EXPERIMENT 5 (PSPICE)
TRANSIENT BEHAVIOUR OF RLC CIRCUITS

PRELIMINARY WORK

P1 Give the definitions of the overdamped, underdamped and critically damped cases for a series RLC circuit.

P2 Consider the series RLC circuit shown in Figure 1. Calculate the value of the resistor for the critically damped case (R_c). Calculate and plot the zero state responses of $v_c(t)$ and $v_L(t)$ for

a) Overdamped case $R=4R_c$
b) Critically damped case $R=R_c$
c) Underdamped case $R=0.25R_c$

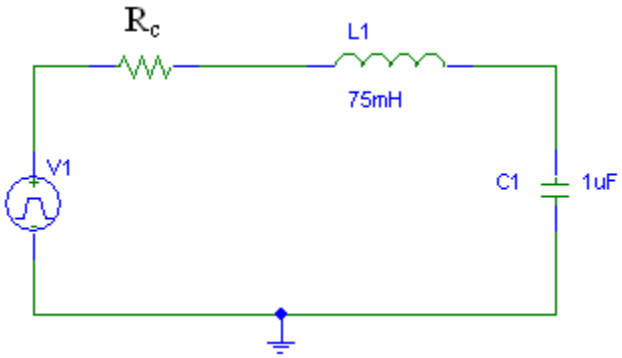
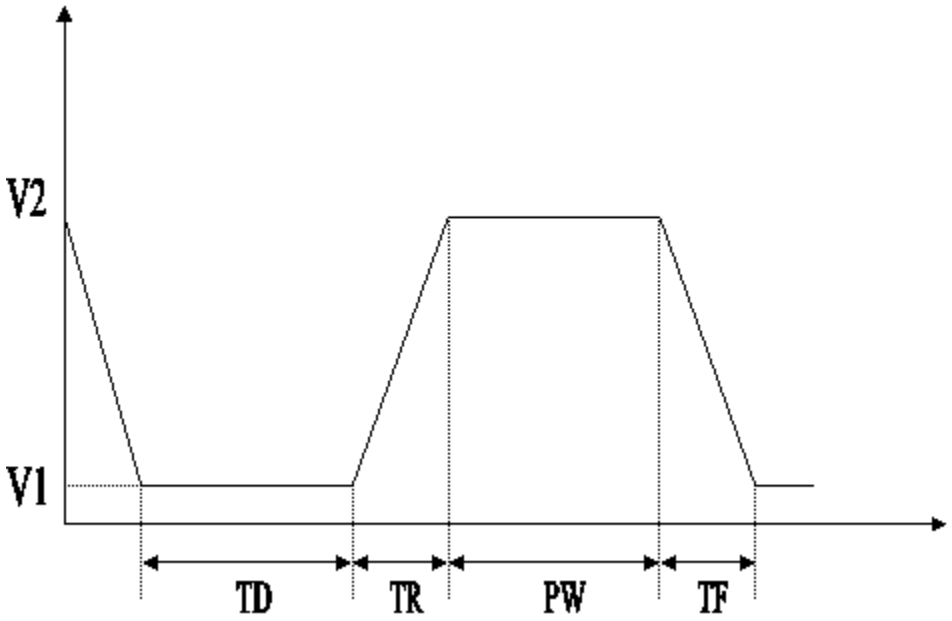


Figure 1

EXPERIMENTAL WORK

E1 Setup the circuit given in Figure 1. Choose **VPULSE** as voltage source. Double click VPULSE and change several values associated with it. V1 represents the low voltage value of the square wave. V2 represents the high voltage value of the square wave. TD is the delay time to wait during the square wave's period before going high. TR is the rise time of the pulses. TF is the fall time of the pulses. PW is the pulse width for the high voltage. PER is the square wave's period.



Set **VPULSE**'s parameters as V1=-2V, V2=2V, TD=1u, TR=0.5u, Tf=0.5u, PW=0.01, PER=0.02. Choose **GND_EARTH** as ground**.**

In each cases, plot $v_R(t)$, $v_c(t)$ and $v_L(t)$ for

a) Overdamped case $R=R_c$
b) Critically damped case $R=R_c$
c) Underdamped case $R=0.25R_c$

Verify Kirchoff Voltage law by plotting $v_R(t)+v_c(t)+v_L(t)$

E2 Setup the circuit shown in Figure2 By setting R2 to each of the values used in E1

a) Observe the state trajectories, by changing the Plot axis variable to capacitor voltage.

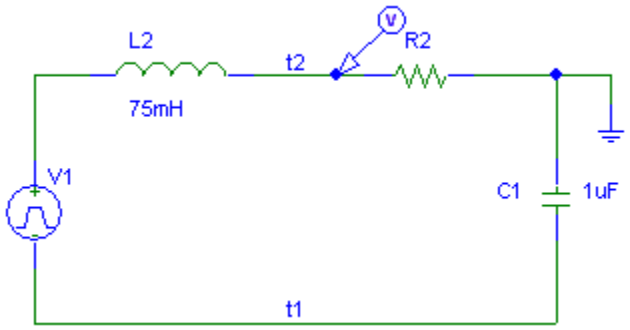


Figure 2

E3 By varying R4 obtain the overdamped, critically damped and underdamped responses. In each case, plot $v_c(t)$ and $v_R(t)$. Record also values of R and plot the state trajectories for each type of damping.

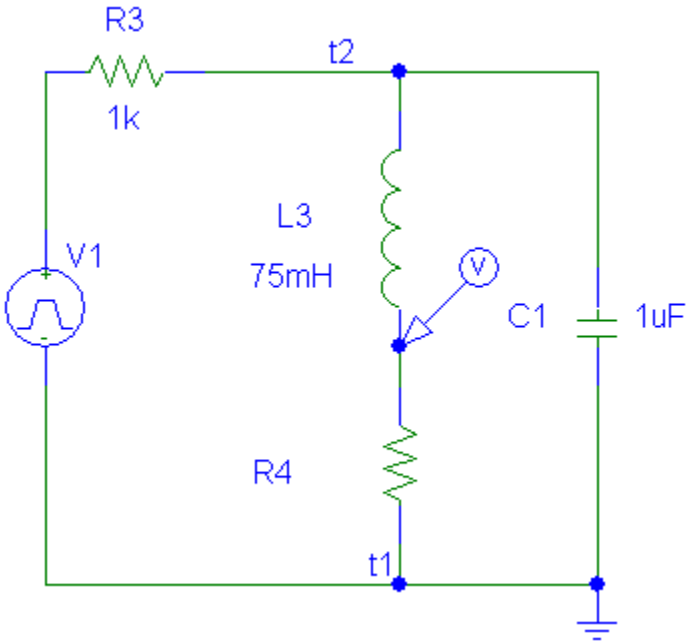


Figure 3

CONCLUSION

C1 What are the main differences between the responses observed for the three types of dampings in the series RLC circuit.

C2 Do the same differences you noted above for the series RLC circuit appear for the parallel RLC circuit as well.