5v

τ = (Tb-Ta)/ ln(($Va - Vo_\infty$) /($Vb - Vo_\infty$)) = 1116us

α = 1/τ = 896 rad/sec

ωd = 2*pi/(Tb-Ta) = 4.36k rad/sec

C = 200nF?



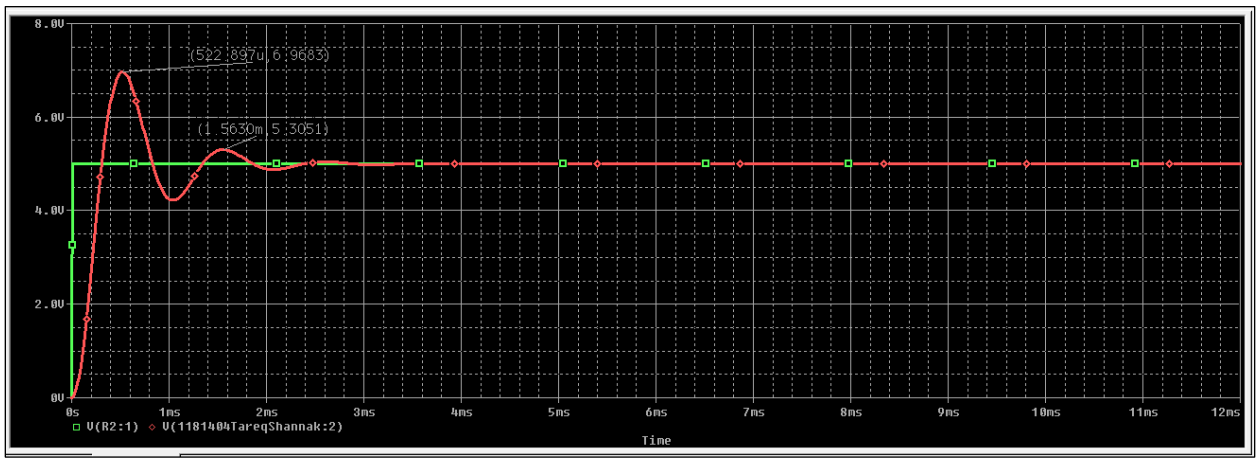
Va = 6.9676, Vb =5.3048, Ta = 1.0444ms, Tb = 3.3146ms, V_∞ = 5v

τ = (Tb-Ta)/ ln(($Va - Vo_\infty$) /($Vb - Vo_\infty$)) = 1.217ms

α = 1/τ = 821 rad/sec

ωd = 2*pi/(Tb-Ta) = 2.766k rad/sec

L = 250Mh?



Va = 6.9683, Vb =5.3051, Ta = 522.897us, Tb = 1.563ms, V_∞ = 5v

τ = (Tb-Ta)/ ln(($Va - Vo_\infty$) /($Vb - Vo_\infty$)) = 557.909us

α = 1/τ = 1792 rad/sec

ωd = 2*pi/(Tb-Ta) = 6.037k rad/sec